DATA DISTRIBUTION

IN A COMPUTER NETWORK

A Thesis

Presented to

the Faculty of the Department of Computer Science

University of Houston

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

---

by

Richard Louis Morrison

May 1974

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R.L.M.

Houston, Texas

May, 1974

PREFACE

Definitions

A common understanding of terms between the writer and the reader is requisite to common understanding of conclusions.

Following are definitions of terms as they will be used in this manuscript.

1. Computing System - The entire collection of all hardware and software systems that can be accessed by a user of the computing system to solve a problem.

2. Hardware System - A computer and its immediate, local peripheral equipment.

3. Software System - A logical group of computer instructions (and associated information required to execute the instructions) that perform a particular function for the computing system. For example, one software system might be the instructions that manage one particular file organization type on a given storage device type.

4. Data Management Facility - The hardware and software systems that store and control the information set of the computing system. The data management facility may be composed of multiple hardware and software systems.

5. Information Set - All the information stored in the data management facility for update/retrieval by the computing system. The information set is composed of one or more data base.

6. Data Base - That portion of the information set for a computing system that is stored in and controlled by a single data management facility.

7. Centralized Data Base System - A computing system wherein the entire information set used by the computing system is stored in, and controlled by, a single data management facility. Other components of the computing system must access the information set through the single data management facility.

8. Distributed Data Base System - A computing system wherein the information set used by the computing system is distributed through multiple, separate data management facilities. Other components of the computing system must access the information set through the data management facility controlling the required portion of the information set.

9. Communication Line - Any physical means of transmitting data among multiple hardware systems, such as public telephone lines or microwave systems.

10. Network - A computing system composed of more than one hardware system, connected by communication lines, and also composed of one or more software system.

11. Data Retrieval Time - The elapsed (clock) time required to access and retrieve information from the information set.

12. Queue Time - The amount of time spent waiting for something required, which is not currently available.

13. Process Time - The amount of time spent in acting upon whatever requires processing.

14. Service Time - Queue time plus process time. For example, the amount of time a transaction spends waiting for the CPU plus the time the CPU takes to act upon that transaction (assuming no interruptions).

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ABSTRACT

The design of a hardware configuration to fit the varying needs of any given application system is a difficult task. Requirements for the application system often are vague. Data management requirements for the application system are often underestimated.

It is the purpose of this thesis to explore hardware configurations for large-scale data base systems, and to attempt to give some insight into possible designs for those systems. In particular, the question that will be addressed is the effectiveness of distributed data base systems as opposed to centralized data base systems, and the applicability of the distributed systems to the solutions of common computing problems.

The thesis will briefly describe several computer networks, with emphasis on hardware configurations. These configurations will be broken into functional components for a basis of comparison and simulation. The case study will then be defined and two hardware configurations proposed for case study analysis. These two configurations will be compared from performance, cost, and reliability viewpoints. Conclusions will be drawn both with regard to the case study and with large-scale data base systems in general.

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INTRODUCTION

Research Theme

The objective of this thesis is to identify hardware configurations applicable to large-scale data base systems, and explore the relative merits of two diametrically opposed configuration designs.

The design of a hardware configuration to fit the varying needs of any given application system is a difficult task. Requirements for the application system often are vague. Data management requirements for the application system are often underestimated.

It is the purpose of this thesis to explore hardware configurations for large-scale data base systems, and to attempt to give some insight into possible designs for those systems. In particular, the question that will be addressed is the effectiveness of distributed data base systems as opposed to centralized data base systems, and the applicability of the distributed systems to be solutions of common computing problems.

INTRODUCTION

Research Objective

Hardware configuration is an important aspect of the design of large-scale data base systems. This thesis makes use of a case study to research hardware configuration design.

It is possible to design more than one functional hardware design, or configuration, to provide support for the requirements of any given large-scale data base application system. An obvious question that therefore must be answered is which functional configuration provides better support for the given application system.

There are many facets to this question. For example, load balancing and/or multiprocessing might be viable alternatives for a computer network configuration. However, it is beyond the scope of this thesis to completely address all facets of this question. Therefore, the following subset of that question is identified to bound the scope of this study: Under what conditions, if any, is a distributed data base system more effective from a performance/cost/reliability standpoint than a centralized data base system?

Many different configurations have been documented in the trade literature, each with their respective advantages and disadvantages. This study will help in the evaluation of various hardware configurations possible to support large-scale terminal/data base application systems, in order to increase performance and reliability, while reducing cost per unit of work for the purchasing agency.

An investigation will be made to identify computer network configurations currently being used by the data processing industry. There are two discrete parts to the study: design of the system center(s), and design of the communication network. Emphasis will be placed on the former. However, the importance of evaluating the network with regard to its impact on the system center design shall be considered. The line configuration task to be done for this study is to identify and characterize the basic types of communication lines and hardware configurations in large-scale terminal/data base applications. Chapter 5 further discusses line configurations for the case study.

An abundance of information is available within data processing industry literature relating to teleprocessing system organizations, capabilities, costs, and advantages. However, these systems typically are used to provide computational resources (program sharing) to network users. That is, requests are routed through the network to a processor with available resources (of the type necessary to satisfy the request if the network is heterogenous). The problem being addressed by this study is computing system organization for large-scale data base systems; the difference being that requests entering the system require retrieval of large amounts of data from the computing system as well as the computational resources required to process this data. Where this data should be placed within the network to minimize retrieval time is the question being addressed. For a large-scale data base, how should the hardware be configured to provide optimal cost/performance effectiveness? The significance of this problem is extensive. Very little information has been found concerning this problem through a literature search. Achievement of the objectives of this thesis will provide insight into the systematic design of hardware/software configurations to support large-scale terminal/data base systems.

The thesis will briefly describe several computer networks, with emphasis on hardware configurations. These configurations will be broken into functional components for a basis of comparison and simulation. The case study will then be defined and two hardware configurations proposed for case study analysis. These two configurations will be compared from performance, cost, and reliability viewpoints. Conclusions will be drawn both with regard to the case study and with large-scale data base systems in general.

2. MAJOR CONFIGURATIONS STUDIED

MAJOR CONFIGURATIONS STUDIED

Introduction

Major computer network systems are briefly described from a computer hardware and supportive software systems standpoint.

This chapter briefly describes two computer networks, ARPA and TUCC, which are used as a basis for the configurations proposed in Chapter 5 to analyze the case study. The ARPA network, in particular, is well documented in industry literature, if further information is desired.

Appendix A describes other major computer networks, all of which are similar in construction to ARPA or to TUCC.

MAJOR CONFIGURATIONS STUDIED

The Advanced Research Projects Agency Network (1)

The ARPA network is a distributed, heterogeneous network composed of widely varying host processors.

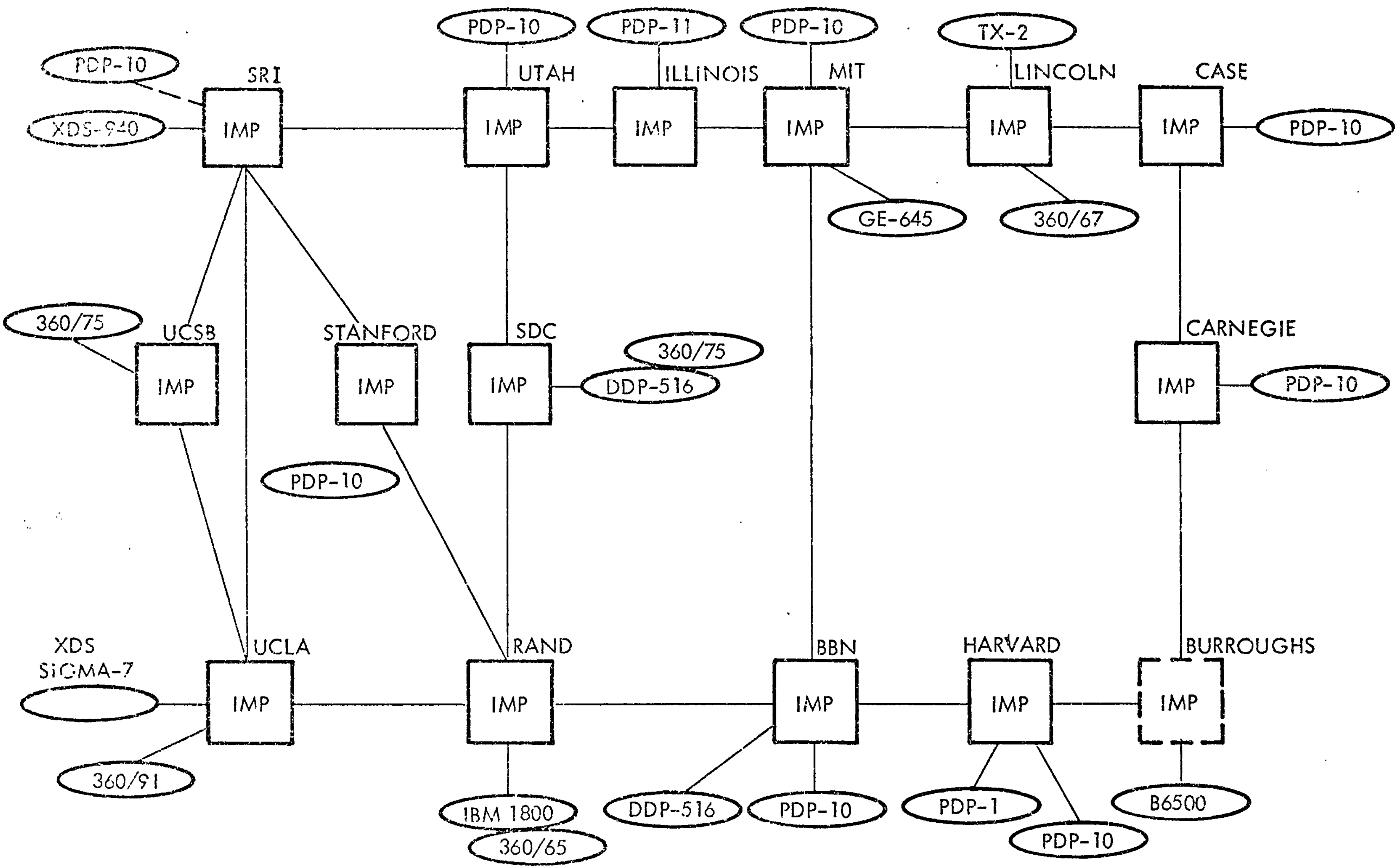
The Advanced Research Projects Agency (ARPA) network is a heterogeneous network distributed throughout the nation. It is designed to explore network technology while interconnecting sponsored research centers. Its key goals are to permit access of programs, services, and data from any place on the network.

The communication controllers in the ARPA network are modified Honeywell DDP-516 computers connected via 9- and 50-kilobit, full-duplex leased telephone lines. The communication protocol operates in a store-and-forward fashion. Each Interface Message Processor (IMPS) assumes no further responsibility for a message after it is handed forward correctly.

Messages are broken into smaller sub-messages called packets to minimize retransmission in the event of errors in long messages. These packets of about 1000 bits are independently forwarded through the communications controllers (IMPS). The IMPS attached to the message destination host processor is responsible for reassembling the packets into the original message before transmission to the destination host. In addition, the IMPS govern routing of messages through the network to increase network utilization and minimize transit time of the message.

The Network Control Program (NCP) resides in each host processor. The NCP controls connection and termination of communications between programs on the varying host processors.

There are a large number of host processors (20 - 30) on the ARPA network, ranging from a PDP-11 through the ILLIAC-IV. The network has extensive management and technical steering groups, as well as a working group composed of host representatives. In addition, Bolt, Beranck, and Newman (BBN) is charged with maintenance of the communications section of the network.



ARPA NETWORK - FEBRUARY 1971

Figure 2-1

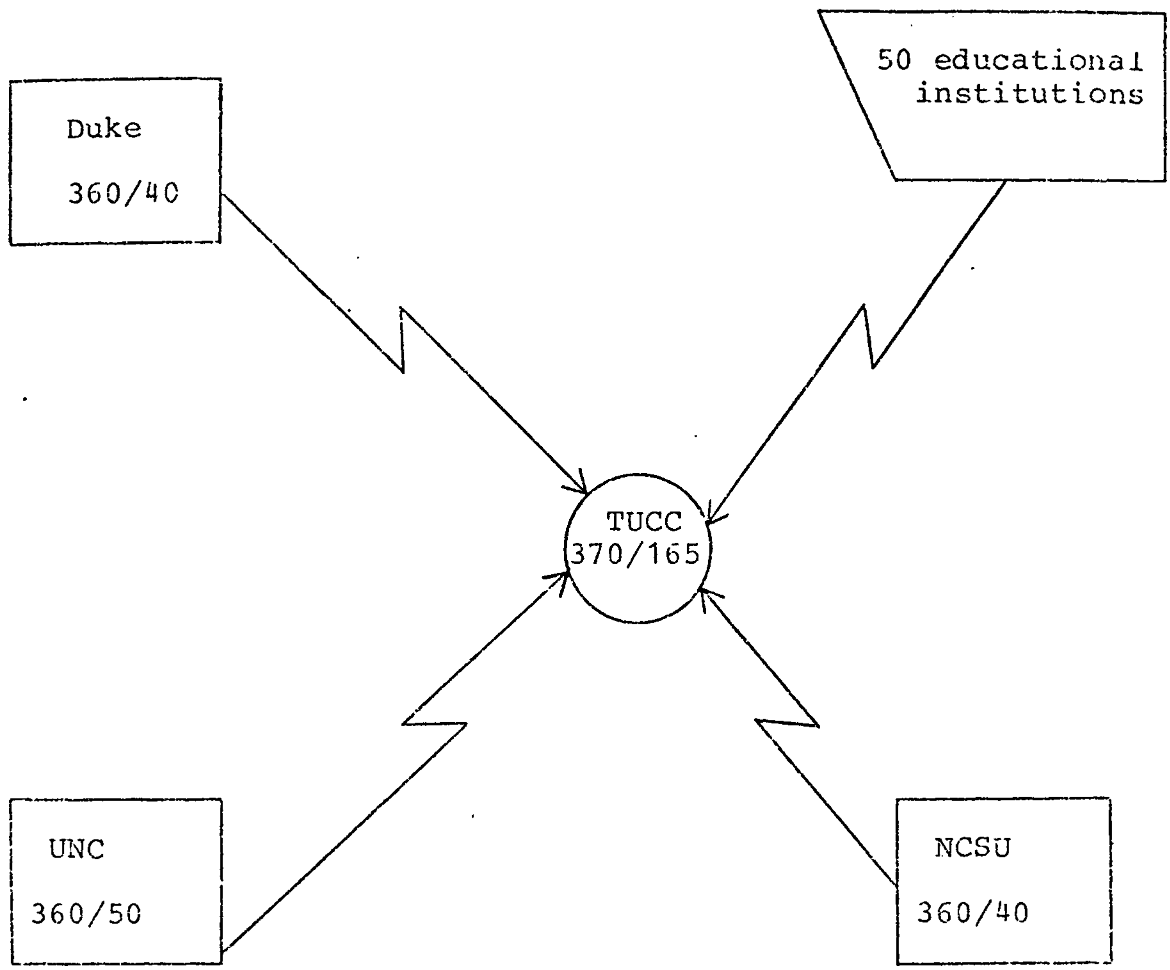
MAJOR CONFIGURATIONS STUDIED

Triangle Universities Computation Center (1,3)

The TUCC is a centralized, homogeneous network composed of IBM S/360 and S/370s.

The Triangle Universities Computation Center (TUCC) is a joint undertaking of the Duke, North Carolina State, and North Carolina Universities. It is a straightforward, relatively simple network installation, and has been operational since 1966. It is a centralized, homogeneous network composed of IBM S/360 and S/370 computers. The central node is a S/370 Model 165; nodes at each University are S/360 Model 40 or 50. The S/360s do local batch jobs in addition to handling the telecommunications required by the network.

The network uses off-the-shelf hardware with minimal extensions to OS/360. The three nodes are connected to the central facility via Telpak A lines (40.8 kb, half-duplex) through IBM 2701 data adapters. In addition to the three TUCC nodes, local schools and colleges are serviced by the central computer via a variety of medium and low speed input/output devices.



THE TUCC NETWORK

Figure 2-2

3. NETWORK COMPONENT DESCRIPTION

NETWORK COMPONENT DESCRIPTION

Functional Network Components

Functional components of a computer network are the communications controllers, the communication lines, the communication nodes, and the network controllers.

Although computer networks can be very complex hardware and software systems, they can be classified in three basic hardware components and one basic software component. The hardware components are communication lines, communications control, and nodes on the communications network.

Communication lines are the transmission devices whereby messages may be sent between communications controllers. These utilize many varying techniques such as public or private telephone lines, micro or millimeter wave transmission, or wave guide systems. Lines may be digital or analog in format. Lines are of varying speed capacity, ranging from 75 to many hundreds of thousands of bit transmission per second capacity.

The category of communication lines also includes modulation, demodulation, information coding, multiplexing, and concentration. Modulation and demodulation are respectively the process of conversion from digital to analog format and the reverse. Modulation is necessary when transmitting digital information, such as from a digital computer, over telephone lines. Modulation and demodulation are performed by a modem, or data set. The modem is also responsible for coding information for transmission. Many different coding techniques are possible.

If the communication line utilization is low, it may be cost effective to include multiplexors. This allows multiple messages to be transmitted simultaneously over the same line, increasing the efficiency or throughput of the line and thus lowering the number of lines required. A multiplexor does not change the format or encoding technique of any message transmitted through it. A concentrator serves much the same purpose of a multiplexor but may change the format or coding technique of a message.

The communications controller is a hardware device to control the use of the communications lines. It may or may not be programmable. It initiates the establishment of communication and synchronization and controls when to send or receive messages. It controls polling and addressing. It addresses all error signals, and is responsible for all error detection and correction. The communications controller may also perform any message switching functions necessary. However, if the communications controller is not programmable, the network controller may perform many of these functions.

The communications nodes are the hardware devices (and associated software) connected to the network through the communications controller. A node may consist of one or more devices such as the following:

1. a batch or interactive terminal
2. other data entry devices (perhaps radar input)
3. data management facilities and their associated data bases
4. applications processors
5. the network control processor
6. any combination of the above.

A number of other considerations are appropriate before implementing a network: half- or full-duplex lines, parallel or serial transmission, synchronous or asynchronous transmission, message structure, and network protocol. Each of these affect the hardware organization.

The network controller is a software component of a computer network. In general, this includes all host software directly involved with control of the network. This function may include some of the stated functions of a communications controller that is non-programmable. In addition, it is responsible for addressing messages from a host processor for transmission by a communication controller. The network controller is also responsible for communications security and message accountability.

Depending upon the actual hardware used in a computer network, the functions listed may be moved from one functional component to another. For example, if a remote concentrator is replaced by a remote line computer of some intelligence, many of the functions of the communications and network controller may be moved to the line computer as a part of the re-configuration.

4. CASE STUDY DESCRIPTION

CASE STUDY DESCRIPTION

Acknowledgment

The author attended an intense class entitled "Designing Communication Systems" at the Systems Science Institute (SSI) in Los Angeles, California during October-November, 1973. The purpose of this class was to study the design of communications lines for communication networks from a cost/performance standpoint, through use of statistical analysis, simulation models (GPSS), and mathematical (APL) analysis models.

It is not the purpose of this thesis to discuss communication line configuration design itself. However, a communication network design case study was developed in the class to aid in the practical analysis of network design. The case study is realistic, and well demonstrates network design principles. With some modification, this case study also provides a realistic basis for a discussion of distributed data bases, and its associated distributed processing. The rest of Chapter 4 defines the case study, as modified for distributed processing.

CASE STUDY DESCRIPTION

The IPL Company

Interstate Power and Light Company is a medium-sized electric utility servicing 261,000 customers in the western states. In addition to the main office, located in Los Angeles, there are eighteen local offices which serve the bulk of the customers. The company is a progressive one, wanting to provide the best service possible to its customers.

IPL has been growing at an annual rate of 6.6% and expects to continue this growth rate through the next decade.

IPL is a long-time customer of IBM and has progressed from an initial 402 through the 407 and 1401 to the presently installed 360/30 tape/disk system. The primary application has always been customer accounting. However, other applications have been installed and currently one of the partitions of the Model 30 is devoted to work other than customer accounting.

The vice-president and the DP manager feel that several of the most common customer service transactions should be handled on-line. They have spent a considerable amount of time summarizing the requirements for their system and gathering data. The task to be done now is to design and procure the computing system necessary for successful implementation of the application.

CASE STUDY DESCRIPTION

Installed Hardware

1. Central location (two-shift operation)

   a. Computer system:

      System/360 Model 30 - 64K

        with decimal arithmetic, interval timer, storage protect, one selector channel and console typewriter.

      1403 - N1 printer and 2821 control unit

      2540 - 1 card read punch

      2400 - 2 magnetic tape unit (4 drives, 800 bpi) and 2801 control unit

      2319 disk storage facility with 4 modules

   b. Other devices:

      10 - 029 keypunches

      4 - 059 verifiers

      2 - 083 sorters

      1 - 088 collator

   c. Total rental cost of installed hardware is approximately $12,000 per month.

   d. The Model 30 system is operating under DOS multi-programming with a 16K supervisor, a 30K background partition, and an 18K foreground partition.

2. Remote locations - none.

CASE STUDY DESCRIPTION

Personnel Requirements

1. Customer service personnel - 86 current total.

   a. Local offices - one person per three thousand customer accounts. Each office has the requirement for a minimum of three people. Provision must be made for vacations and illness, as well as clerical duties in off-peak hours. However, all personnel are available for the customer service function during peak hours.

   b. Average salary of clerical people is $450./month.

2. Data processing personnel (27)

   a. DP manager (1) - $1,600/month.

   b. Programming supervisor (1) - $1,300/month.

      Programmers (3) - $1,000/month.

   c. Operations supervisor (1) - $1,000/month.

      Lead operator (2) - $700/month.

      Shift operators (2) - $650/month.

      Lead keypunch operator (1) - $575/month.

      Keypunch operator (11) - $500/month.

      Clerks (5) - $450/month.

3. The prime shift personnel work 8:00 - 5:00, and second shift personnel 11:00 - 8:00, which provides twelve hours of systems time per day.

4. Office locations and number of accounts and personnel:

No.	Office Name	% of Total Accounts	No. of Accounts Now	No. of Accounts 5 yrs.	No. of Clerks Now	No. of Clerks 5 yrs.
1.	Albuquerque, NM	.031	8000	11012	3	4
2.	Boise, ID	.015	4000	5506	1	2
3.	Flagstaff, AZ	.015	4000	5506	1	2
4.	Fresno, CA	.015	4000	5506	1	2
5.	Helena, MT	.015	4000	5506	1	2
6.	Las Vegas, NV	.027	7000	9636	2	3
7.	Orange County, CA	.061	16000	22024	5	7
8.	Pasadena, CA	.042	11000	15142	4	5
9.	Phoenix, AZ	.031	8000	11012	3	4
10.	Portland, OR	.054	14000	19271	5	6
11.	Reno, NV	.034	9000	12389	3	4
12.	Sacramento, CA	.061	16000	22024	5	7
13.	Salt Lake City, UT	.027	7000	9636	2	3
14.	San Diego, CA	.073	19000	26154	6	9
15.	San Fernando, CA	.069	18000	24778	6	8
16.	San Francisco, CA	.088	23000	31660	8	11
17.	Seattle, WA	.069	18000	24778	6	8
18.	Spokane, WA	.023	6000	8259	2	3
19.	Los Angeles, CA	.250	65000	89475	22	30
		1.000	261000	359274	86	120

CASE STUDY DESCRIPTION

Current Customer Accounting Application

IPL uses a more or less standard approach to customer accounting. In order to simplify the workload and spread it out over the month, a "cycle" billing scheme is used. The accounts handled out of each office are divided into 21 cycles, or one for each working day of the month. This allows the central billing system to send out 1/21st of the bills daily. Also, the same number of meters are read daily. The payment is made to the local office nearest to which the customer lives. Management would prefer to have deposits made to local banks to maintain a local community relationship.

The master file, kept in the main office in Los Angeles, is arranged in account number sequence. The first two digits of the twelve-digit number are cycle number; the next two digits are town code. The next seven digits are meter number. The last digit is tenant number. This allows the number to reference a location; that is, service address, instead of a particular customer. Each time a different person requests service at a location, the tenant number is incremented to make the account number unique for this customer.

An accounts receivable register for each cycle is sent to the respective office when the cycle is billed. A daily cash journal is also prepared for off-cycle accounts (those accounts not being billed today; however, payments have been received and are being posted). This provides the information required when a customer comes to pay but has no remittance slip. The time required to find the bill is between two and five minutes.

The accounts receivable register is also used as a source of information when trying to satisfy a high bill inquiry; that is, the customer is complaining because he thinks his bill is too high. The current and twelve previous months' registers are maintained in order to supply this information. Because of the volumes of paper involved, the amount of time required to handle this inquiry varies between five and thirty minutes.

There are, of course, numerous transactions initiated in the local offices which result in the maintaining of the master file. These are all included in the batch system.

Each local office maintains a ledger card file which contains, for each service location, meter and service information. The file is hard to maintain, and difficult to correlate to the central master file.

Because IPL is considering installing a teleprocessing system, they contracted a time-motion consultant to examine the amount of time that clerks spend with the customers they service. Following are the results of that study.

The minimum time a clerk spends with a customer is 15 seconds for all transactions.

Above the 15 seconds minimum, additional time to service the customer appears to be exponentially distributed.

The average additional time spent with a customer by transaction type is given below. This does not include the time to look up the answer to a customer request, but does include conversation, information recording, and payment times.

	Before Request is Serviced	After Request is Serviced
1. Cash Payment	30 sec.	15 sec.
2. Inquiry-A/R Balance-Pay	30 sec.	30 sec.
3. Inquiry-A/R Balance-No Pay	30 sec.	15 sec.
4. History Inquiry	60 sec.	90 sec.
5. Turn On	120 sec.	15 sec.
6. Turn Off	30 sec.	10 sec.
7. Billing Adjustment	180 sec.	25 sec.

CASE STUDY DESCRIPTION

Proposed Customer Accounting Application

In addition to performing the customer accounting job currently done on the S/360 Model 30, the system will provide much in the way of readily-addressible information required to make the operation more efficient and economical and also make the customer more pleased with the service rendered him. In particular, provision for the following system capabilities should be considered:

1. Historical records of consumption by service address (usage for the current and twelve previous months).
2. Immediate access to the customer's current accounts receivable file.
3. On-line entry of information concerning the initiation and termination of service for any given customer.
4. Decreased time lag in entering cash payments into the system.
5. Retrieval of the customer's basic record by account number, name, or service address (see transaction information).
6. The system will have to accommodate a peak rate of 20% of the average daily volume per hour.

7. Ninety percent of the responses in less than seven seconds (that is, maximum of seven seconds -- ninety percent of the time -- between the keying of the last character of a message until the response starts being printed. Commonly called Last-in-first-out, or LIFO, response).
8. IPL would like 90% of their clerks to spend less than 180 seconds from the time they are ready to input data until a transaction is completed (time away from customer).
9. IPL feels they would like to be able to service the customer so that most (90%) people would be out of the office in less than six minutes.
10. IPL would like the system to support their needs for a minimum of five years, assuming their current growth rate remains constant for that time.

Data Base Statistics

The customer basic record is 300 bytes in length as currently designed. This length includes two fields for money transactions throughout the billing cycle. More than two such entries, or various other conditions, cause the creation of trailer records.

The content of the customer basic record is:

Field	Bytes	Type	Print Length
Account Number	12	P	15
Billing Cycle	2	P	2
Branch Office	2	P	3
Meter Number	7	P	8
Tenant Number	1	P	2
Record Code	1	X	
Service Address	25	P	25
Name	22	P	22
Personal Data	15	P	
Date of Turn On/Off	6	P	8
Credit Rating	1	X	
Service Code	1	X	
Due Date	4	P	5
Account Balance	4	P	6
Arrears	5	P	8
Deposit	3	P	4
Payment Date	4	P	5
Current Usage	2	X	5
History Usage	36	X	108
Last Meter Reading	5	P	5
	146		

154 bytes of purely application-oriented data, maintenance information, etc., total 300 bytes.

Whereas all application-oriented information is included in the 300 bytes, no provisions have been made for accounting control, audit trail, back-up, recovery, transaction reprocessing, etc. Any space required for this type of information will be net plus to the 300 bytes.

There are 261,000 (359,274 in five years) active accounts and 30,000 inactive (vacant) accounts.

Some customers require a trailer record in addition to the basic master record. Each basic master record has zero to five trailer records. Seventy-five percent of the master records have no trailers. There is a total of 130,000 trailer records.

As indicated, the trailer records can be generated by more than two money transactions per billing period, or by an address overflow condition, or by multiple meters. The trailers are of the same record format and sequence as is the master file; however, the actual information required to be stored averages 150 bytes per trailer and varies from 50 to 225 bytes.

Transaction Type Statistics

The number of messages of a given type in a month is determined by multiplying the stated percentage times the number of active accounts. Assume the total number of messages is prorated to a given location by the percent of the active accounts at that location. Assume also that the activity is uniformly distributed over the days of the month. Except for some post cash transactions and some inquiries on accounts receivable balance, all the percentages below are mutually exclusive; i.e., a person doesn't go into a branch office to ask multiple questions.

Transaction types and volumes -- expressed as a percentage of total active accounts:

	Transaction Type	Frequency - %
1.	Collect - Post Cash	100.0
2,3.	Inquiry - A/R Balance (pay or no-pay)	10.7
4.	Inquiry - History	2.8
5.	Update - Turn On	5.5
6.	Update - Turn Off	5.1
7.	Update - Billing Adjustment	0.9

Transaction Information

	Transaction Type	Input Data (Freq.%)	Output Data
1.	Post Cash - Single	Transaction ID Account Number Payment Amount Operator ID	Received Payment Acknowledgment
2.	Inquiry - A/R Balance - Pay - and -	Transaction ID Account No.(25%)	Other two items of identifying data
3.	Inquiry - A/R Balance - No Pay	or Name (50%) or Service Addr (25%)	Service code Bill, Amount - Past due (arrears) - Amount - Taxes - Total Billing date Current usage Previous meter reading Current meter reading

	Transaction Type	Input Data (Freq.%)	Output Data
4.	Inquiry - History	Transaction ID Account No. (75%) or Name (15%) or Service address (10%)	Other two items identifying data Billing date Current bill amount - Past due (arrears) - Amount - Taxes - Total Past History - 13 months - Service code - Usage - Annual rate (month * 12)

	Transaction Type	Input Data (Freq.%)	Output Data
5.	Turn On	Transaction ID	Account Number
		Service Addr.	Turn-off date
			Turn-off reading
		THEN	*THEN*
		Name	Cash receipt
		Prior Address	acknowledgment
		Deposit Amount	
6.	Turn Off	Transaction ID	Other two items
		Account Number	identifying data
		(25%)	Billing date
		or Name (50%)	Current bill amt.
		or Service	- Past due
		addr. (25%)	(arrears)
			- Amount
			- Taxes
			- Total
		THEN	*THEN*
		Turn off date	Turn off
		Refund Mailing	acknowledgment
		address	

	Transaction Type	Input Data (Freq.%)	Output Data
7.	Billing Adjustment	Transaction ID	Other two items
		Account No.	identifying data
		(25%)	Current bill amt.
		or Name (50%)	- Past due
		or Service	(arrears)
		addr. (25%)	- Amount
			- Taxes
			- Total
		THEN	*THEN*
		Authorization	Adjustment
		Debit/credit	acknowledgment
		code	
		Adjustment	
		amount	
8.	Post Cash - Batch	Transaction ID	Batch entry
		Operator ID	acknowledgment
		Batch total amt.	
		Batch item count	
		THEN	*THEN*
		Account No.	Payment received
		Payment	acknowledgment
		.	.
		.	.
		.	.

CASE STUDY DESCRIPTION

Application Statistics

I. Bill Payment Statistics

A. Eighty-five percent of all payments are accompanied by the remittance slip.

B. Printed on the bill mailed to the customer is the address of his local branch office. He is requested to make his payment there. Seventy percent of the people mail their payment; the remaining 30% actually walk-in to their office to pay their bill.

C. Remittance slip statistics:

	Pay with Remittance Slip	Pay without Remittance Slip	Total
Mail Payment	.595	.105	.70
Walk-ins	.255	.045*	.30
Total	.850	.150	1.0

D. There are two reasons for inquiries on account balances:

1. someone who wants to pay has walked into the office but doesn't have the remittance slip.

2. someone who calls or walks into the office but does not pay.

Inquiries are broken down as follows:

Inquiries and

Pay	.045*
Not Pay	.062
	.107**

*This 4.5% is the same as the 4.5% in C. above. Since these people pay without a remittance slip, an inquiry must be made to fine the amount they owe.

**There are a total of 10.7% of the customers who inquire on accounts receivable balance.

II. Data Fields Statistics

A. The average name size is 15 characters.

B. The average service address size is 20 characters.

C. Device control characters average 10% of the total message length (input and output).

III. CPU Process Time Statistics

A. All times are approximate and should be used only for this case study.

B. All times are expressed in centiseconds.

C. Application processing times include I/O set-up but no disk or other I/O device time.

D. Processing time by transaction type:

	Transaction Type	Transmission No.	CPU Time
1.	Post Cash - Single	In 1	80
		Out 1	50
2.	A/R Inquiry	In 1	80
		Out 1	50
3.	A/R Inquiry	In 1	80
		Out 1	50
4.	History Inquiry	In 1	80
		Out 1	95
5.	Turn On	In 1	80
		Out 1	50
		In 2	50
		Out 2	50
6.	Turn Off	In 1	80
		Out 1	50
		In 2	50
		Out 2	50
7.	Adjustment	In 1	80
		Out 1	50
		In 2	50
		Out 2	50

E. The following multipliers may be used to compute processing times for other CPUs. These numbers are representative, but not necessarily completely accurate. No commitment by IBM is expressed or implied for correctness of these numbers.

CPU	Multiplier
S/360 M30	1.0
S/370 M135	.7
S/370 M145	.5

CASE STUDY DESCRIPTION

Objectives of the Case Study

It should be realized that systems design is a study in economics and that the performance requirements of the system materially affect system cost. Each design tradeoff must be explainable in economic terms and the total solution must be cost justifiable.

Systems designs should go through a technical audit, or review, before being implemented. It is more economical to correct errors in the design phase than in the implementation/test phase. The technical audit is an informal, highly technical review and justification of the system design (or, in this case, solution of the case study). The audit must include, but is not limited to, the following:

1. Central hardware selection and configuration.
2. Terminal selection.
3. Message formats.
4. Line configuration design.
5. System operation.
6. Operating and communication systems software selection.
7. System control and backup procedures.
8. Data base design.
9. Detailed implementation (and conversion) plan including personnel requirements.

10. Application designs.

11. System justification.

These items are further discussed in Chapters 5-9. For purposes of this thesis, item 1. above will receive the majority of the attention.

The objective of the case study in this thesis, then, is to provide a realistic, well defined computing application as a basis for comparing different concepts in hardware configurations.

5. PROPOSED CASE STUDY CONFIGURATIONS

PROPOSED CASE STUDY CONFIGURATIONS

Configuration Spectrum

Defining a configuration spectrum provides the environment for evaluating application requirements in relation to the data base configuration.

The overall purpose of this study is to establish a basis for the comparison of hardware/software configurations, with particular emphasis on the data management facility, that best fits the unique requirements of large-scale data base applications. The initial survey of computing systems revealed numerous configurations varying greatly in size, degree of sophistication, and purpose. While many configurations are evident, the basic functional components are essentially the same, regardless of the actual hardware/software that comprise each computing system. Therefore, it is obvious that the distinction to be made when evaluating each configuration is not in the functional components as such, but rather how these components are organized and configured within each system. The configuration spectrum evolved as a mechanism for providing computing system environment alternatives against which a given applications requirements could be evaluated. The spectrum provides a method for relating extremes in network configurations in terms of their ability to support a given set of requirements.

In attempting to define the configuration spectrum, consideration was given to the structure of all the computing systems surveyed, concentrating on the arrangement of the functional entities within the structure. From the initial research, the scope of the spectrum evolved, ranging from the functional concentration of centralized processing to the democratic organization of distributed processing. The purpose of the configuration spectrum, in addition to providing alternatives for requirement evaluation, is to represent generalized computing system structures currently in use. These structures must, of necessity, be generalized in order to account for extremes in functional organization in the various configurations as well as to provide for efficient evaluation of application requirements and capabilities. At one end of the configuration spectrum is the centralized structure where all functions are concentrated into one node which controls the processing of the entire computing system. The opposite end of the spectrum is the distributed processing or peer-level configuration which allocates equal functional responsibility to each node in the structure.

Appendix B discusses other hardware configurations prevalent in use today throughout the industry. These configurations will not be included as proposed case study configurations for the reasons stated in Appendix B.

PROPOSED CASE STUDY CONFIGURATIONS

Total Function Concentration Through Centralized Processing

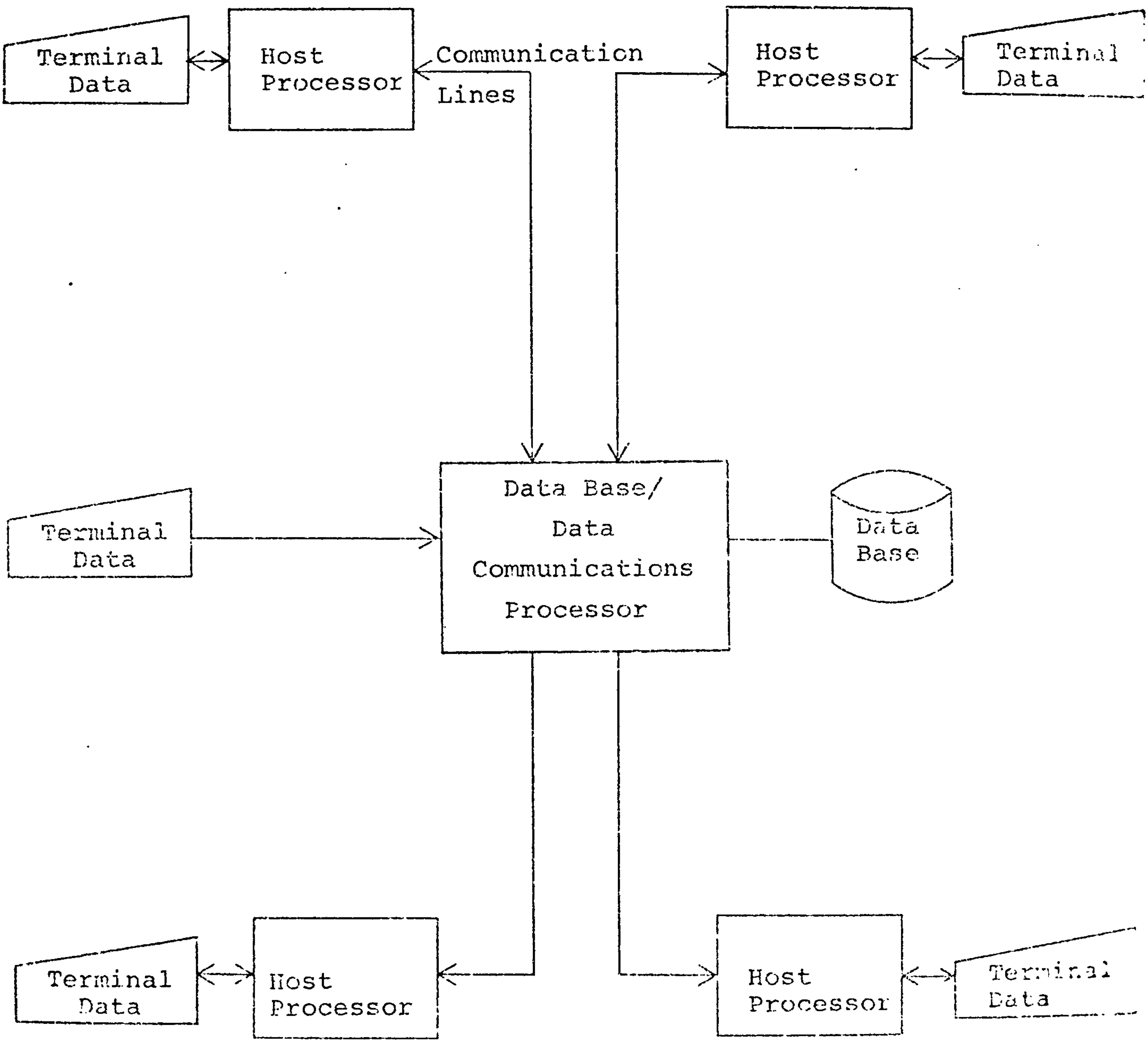
Centralized processing allows concentration of the data communication and data base functions at one point in the configuration.

Centralized processing is a common network structure, typically referred to as the master/slave configuration. In the context of the configuration spectrum, this particular structure is representative of the totally concentrated approach. The functional elements of this configuration include a central large-scale computing system and any number of satellite host processors attached directly or through a communication controller interface to the central system. The supervision and control of the data communication processing as well as the data base processing are the responsibility of the central system. In this configuration, the central system schedules work for the satellite host processors. These processors perform all of the application oriented functions, making use of the data communication and data base services of the central system as necessary. All terminal data is routed to and from the appropriate host processor(s) via the central system. The host processors may be configured to interface with a remote job entry (RJE) data source, but all of these inputs must be routed to the central system for processing. As with other types of communication in this configuration, all requests for access to the data base are routed to and processed by the central system.

An example of the centralized processing concept is the network of computing systems that comprise the Triangular Universities Computation Center (TUCC). The TUCC is made up of three satellite host processors connected through communication controllers to the central system. This system is used for administrative type processing, support of RJE devices, and computer aided instruction.

The centralized system for the case study is composed of an IBM System/370 Model 145 and its associated components. Appendix C shows the configuration in detail.

The processor is located in Los Angeles, California. The data for each of the local offices is maintained on-line in this system. The local offices are linked to the processing center through leased telephone lines. Remote terminals are IBM 3270s and associated hardware.



A Centralized Configuration

Figure 5-1

PROPOSED CASE STUDY CONFIGURATIONS

Equality of Function Through Distributed Processing

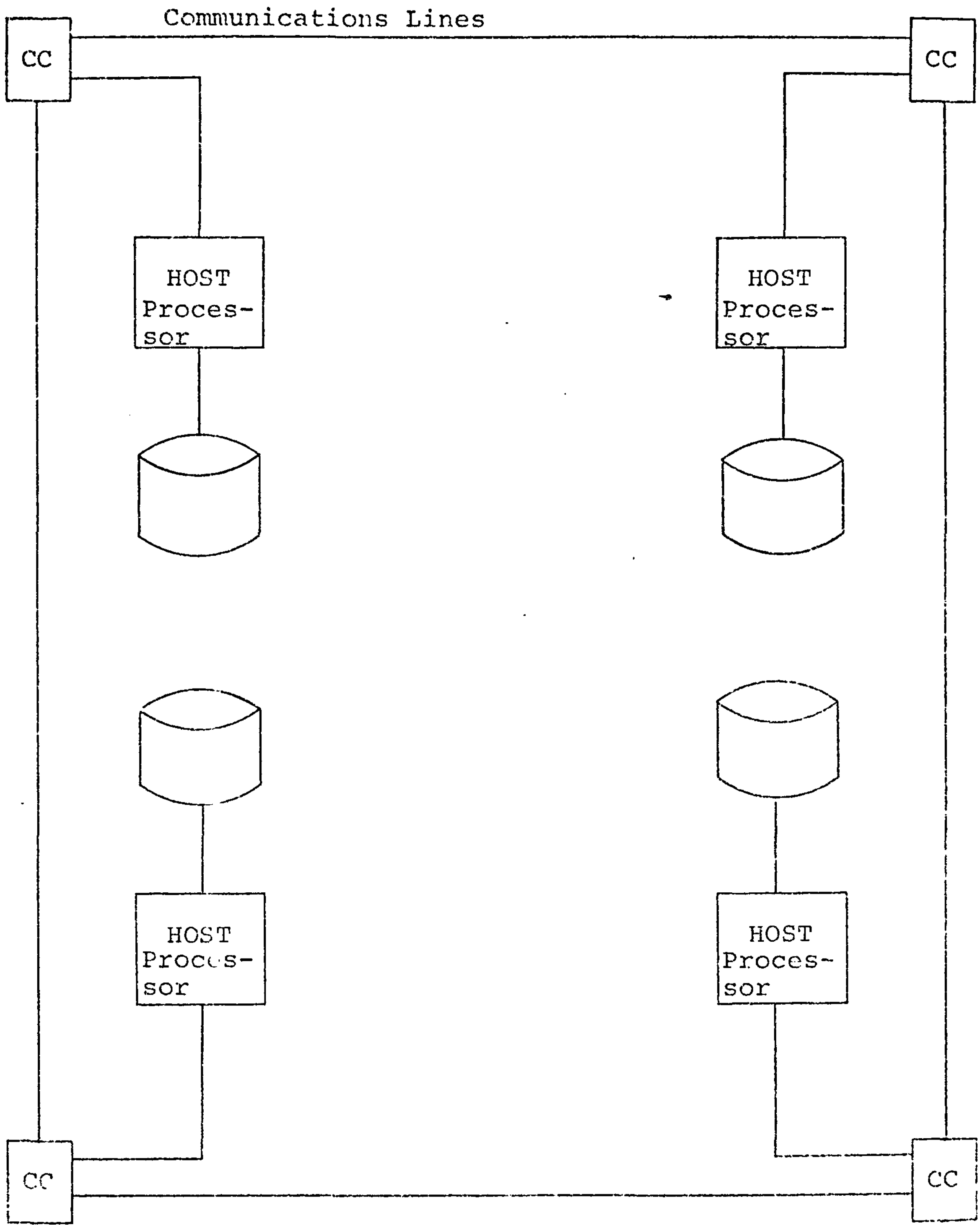
Distributed processing provides a democratic approach to the organization of the data communication and data base functions within a configuration.

Distributed processing is a relatively new concept in computing system structures where each node in the configuration is equal in terms of functions performed. Variously referred to as peer-level processing or ring structures, distributed processing configurations have the distinction that both the data communication and data base functions are directly associated with each host processor. The functional elements in this configuration include communications controllers, and host processors with directly attached data bases. The system of host processors are connected through the communication controllers. These controllers provide terminal and inter-host routing, line support, store-and-forward capabilities, as well as other generalized communication support for the two or more host processors. The host processors perform all of the application oriented functions including data base processing. The majority of the required data will be available from each local data base; however, there exists the capability to access the data base of another host processor through the communications controller interface.

An example of the distributed processing configuration is the Advanced Research Project Agency (ARPA) network with nodes located throughout the continental United States. This system is connected through a series of specialized programmable communication controllers known as Interface Message Processors (IMPS). These controllers interface with a wide variety of computer hardware ranging from minicomputers to IBM 360/91s. Originally, a research project in resource sharing, the ARPA network has expanded to include nodes at many universities with commercial uses as a by-product.

The distributed system for the case study is composed of two IBM System/370 Model 135s, and their associated components. Appendix C shows the configuration of each in detail.

The processors are located in Los Angeles, California, the main office, and in San Francisco, California. Each local office is assigned to one of the processing centers, where their data is maintained on-line. The local offices are linked to their respective processing centers through leased telephone lines. In addition, the processing centers are linked by a similar line.



A Distributed Configuration

Figure 5-2

PROPOSED CASE STUDY CONFIGURATIONS

Line Configurations

Leased, full-duplex telephone lines operating at 600 characters per second will be used to connect local offices to the processing center.

Various line configurations have been evaluated and costed, ranging from half-duplex leased telephone lines operating at 300 characters per second to full-duplex lines operating at 600 characters per second. For the case study, line traffic was not high enough to consider higher capacity, more expensive lines.

The cost of lines was relatively constant for all configurations. Five lines would be required to support the centralized system when operating with leased, half-duplex, 300 character per second lines using polled, released line control techniques. The cost of this line configuration would be $6037.50 per month (AT&T Type 3002 - Tariff 260).

Increasing line speed to 600 characters per second reduces requirements to four lines. However, modem charges increase and total line cost drops only slightly. Changing to full-duplex at 300 characters per second requires two lines and full-duplex at 600 characters per second requires only one line.

Full-duplex lines, operating at 600 characters per second, will be used for the case study. Figure 5-3 shows the line configuration and cost for the centralized system, and Figure 5-4 shows the line configuration and cost for the distributed system. Costs are based on AT&T Type 3002, Tariff 260.

The purpose of this thesis is not to define criteria for optimal line configuration. A number of mathematical models are available for that purpose. Therefore, any reasonable line configuration is acceptable for case study analysis as long as the same standards are used for designing the line configuration for the centralized and the distributed system configurations.

The line configurations above were chosen due to their comparatively equal cost with other configurations. Additionally, the full-duplex lines are not heavily loaded. These configurations will support the system even if growth has been underestimated by a factor of two, while a half-duplex configuration requires additional lines to support added growth.

Line Configuration

From:	To:	No. of Terminals	Cost of Link
Albuquerque, NM	Flagstaff, AZ	1	$542.52
Phoenix, AZ	Flagstaff, AZ	1	295.35
Flagstaff, AZ	Las Vegas, NV	1	433.95
Las Vegas, NV	Pasadena, CA	1	452.10
San Diego, CA	Orange County, CA	1	221.10
Orange County, CA	Pasadena, CA	1	94.05
Pasadena, CA	Los Angeles, CA	1	33.00
Portland, OR	Seattle, WA	1	333.30
Seattle, WA	Spokane, WA	1	468.60
Helena, MT	Spokane, WA	1	520.58
Salt Lake City, UT	Boise, ID	1	557.54
Spokane, WA	Boise, ID	1	544.83
Boise, ID	Reno, NV	1	606.05
Reno, NV	Sacramento, CA	1	275.55
San Francisco, CA	Sacramento, CA	2	195.69
Sacramento, CA	Fresno, CA	1	351.45
Fresno, CA	San Fernando, CA	1	399.30
San Fernando, CA	Los Angeles, CA	1	66.00
Los Angeles, CA	*Los Angeles, CA	4	0.00
		23	$6,390.96

*Data Processing Center

CENTRALIZED SYSTEM LINE CONFIGURATION

Figure 5-3

Line Configuration

From:	To:	No. of Terminals	Cost of Link
Portland, OR	Seattle, WA	1	$333.30
Seattle, WA	Spokane, WA	1	468.60
Helena, MT	Spokane, WA	1	520.58
Spokane, WA	Boise, ID	1	544.83
Salt Lake City, UT	Boise, ID	1	557.54
Boise, ID	Reno, NV	1	606.05
Reno, NV	Sacramento, CA	1	275.55
Fresno, CA	Sacramento, CA	1	351.45
Sacramento, CA	San Francisco, CA	1	195.69
San Francisco, CA	*San Francisco, CA	2	0.00
Albuquerque, NM	Flagstaff, AZ	1	542.52
Phoenix, AZ	Flagstaff, AZ	1	295.35
Flagstaff, AZ	Las Vegas, NV	1	433.95
Las Vegas, NV	Pasadena, CA	1	452.10
San Diego, CA	Orange County, CA	1	221.10
Orange County, CA	Pasadena, CA	1	94.05
Pasadena, CA	Los Angeles, CA	1	33.00
San Fernando, CA	Los Angeles, CA	1	66.00
Los Angeles, CA	*Los Angeles, CA	4	0.00
*San Francisco, CA	*Los Angeles, CA	0	640.70
		23	$6,632.36

*Data Processing Center

Distributed System Line Configuration

Figure 5-4

6. PERFORMANCE COMPARISON

PERFORMANCE COMPARISON

User Capabilities

The computer network shares its resources and capabilities among its various users through data sharing, program sharing, special facilities sharing, and load sharing.

One purpose for a general computer network is to expand the computer capabilities offered to its users. This expansion is accomplished by combining individual computer nodes through communications media for the purpose of sharing the network's resources and capabilities among all users. The capabilities commonly expected of a computer network include data sharing, program sharing, special facilities sharing, and load sharing.

Data sharing provides data access for individual network users regardless of data location within the network. Depending upon the type of network involved, data may be concentrated in one common data base or distributed over a number of local data bases. Therefore, gaining access to this data could involve a single query to a local data base or multiple queries to data bases throughout the network. However, with data sharing, the network data relevent to a specific user is available for his data processing needs.

Program sharing is similar to data sharing in the sense that the individual user can utilize any of the network's program resources without consideration of the program location. The terminal user would typically utilize this capability. This user can request any one of a number of program services from a single terminal. Such a request is forwarded to a network controller which locates the appropriate network node containing the required program. With communication established, the necessary program processing occurs and the results are returned to the terminal.

Special facilities sharing allows the network user to utilize any special equipment or capability which is located only at specific nodes. This capability provides the user with access to special hardware such as unique graphic equipment, hardcopy facilities, or special tape drives. This sharing not only expands the scope of user processing capability, but also offers cost advantages, in that expensive special equipment is not duplicated within the network.

Load sharing is the most difficult capability to achieve in a computer network. Ideally, load sharing allows a network node with an excessive processing load to transfer a portion of its processing to a less burdened node. This type of capability presents many problems to current network technology, not the least of which includes the use of heterogenous computers.

The network described in the case study, although specialized for one particular company, provides each of these four capabilities. Data sharing, program sharing, and special facilities sharing is offered to each terminal user in each of the local offices. The case study system utilizes load sharing only in the sense that the two CPUs send commands to each other to retrieve data from the other data management facility.

As defined above, load sharing would be possible only in the distributed system. The two processors could pass work between themselves, but only if it did not involve the data base, or if the necessary data base records were passed along to the processor receiving the work.

In multiprocessing systems, or in large-scale installations where multiple homogenous processors have direct access to the computing system's data management facility, a pure form of load sharing is possible. Any item of work from an overloaded processor may be passed to a processor with idle resources, and the task can be completed without interference to the overloaded CPU. For example, in a System/370, Model 158 MP or 168 MP, operating under VS2 Release 2, a single task may switch back and forth between the two processors, depending upon the dynamics of the system.(5)

PERFORMANCE COMPARISON

Comparative Criteria for Computing System Configurations

Response time and network component utilization are the performance standards that will be used in the comparative analysis of the computing systems.

The proposed configurations for case study analysis will be evaluated with respect to two performance standards: response time and network component utilization. These are the crucial standards by which the effectiveness of each network configuration can be judged. It must be understood that these performance standards are interrelated; that is, the performance for one standard will influence to a greater or lesser degree the other standards.

Response time is the elapsed time between transaction initiation and completion. The most obvious response time example is the use of an interactive terminal. In this particular case, response time begins when the terminal user depresses a key to transmit his input and completes when the response is received at the terminal. Such a response time may simply be composed of the line transmission times to and from a CPU and some processing time. However, the process can be much more complicated. The terminal response may necessitate one or more accesses to a data base located peripherally to the application CPU, or in another CPU. In addition, individual transactions must compete with other transactions for use of these resources. This resource contention can substantially increase an individual transaction's response time and must be carefully considered. These factors illustrate the complexity of this performance criteria, and it is obvious the functional components of the various configurations influence to a large degree the response time.

Computing system component utilization is a percentage measurement of the processing capabilities utilized in the components of the network. This measurement provides a basis for comparing the configurations for efficiency and growth capacity.

PERFORMANCE COMPARISON

Configuration Performance Comparison

The GPSS Model is used as a basis to compare performance in response time and computing system component utilization between the two proposed configurations.

Response Times

The LIFO, or terminal, response time for the distributed configuration ranged from 95 to 113% of the centralized configuration LIFO response time. The distributed configuration sometimes gave faster response, even though the processors are slower. Since the total load is shared over two processors in the distributed configuration, each has less to do than the centralized processor, causing smaller queue times for the distributed CPUs. This can balance out the longer process times in the distributed configuration.

Average CPU queue time in the centralized configuration is .24 seconds. In the distributed configuration, CPU queue time averaged .19 and .13 seconds for the two CPUs. The difference appears to be small until one considers how many instructions can be executed in that time difference.

Since nothing in the local offices change between the two configurations, the only effect upon the local office is caused by differences in LIFO, or terminal response time. The small difference in LIFO time between the centralized and distributed configurations leads to negligible difference in time away from customer and in customer time in branch office.

External performance, or response times, between the two configurations therefore are equivalent. Customer time in office averaged 141.16 seconds over all cities in the centralized configuration, and 135.01 seconds in the distributed configuration.

Line Utilization

Line utilization for both configurations is quite low. For the centralized configuration, line utilization is 18%, plus 5.5% for the terminals in Los Angeles, or a total of 23.5%. For the distributed configuration, line utilization for line one (Los Angeles) is 8%, plus 5% for the terminals in Los Angeles, or a total of 13%. Line two utilization is 7% plus 2% for the terminals in San Francisco, or a total of 9%.

Three-hundred-character-per-second lines, instead of the proposed 600-character-per-second lines, would increase line utilization. For the centralized configuration, this would mean a line utilization of 40-50%. A model execution shows that this configuration still meets design response goals. However, 50% is approaching the range (50 - 60%) where service time increases exponentially as line utilization increases. Thus, a small underestimation of line traffic or of message size, or both, could cause unacceptable response times for the centralized configuration.

Three-hundred-character-per-second lines for the distributed configuration, on the other hand, would increase line utilization to 25% and 17%*, respectively. Both these numbers are well within the acceptable range. The slower line speeds increased LIFO response time an average of only six percent, which was still within the design goal of seven seconds. Average customer time in office over all cities increased to 142.54 seconds, or 1.38 seconds longer, on the average, than the centralized configuration.

Therefore, 300-character-per-second line speeds cannot be recommended for the centralized configuration, but are recommended for the distributed configuration. Lowering the line speed will decrease both cost and line transmission errors for the distributed configuration.

CPU Utilization

The CPU utilizations for the two configurations are quite different. The centralized configuration (S/370 M145) model reported CPU utilization of 53%. The distributed configuration (S/370 M135s) model reported 42% and 31%, respectively. One way to contrast the two configurations is to compare the CPU left available for other processing above what the case study requires. For the centralized configuration, this is

100 - 53 = 47% available (M145).

*Actual model execution results.

For the distributed configuration, this is

(100-42) + (100-31) = 58% + 69% available (M135).

To make a direct comparison,

58 * 5/7 = 41.6% (M145)

69 * 5/7 = 49.4%

91.0% (M145)

That is, the distributed configuration leaves 91% of a Model 145's processing power available. This is twice what is available in the centralized configuration.

Therefore, the distributed configuration requires considerably less of the total processing capability of the computing system than the centralized configuration to provide equivalent terminal response times.

Data Management Facility Utilization

Data management facility utilization was 6.4% for the centralized configuration. For the distributed configuration, data management facility utilization was 3.6% and 2.8%, for the hardware systems in Los Angeles and San Francisco, respectively. The average response time for the data management facility in the centralized configuration was 7.7 centiseconds. That is, it took 7.7 centiseconds, on the average, to retrieve all the information required to process any given terminal transaction. For the distributed configuration, average data management facility response time was 7.61 and 7.45 centiseconds.

7. COST COMPARISON

COST COMPARISON

Processing Center Costs

Cost of each of IBM System/370 Models 135 and 145 are compared in relation to case study configurations.

Component configurations for both of the IBM System/370, Models 135 and 145 are shown in Appendix C.

All costs quoted in this section are derived from the IBM Consultants Manual, and reflect normal monthly rental rates, with no discounts for long-term leases or any other discounts. It should be realized, therefore, that costs quoted in this section may be higher than actual lease rates. No obligation is expressed or implied on the part of IBM for correctness or completeness of these quoted configurations and costs.

The S/370 Model 135, as configured in Appendix C, Figure C-1, leases for $21,021 per month.

The S/370 Model 145, as configured in Appendix C, Figure C-2, leases for $36,634 per month.

Processor costs for the distributed system proposed for case study solution, with two S/370 Model 135s would be $42,042 per month. Processor costs for the centralized system is just the cost of a S/370 Model 145, $36,634 per month.

The prices quoted above consider equivalent I/O equipment on each processor. Therefore, the distributed configurations contain twice as many disk and tape drives as the centralized system. This may or may not be required, depending upon what background jobs are to run on the machines. If not required, rental rate can be reduced by $3,455 per month on systems in the distributed configuration.

COST COMPARISON

Line Costs

Cost of the leased lines are discussed in relation to the proposed case study configurations.

Line configurations for analysis of the case study were discussed in Chapter 5, Line Configurations. The cost of each link, as shown in Figures 5-3 and 5-4, was calculated using AT&T tariff information. Distances between cities were calculated using standard H,V coordinates for each city from the Donald Elliptic Projection of the United States. The cost of terminals and modems is included as part of line costs.

Total line cost for the centralized system is $18,724.95 per month. Total line cost of the distributed system is $18,955.36 per month. Figure 7-1 breaks down the total cost for each configuration.

Line Cost

Centralized Configuration

Cost of lines	$ 6,390.96
C-2 conditioning	532.00
Cost of terminals	9,885.00
Service terminal charge	291.00
Additional service terminal charge	11.00
Data set charge	1,615.00
	$18,724.96

Distributed Configuration

Cost of lines	$ 6,632.36
C-2 conditioning	532.00
Cost of terminals	9,885.00
Service terminal charge	291.00
Data set charge	1,615.00
	$18,955.36

Line Costs

Figure 7-1

COST COMPARISON

Personnel Cost

Personnel costs are discussed in relation to the proposed case study configurations.

Personnel requirements to support the current customer accounting application are discussed in Chapter 4, Personnel Requirements. Some changes can be made with the implementation of an online system. The system is being designed to support requirements in five years; therefore, for the sake of simplicity, personnel requirements will be costed at a level rate using the number of people required in five years. Actual cost may be lower or higher, depending on actual personnel growth rate, and cost of salary increases over the five-year period.

The minimum number of customer service personnel to still meet system requirements was determined through the GPSS model by decreasing the number of clerks at each office until requirements were not met at each respective office, or until clerk utilization at that office rose above 70%. This number of clerks is then the minimum required to support response time requirements. Note that the output in Appendix E shows clerk utilization higher than 70% because the model at this point simulates online customer accounting of mail-in payments. This simulates the real-life situation where a clerk may be busy when a customer walks in to make a payment, causing the customer to wait momentarily.

The minimal number of clerks required to support response time requirements in five years is 93. However, to account for vacation, illness, and other time off, a total of 110 clerks are required, totaling $49,500 per month in salary.

Data processing personnel requirements are different for the centralized and the distributed configurations.

Centralized system - Personnel requirements will remain the same as stated in Chapter 4, except as follows:

a. Programmers (4) - $1,000/month.

b. Lead keypunch operator - not needed.

c. Keypunch operators (3) - $500/month.

d. Clerks (2) - $450/month.

Data processing personnel for the centralized system total 16, and total salary is $13,000 per month.

Distributed system - Personnel requirements will remain the same as stated in Chapter 4, except as follows:

a. Programmers (4) - $1,000/month.

b. Operations Supervisors (2) - $1,000/month.

c. Lead operators (4) - $700/month.

d. Shift operators (4) - $650/month.

e. Lead keypunch operator - not needed.

f. Keypunch operators (3) - $500/month.

g. Clerks (3) - $450/month.

The bulk of the data processing personnel remain at the main office in Los Angeles. Only one operations supervisor, two lead operators, two operators, and one clerk reside in San Francisco. Data processing personnel for the distributed system total 22, with a total salary of $17,150 per month.

COST COMPARISON

Cost Summary

Total system cost is summarized for each processor configuration.

Figure 7-2 summarizes the total system cost, including processor, communication line, and personnel costs, with respect to the proposed centralized and distributed configurations.

	CENTRALIZED	DISTRIBUTED
Processor type	S/370 M145	two S/370 M135
Processor cost	$36,634.00	$42,042.00
Communications cost	18,724.96	18,955.36
Personnel cost	13,000.00	17,150.00
Total cost	$68,358.96	$78,147.36

Cost Summary

Figure 7-2

8. RELIABILITY COMPARISON

RELIABILITY COMPARISON

Reliability: A Function of Redundancy

Computer systems reliability is an important aspect of systems design. Back-up procedures must be devised for use in the event of system failure.

Reliability is an important aspect of system design. It is imperative to the customers or users of any system that the system be available when needed. Suppose someone walked into his bank and was told he could not make a withdrawal from his savings account because the computer was down; he might well be frustrated enough to move his account to another bank.

The point to the example is that reliability is an important consideration and, for this reason, back-up procedures must be devised for every system.

It is obvious that reliability is a crucial aspect of hardware procurements. Contracts for hardware procurements specify reliability as a requirement (although, unfortunately, sometimes just as a general comment such as "the system shall be reliable"). Actually, the national average on mean time between failure, and mean time to repair for proposed equipment should be a required figure in an offeror's proposal (if applicable). Some contracts go to the extent of not paying rental until an installed system has demonstrated its reliability by continual operation for some period of time without failure.

However, no matter how well the system was manufactured, and no matter how much preventative maintenance is performed, it will eventually break down, possibly at the height of customer usage. The well-managed company will be prepared for this occasion, and its back-up procedures will be immediately effective. Service may be below par until the system is repaired, but at least the customer will be able to make a withdrawal from his savings account.

For small companies, perhaps a manual method would be adequate for back-up. In the case study, a listing of current account balances for each branch office could be mailed to each respective office on a weekly basis. Then, in the event of computer failure, or loss of communications capability, the listing would be available to aid customer services.

Larger companies might well consider duplexing their system. The Mission Control Center at the Johnson Space Center in Houston, Texas, supported the Apollo and Skylab missions, and is a good example of a large-scale system. Three Univac 494s for communications, five IBM 360/75s for application processing, and two CDC CYBER/73s for data base processing, were used. Within each of the three classes, all machines were switchable; any one could be used for support. Each machine was complete of itself (in its class); no components were shared with any other machine in the same class (no single points of failure). Two of the 360/75s were used during critical phases of Skylab to support the real-time system. The other three 360/75s were used to support the Skylab terminal applications. Both machines supporting the real-time system received identical input and performed identical operations, but results of one were "bit-bucketed," except for certain monitor displays. If something happened to the primary 360/75, turning one switch (requiring much less than a second) permitted the secondary 360/75 to take the primary role. If something happened to both machines, less than ten seconds were required to initialize and have operational a third 360/75, which might have been supporting the terminal system, running jobshop or some other non-Skylab related job. Obviously, reliability is extremely important in manned spaceflight systems.

The major drawback to duplexed systems is cost. Most companies do not find it cost-effective to have an extra computer waiting to be used only if the first one fails, especially when it would have to possess similar capability as the first. However, it might be justifiable if the second machine can be used for other services that can be interrupted in the event the first computer fails.

RELIABILITY COMPARISON

Configuration Reliability Comparison

From a reliability standpoint, the function of any computing system is to provide support of customer transactions throughout the entire work day, without failure.

Computing system reliability is the major issue for this comparison. Other items, such as software reliability, should be fairly constant between the two configurations.

Wilkov, in his definition of computing system reliability (6), includes CPU (node) and communication line reliability. The most reliable configuration is one where failure of a node or a line affects communication between the least number of operating nodes; or, the operable system is not affected without failure of a maximum number of lines or nodes. Therefore, a reliable system is one in which there are redundant paths among all nodes. Obviously, services tied to a failing node are not accessible, but the rest of the computing system is serviceable.

Two lines are used for the distributed configuration; therefore, a single line failure could affect at most half the local offices. The probability of both lines being inoperable seems small. Thus, if one line does fail, offices tied to the failing line must go to manual back-up procedures to serve their customers until the line becomes available. If the line fails on the centralized system, or if both lines fail in the distributed system, all offices must use the back-up procedures.

With either configuration, modems could be equipped with back-up switchable support. Then, in the event of line failure, public lines, through DDD, could be used until the leased line problem was corrected. However, line speed would probably have to be dropped to 300 characters per second over the non-conditioned lines.

A processing center failure in the centralized system stops operation of the entire network. Again, in the distributed system, only half the network would be affected. If we went a step further in the distributed system and put mini processors with their own data base storage at each local office, CPU failures would affect only the local office.

With the distributed system, a processing center failure need not force local offices to a manual back-up procedure. The line connecting the two processing centers could be connected to the line tying local offices to the failed CPU through a multiplexor or concentrator. All local offices would then be connected with the operable CPU. However, a problem still exists: the data for local offices normally tied to the failed CPU still resides on the failed CPU. This is a very difficult problem, and one that must be addressed before distributed data base systems will be an extremely viable configuration alternative.

For the case study, each center will exchange current data with the other center once a week. This could be done through the mail or over the line between the two centers. Then, in the event of failure in one processing center, the other processing center can support with no more than week-old data, which matches the manual back-up procedure. When the failed processing center again becomes available, all its transactions during the failed time period must be re-processed to bring the online data base up to date, and resolve any conflicts caused by using the old data.

If the processing centers are sufficiently close, the permanent, online data bases may be switchable among the CPUs. This allows a secondary processor to directly access and update the permanent data base for a failed processor. This arrangement is implemented in the Real Time Computer Complex at NASA's Johnson Space Center, with a 2314 Direct Access Storage Facility that is switchable to any of the five IBM S/360 Model 75s. The data base for the Skylab Terminal System, residing in this facility, was switched to whatever CPU was supporting the terminal applications using the data base.

9. CONCLUSIONS

CONCLUSIONS

Configuration Comparison

Case study analysis shows that for equivalent cost the distributed configuration offers better performance and better reliability than the centralized configuration.

Chapter 6 discusses the relative performance of the two configurations. To summarize, terminal response, time away from customer, and customer time in branch office are equivalent between the two configurations. So, the design goal of equivalent external response times between the configurations is met.

However, internal CPU performance for the two configurations is different. The centralized configuration uses 53% of a System 370 Model 145, while the distributed configuration uses a total of 73% of a System 370 Model 135.

The 73% CPU used in the distributed configuration translates to 52%* of a Model 145. This lower percentage utilization,while only slightly lower than the centralized configuration, is most likely due to smaller queue times in the distributed configuration. I believe that a more detailed model of CPU process time, including queue maintenance, woule show a greater difference between the two configurations.

A comparison of data management facility utilization and response times for a centralized versus a distributed comput-

*Using the 5/7 ratio as defined and used in the model.

ing system is an important goal of this thesis. Relative performance and comparative cost of the two configurations is the crucial aspect of the decision to implement one or the other configuration.

As stated in Chapter 6, the model of the distributed configuration reported lower data management facility utilization, and faster data management facility response times than the model of the centralized configuration. Data management facility response times were as much as 6% faster for the distributed configuration. An even greater difference might be observed if data management facility utilization were higher than the reported 7%. Lower data management facility utilization contributes to the faster response times, because of shorter queue times, and also provides greater growth potential, in utilization, than the centralized configuration.

Chapter 7 discusses the relative cost of the two configurations. The centralized configuration total cost is $68,358.96 per month. The distributed configuration total cost is $78,147.36 per month.

A strict cost comparison would show the centralized configuration a better alternative than the distributed configuration, due to its lower cost. However, these costs can not necessarily be compared directly. Chapter 6 discusses dropping line speed to 300 characters per second instead of 600 characters per second. At the lower speed, line conditioning is not necessary, reducing monthly cost by $532 for the distributed configuration. Chapter 7 points out that the peripheral equipment on each system in the distributed configuration is the same as on the system in the centralized configuration. Therefore, twice as many tape and disk drives are available in the distributed configuration as in the centralized configuration. If this is not needed, rental can be reduced by $3,455 per system per month.

Therefore, the distributed configuration costs $2,346.40 per month over the cost of the centralized configuration. This additional cost for the distributed configuration is only 6% of the monthly rental cost of a Model 145.

The cost/performance comparison of the two configurations is therefore complete for this thesis. For approximately equivalent cost, the distributed configuration offers better CPU and data management facility performance than the centralized configuration.

Other Factors

Other factors contributing to the conclusions are available resources and reliability in the computing system.

Another way to compare the two configurations is to consider the CPU available for other functions above what the case study requires. For the distributed configuration, 127% of a Model 135 is equivalent to 91% of a Model 145. A direct comparison is now possible between the two configurations: 47% available for the centralized configuration, and 91% available for the distributed configuration. This difference is significant! It shows that, while maintaining equivalent external response times, the distributed configuration can support nearly twice the background load that the centralized configuration can support.

Also, consider what would happen if the processing load for the case study were doubled in each processor. Just assume that the processing load were underestimated by a factor of two. Doubling the 53% utilization of the centralized configuration would require a faster CPU just to get the processing done. On the other hand, doubling utilization of each processor in the distributed configuration yields utilizations of 84% and 62%. While 84% is high, both are within an acceptable range, demonstrating that the distributed configuration has better potential for supporting growth of the application system.

I contend that these differences are significant enough to give the distributed configuration a distinct performance advantage over the centralized configuration.

As Wilkov (6) pointed out, reliability means more than not having a particular piece of hardware fail. Reliability must be defined in terms of the users of the computing system. The user of a computing system usually does not care whether or not a particular hardware box is or is not operable. All he cares about is that he can get his problem solved within a reasonable time period. The only time a user is concerned about particular hardware failures is whenever a unique, or singular, piece of hardware fails. In the centralized configuration, the CPU is singular; that is, there is no hardware backup for it. If it fails, the user cannot use the system until the CPU is repaired.

In the distributed configuration, there are more hardware devices than in the centralized configuration. Therefore, there may be more hardware device failures in the distributed configuration. However, these hardware failures should have less effect upon the system users than hardware failures in the centralized configuration.

This discussion has shown that for the case study, the distributed configuration offers better performance and better reliability, at only slightly larger cost than the centralized configuration. I can only conclude that the distributed configuration is a better alternative than the centralized configuration for the case study.

CONCLUSIONS

Other Considerations

An interesting question would be to ask how to improve performance in the case study.

Adding terminals and clerks in each local office would decrease queue time in the local offices to some extent. However, this may cause longer queue times in the CPU and therefore cause longer LIFO response times.

Now the interesting part of the question is how do we decrease queue time in the CPU, and thereby reduce LIFO response time? The standard, obvious answer, used many times, is to get a bigger, faster, and more expensive CPU.

I believe there is another answer that may be better. A logical extension of the conclusions drawn in the previous section is that multiple CPUs connected in a distributed configuration could provide more cost-effective processing capabilities than one, or a few, large processors.

However, as in all trade-offs, the pendulum can swing too far in the other direction. It seems clear that the processing job cannot be broken into too many pieces, because interprocessor communication would become so large that it would negate any response time gained by overlapping the processing. An attempt to determine this break-even point would make an interesting research topic.

One other model run was made which has a bearing on this point. The run was to compare performance of a distributed configuration versus a centralized configuration in a different environment, and merits discussion.

In a distributed configuration, some probability exists that a terminal request being processed by one CPU will need data from a data management facility of another CPU. Provision for this was made in the model, and the probability of intercommunication occurring can be modified by changing a GPSS function in the model. For the case study, the probability of this occurring was specified at about one percent of all transactions.

One execution of the model was made specifying 100% probability of intercommunication occurring. Results showed very poor performance. External response times were larger than their respective goals. Queue times increased drastically, with queue time for the CPU more than doubling. Utilization of all network components increased.

It is obvious, then, that for the distributed configuration to be effective, the information set must be divided such that a large percent of data requests by a CPU are satisfied from the data management facility directly associated with that CPU.

It is important to note here, and further disucss in Appendix B, that another popular hardware configuration exactly matches the distributed configuration with 100% probability of intercommunication. One installed example of this hardware configuration is the Distributed Computer System. The DCS provides a single data management facility, through which all processors must access all required data.

I conclude from this model execution, that, unless it is impossible to divide the information set to preclude a large amount of interprocessor communication, a better cost/performance ratio could be achieved by distributing the data through the computing system.

APPENDIXES

APPENDIX A: OTHER MAJOR CONFIGURATIONS

CYBERNET (1)

The CYBERNET is a distributed, heterogeneous network composed of CDC 6600 and 3300s.

The CYBERNET network was formed to connect Control Data Corporation's existing data centers, and provides an example of a currently operating commercial network. It was expected that by connecting the centers, they would gain:

1. greater throughput by load balancing
2. greater utilization of available resources
3. better reliability
4. the convenience of enabling a customer to choose a configuration that is best suited to his problem rather than one which is best located geographically.

CYBERNET is a distributed network consisting of CDC 3300 and 6600s connected by voice and wide-band (40.8kbs) lines. The 3300s are used as network controllers.

APPENDIX A: OTHER MAJOR CONFIGURATIONS

CYCLADES (2)

The CYCLADES network is a distributed, heterogeneous network composed of CII, PHILIPS, CDC, and IBM computers.

The CYCLADES network is being developed in France to link twenty heterogeneous computers located in universities, research and data processing centers. Experimentation in data communications, computer interaction, cooperative research, and distributed data bases are goals of the network implementors. A particular objective is to provide various departments of the French Administration access to multiple data bases located in geographically distant areas.

Host-to-host protocols are based on a simple message exchange procedure. CYCLADES used a packet-switching subnetwork as a transparent message carrier. Message addresses can have variable formats, and messages are not delivered in sequence.

APPENDIX A: OTHER MAJOR CONFIGURATIONS

Distributed Computer System (1)

The DCS network is a distributed, heterogeneous network.

The Distributed Computer System (DCS) is a distributed, experimental network constructed at the University of California at Irvine. All nodes of the network are of the PDP family of mini- and midi-scale computers. Network communication used Bell System T1 technology to implement a digital communication ring. The communications controller is a fairly sophisticated, but non-programmable hardware device called the ring interface. There are three types of ring interface:

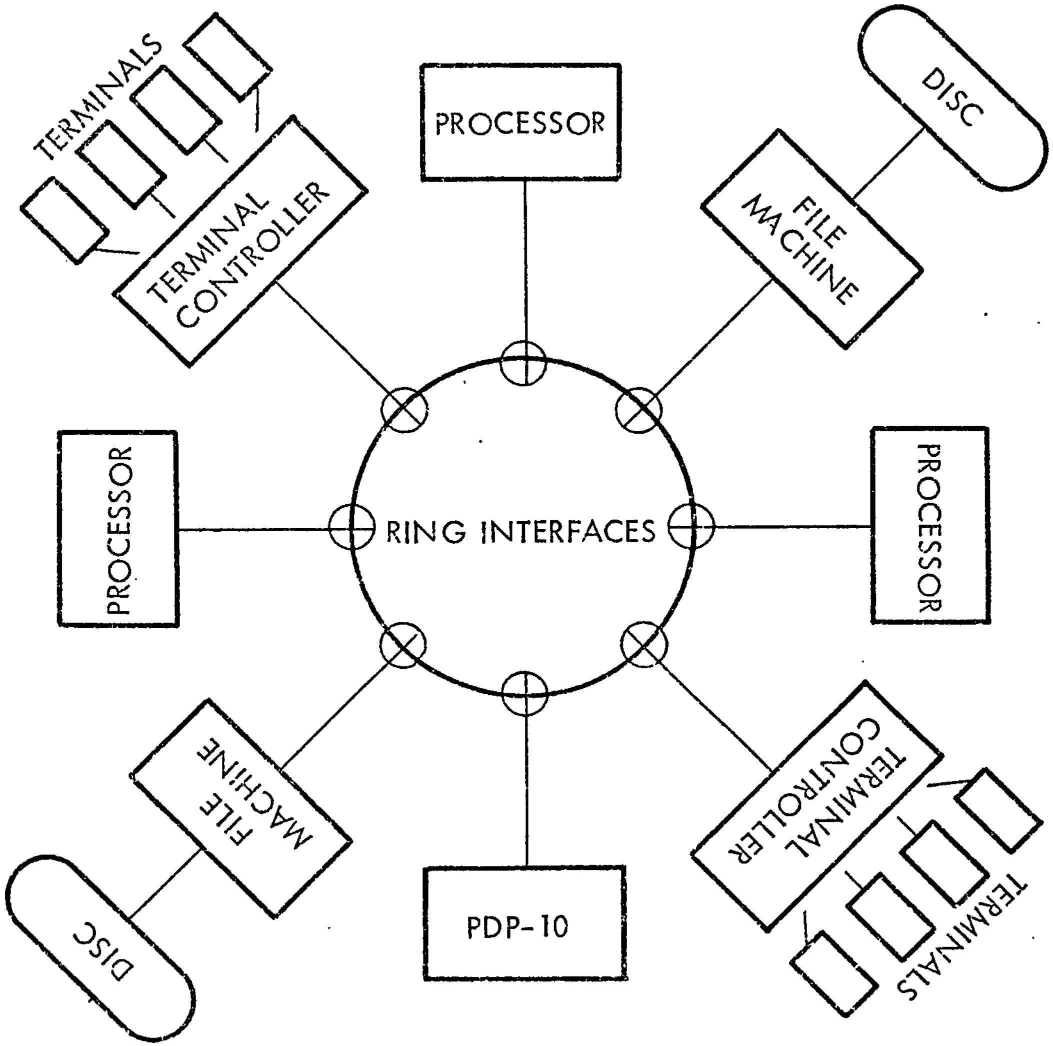
1. to support a host computer
2. to support direct attachment of a terminal
3. to support the construction of a network of rings, operating similar to basic ring operation.

The stated aims of the network are:

1. low maintenance cost and modest start-up cost
2. low incremental expansion cost
3. easy addition of new services
4. reliability.

The network is not planned as a commercially viable system, but to explore distributed architecture issues.

A distributed data base capability is planned and is included in the figure. The main novel feature of the communications protocol, designed for a distributed system, is that messages are addressed to the receiver by means of the name of the receiver, not by the receiver's location. Thus, the receiver can be allowed to migrate to other computers without having to inform the transmitter of its movement.



THE DISTRIBUTED COMPUTER SYSTEM

Figure A-1

APPENDIX A: OTHER MAJOR CONFIGURATIONS

Michigan Educational Research Information Triad (1)

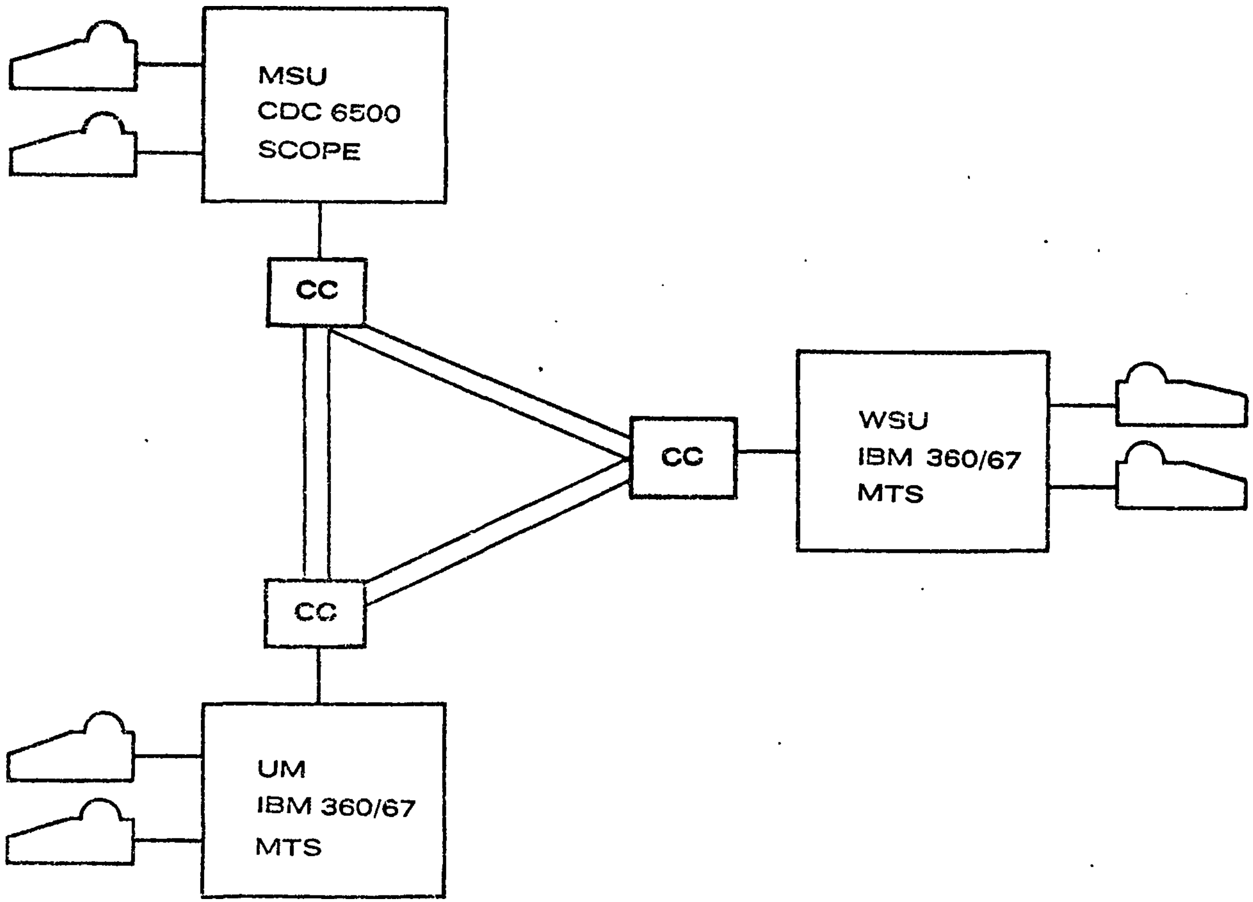
The MERIT network is a distributed, heterogeneous network composed of IBM 360/67s and CDC 6500s.

The MERIT network is a cooperative effort among the Michigan State, Wayne State, and Michigan Universities. Its aim is to share educational computing resources through a computer network.

The MERIT network is a distributed, heterogeneous network consisting of three nodes. Each host computer is connected to the communication network by means of a modified DEC PDP-11/20. The communications lines are a group of dial-up, 2000 bps voice grade lines.

The PDP-11/20 is capable of providing a variable length message transfer from PDP-11/20 main storage to host storage or to the communication system. In addition, it allows the host computer to treat the PDP-11/20 as several peripheral devices. This simplifies the host software since it allows the dedication of a pseudo-peripheral device to each user.

The PDP-11/20, or communication controller, is capable of acting as a store-and-forward system. Thus, if a path is destroyed, an alternate path exists via another communications controller.



MERIT NETWORK

Figure A-2

APPENDIX A: OTHER MAJOR CONFIGURATIONS

The OCTOPUS System (1)

The OCTOPUS System is a mixed organization, heterogeneous network composed of CDC 6600s and 7600s.

The OCTOPUS System is an elaborate heterogeneous network composed of a complement of devices, including two CDC 6600s, two CDC 7600s, and eventually will include a CDC STAR. These machines operate as time-shared facilities, serving the Lawrence Berkley Laboratory. The Laboratory plans to provide a centralized data base to serve the wide variety of input-output devices that view the network as a single resource.

The communications protocol utilizes a store-and-forward method, over twelve-megabit capacity hardwired cables. The system can be considered as two superimposed subnetworks. The first is a File Transport subnet consisting of the workers, a transport control computer - a dual DEC System 10, and the file storage. The second network is a Teletype subnet consisting of PDP 8s (each supporting 128 terminals), the workers, and the transport control computer. It should be noted that the Teletype subnet is a distributed network, while the File Transport subnet is a centralized subnet. The dual DEC System 10 insures reliability in this centralized subnet. In addition, while the subnets are logically independent, there are cross couples providing redundant paths in the event of failure.

APPENDIX A: OTHER MAJOR CONFIGURATIONS

Time Sharing System (1)

The TSS is a distributed, homogeneous network composed of IBM S/360 Model 67s.

The TSS network is composed of homogeneous computers with distributed processing. Each host consists of a 360/67 operating under the TSS/360 operating system. Some of the nodes also have local networks of 360s, but these do not appear as hosts in the TSS network.

The nine nodes are connected via voice grade, switched (DDD) lines through IBM 2701 and 2703s. Therefore, all error recovery, store-and-forward, and other line control functions execute in the host machine. There are plans to expand to 50 kbs lines when the demand exists. There are also plans to attach a 370/145 to act as a communication processor and data base manager.

Since all machines on the network are similar, program and data interchange is possible. Both dynamic file access and remote batch are available.

APPENDIX A: OTHER MAJOR CONFIGURATIONS

TYMNET (4)

TYMNET is a distributed, heterogeneous network composed of Burroughs, IBM, CDC, XDS, and DEC computers.

TYMNET, of Tymshare, Inc., is a distributed network where data can travel from node to node without going through a central location. However, network control is centralized.

As of April, 1973, TYMNET supported 54 cities with 37 large-scale computers using over 40,000 miles of leased telephone lines. The network consists of 80 communication processors called Tymsats (Tymshare satellites). Each city serviced has at least one Tymsat. The Tymsat is a modified Varian 620 minicomputer with at least 8K words of memory. Each Tymsat can handle up to 32 asynchronous low-speed lines (110-300 baud) and up to three synchronous lines (2400-4800 baud). The Tymsat provides automatic baud rate detection and code conversion for these lines.

Tymsats are connected with C2-conditioned Bell long lines through Bell 201 and 203 modems. Lines are full-duplex, although half-duplex is also permitted. A check-summing algorithm is used to detect errors on the synchronous lines connecting Tymsats. Messages are broken into packets of 12 to 66 characters. A 16-bit vertical check sum and a 16-bit spiral check sum are added at the end of each packet.

When a packet is successfully received, that packet's number is returned to the sending Tymsat. If an error is detected, the block is disregarded and not acknowledged by the receiving Tymsat. An unacknowledged packet is automatically retransmitted by the sending Tymsat.

A Tymshare computer is linked to the network through a Tymsat base, differing from a Tymsat in that it does not support asynchronous lines. It connects directly to a memory buss on a host computer and has up to five synchronous lines for connecting to other Tymsat bases.

The controller of Tymnet is the network supervisor, a program that runs under time sharing on an XDS 940. It handles log-ons, performs diagnostics, keeps statistics, and, in general, controls the network.

APPENDIX B

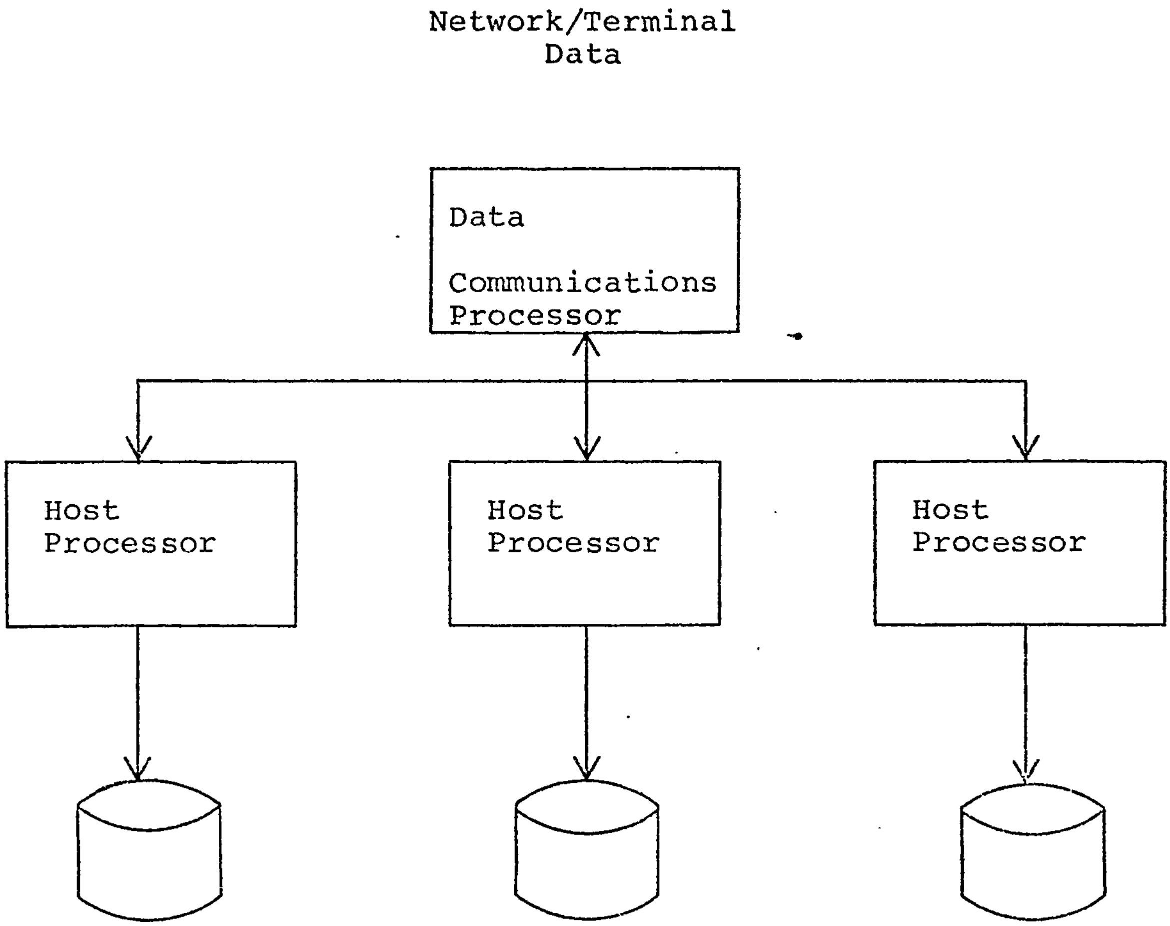
Other Processor Configurations

Two other variations of hardware configuration are the front-end and the front-end/back-end configurations.

Two other hardware configurations merit discussion due to their current popularity in systems design. However, they will not be included as proposed configurations for the case study due to their similarity to the two proposed configurations, and due to their inherent disadvantages.

Front-end configurations

A high degree of sophistication and effective data communication and network processing is achieved in the front-end concept (Figure B-1). This configuration emphasizes the concentration of all related data communication functions in a large-scale front-end system. The functional elements of the front-end configuration include the large-scale data communication system connected directly or through a communications controller interface to the host processors. The data base(s) may be attached directly to the host processors, and all application oriented functions, including data base processing, is handled by these processors. The basis for the front-end concept is that through the concentration of all data communication functions in one large-scale system, this



Front-End Data Communications Configuration

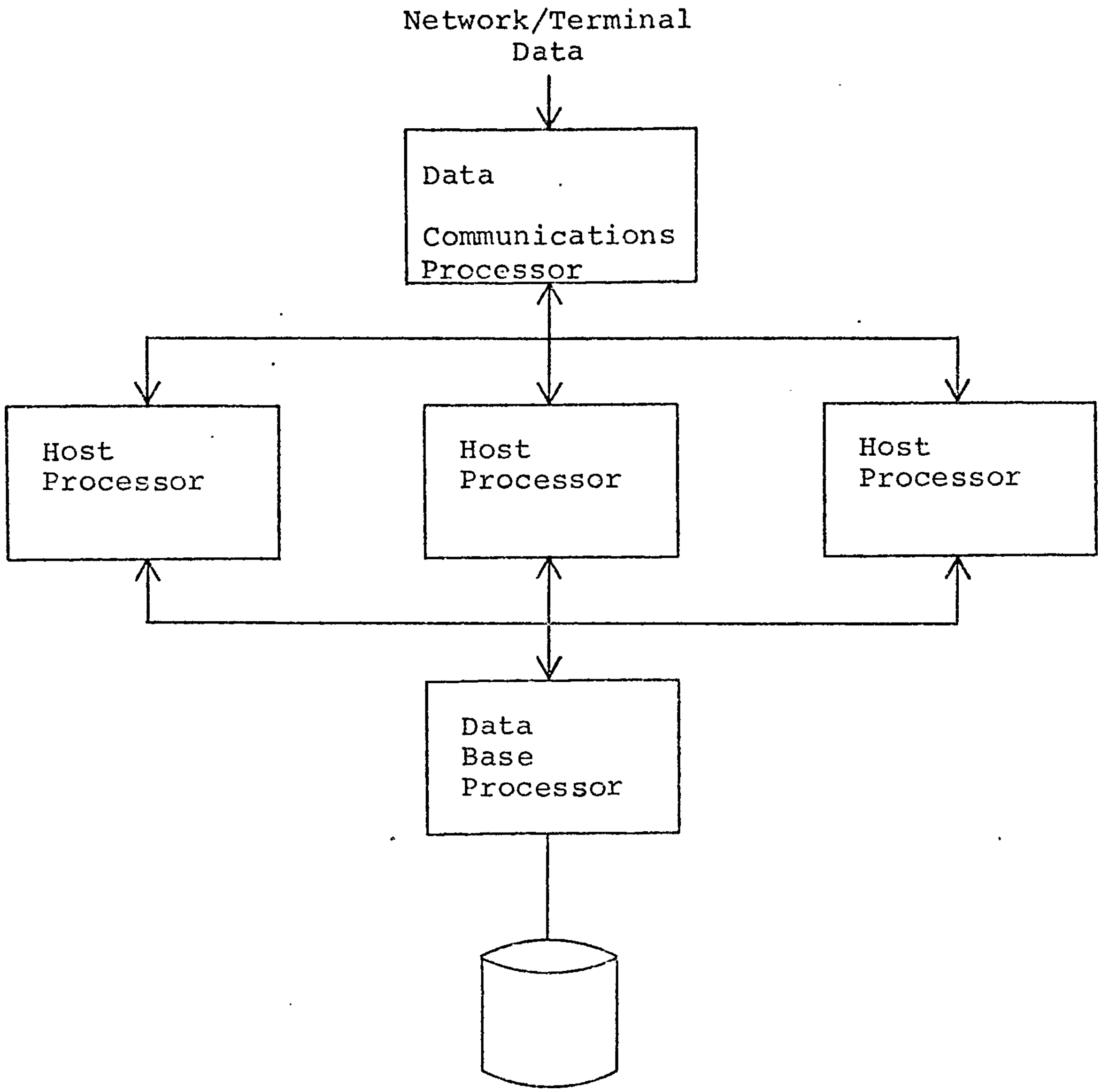
Figure B-1

function is performed more efficiently. Some of the functions performed by the front-end system are network support, terminal support, and message switching. One of its most important functions is that of controlling communication between the host processors, including the routing of messages, commands, and data from the data bases.

An example of concentrated front-end processing is the mission configuration in the Real Time Computer Complex. A large-scale communications oriented system does the front-end processing, including support for the Manned Space Flight Network, message switching, and terminal controller, while host computer systems are dedicated to application functions.

Front-end/back-end configuration

The front-end/back-end concept (Figure B-2) allows maximum computing power to be applied to each of the distinct functions in the configuration: data communication, application processing, and data base processing. The functional elements incorporated into this configuration include at least three distinct computing systems; one to handle the data communication function, one to handle all application processing, and one to handle the data base processing. These systems are connected directly or through a communication controller interface. The front-end or data communication system provides full support for all terminal and network processing including message switching and line



Front-End/Back-End Specialized Processors

Figure B-2

control. Additionally, this system provides centralized access to all host processors in the configuration, routing messages into and out of the network. The back-end or data base system provides access to the data base for all of the host processors. The data base system could also be the mechanism for inter-host communication, rather than using the front-end system. The host processors provide all of the necessary application functions, using the front-end system for external communication and the back-end system for data base processing.

An example of this type of configuration is the terminal system used to support Skylab missions in the Real Time Computer Complex. The front-end system receives and processes terminal data, and then routes it to the host processor where the data is processed and stored on the back-end data base system.

Variations of this configuration are possible. The data communications and the data base processor could be combined in a front-end configuration. Each host could support its own data communications while utilizing the back-end data base processor. The Distributed Computer System is of the latter format.

Configuration disadvantages

Centralization of data communications or data base support obviously permits a great deal of sophistication, or specialization of the processor(s) responsible for those tasks. This leads to efficient, cost-effective utilization of communication and data base support tools.

However, one aspect of these configurations that seems to be continually underestimated is the amount of communication required among the communication and data base processor(s) and the host processor(s). Design of efficient communications protocol between any two processors is a difficult task; and when every terminal command must pass through inter-processor communication and ten or twenty, or more, data base requests per terminal request must go through inter-processor communication, efficient protocol becomes most crucial to systems operation. In some cases, host computer resource usage for inter-processor communication exceeds what would be required if the host processor performed the actual data base support itself.

The interface handler between the host processor and the data base processor for the Skylab missions at the Mission Control Center can be used as an example. The data base processor for this system supported up to 2.1 billion 8-bit bytes of data. With such a large on-line data base, a separate data base processor was deemed necessary: the host processor was already too busy to manage that much data. However, the interface handler in the host processor, controlling communication with the data base processor, required better than sixty thousand bytes of main memory, and better than ten percent of the CPU, even after using special designs and capabilities of the Real Time Operating System. An interesting experiment, now, would be to redesign the system such that the host processor was responsible for all data base processing, and compare performance, or throughput, of the two designs.

Obviously, inter-processor communication is a significant portion of host processor resource utilization, and proper consideration must be given to this point in designing computer configurations.

APPENDIX C

Hardware System Components Listing

Following is a list of hardware system components as taken from the IBM Consultants Manual. No obligation on the part of IBM is expressed or implied for completeness or correctness of this list.

System/370 Model 135

3135 Processing Unit (Model I)

- 3046 Power Unit
- Special Features
  - 12K Storage Increments
  - Extended Precision Floating Point

Channels

- Selector Channels
- Block Multiplexor Channels
- Byte Multiplexor Channels

Console Functions

- 3210 Console Printer - Keyboard
- 3210 Printer Adapter

I/O Units

- 1442 Card Read - Punch
- Integrated Printer Adapter
- 1403-N1 Printer
- 1416 Train Cartridge

Disk Files

- Integrated File Adapter
- 3333 Disk Storage and Control
- 3330 Disk Storage

Magnetic Tape

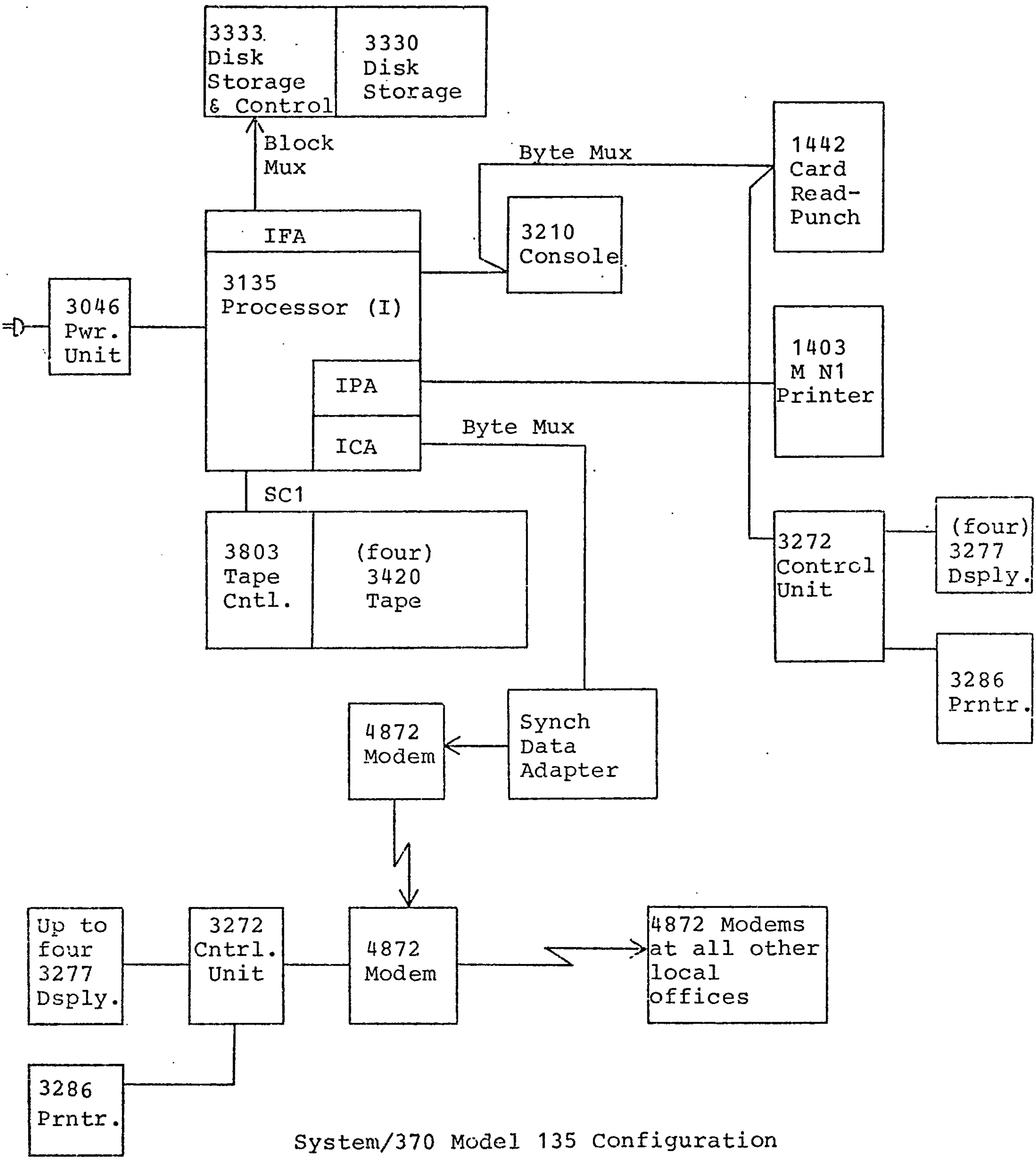
3803 Tape Control

3420 Mag Tape Unit

Communications

Integrated Communication Adapters

Synchronous Data Adapter Type II



System/370 Model 135 Configuration

Figure C-1

System/370 Model 145

3145 Processing Unit (Model J2)

- 3047 Power Unit
- Special Features
  - Clock Comparator and CPU Timer

Channels

- Same as M135

Console Functions

- Same as M135

I/O Units

- 1442 Card Read - Punch
- 3811 Printer Controller Unit
- 3211 Printer
- 3216 Interchangeable Train Cartridge

Disk Files

- Integrated Storage Control
- 3333 Disk Storage and Control
- 3330 Disk Storage

Magnetic Tape

- Same as M135

Communications

3704 Communications Controller (Model A4)

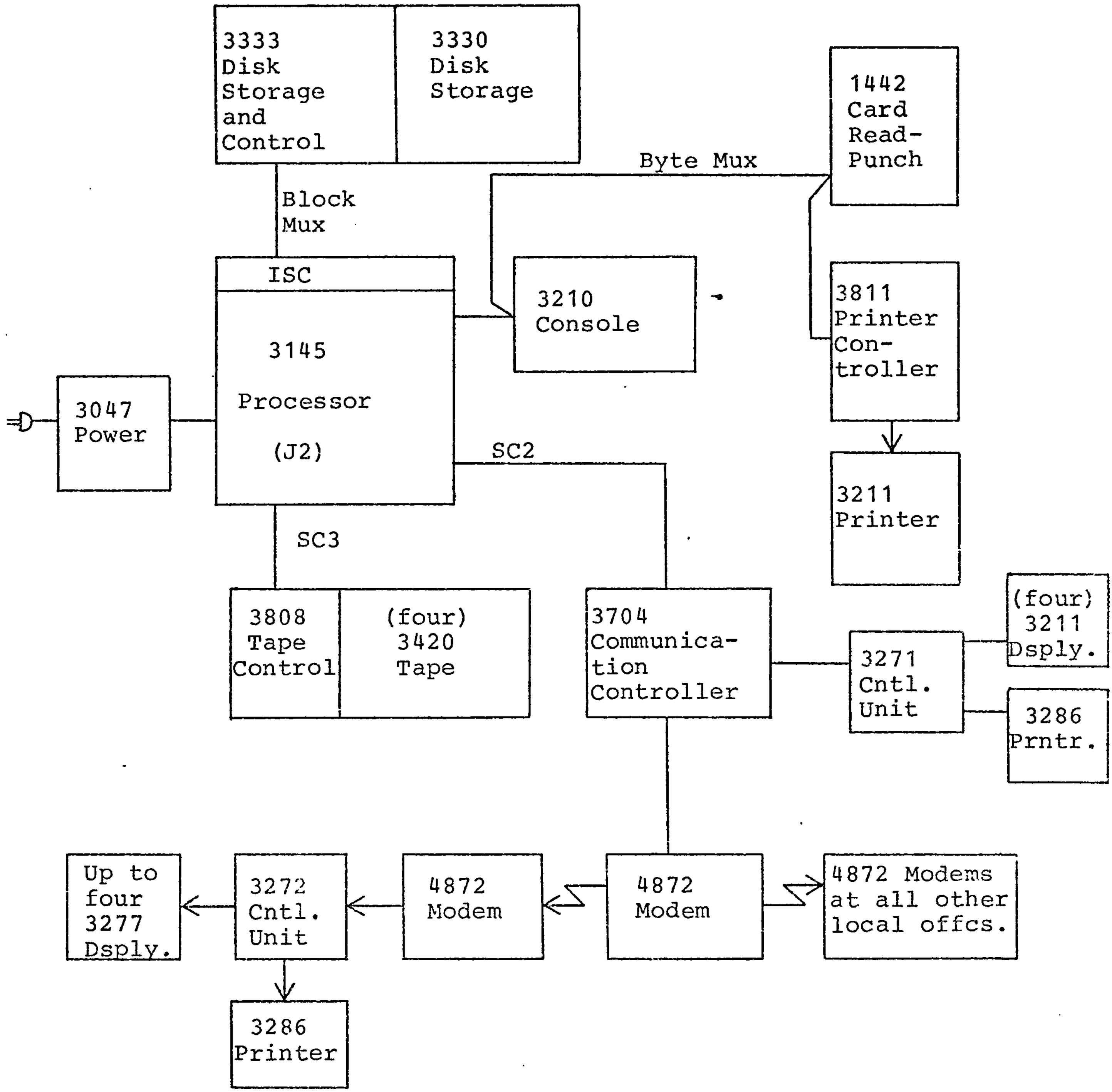
Channel Adapter (Type 1)

Communications Scanner (Type 2)

Line Interface Base (Type 1)

Line Set (Type 1H)

Business Machine Clock



System/370 Model 145 Configuration

Figure C-2

APPENDIX D

Performance Model Explanation

Following is a brief discussion on the GPSS model logic flow and verification of the major functions and uses of the model.

Model Logic Flow

Figure D-1 shows an overall view of what happens in a branch office in the case study, and, correspondingly, the basic logic flow for the model. Appendix E shows the detailed logic flow for the distributed data base system.

In Figure D-1, steps 5 - 8 comprise the terminal response time, which the IPL Company desires to keep below 7 seconds. Steps 3 - 9 comprise time away from customer, which IPL wants less than 180 seconds. Steps 1 - 11 make up time in branch office, which IPL wants less than 6 minutes.

Function Verification

Intergenerate time -

$$\left(\frac{\text{359274 accounts}}{\text{21 days}}\right) \left(\text{20\% peak hour}\right) \left(\text{*50.5\%}\right)$$

$$= \text{1728 transactions per peak hour}$$

$$= \text{.48 transactions per peak second.}$$

So, interarrival time = 1/.48 = 2.08 seconds.

*Total transactions coming into office; see TTYPE function.

1. Customer walks into branch office.
2. Customer talks to clerk.
3. Clerk goes to terminal.
4. Clerk keys-in message.
5. Message sent down line to data processing center.
6. Message is processed.
7. Reply sent down line to terminal.
8. Reply is printed on terminal.
9. Clerk leaves terminal.
10. Clerk talks to customer.
11. Customer leaves branch office.

What Happens in a Branch Office?

Figure D-1

Transaction type - TTYPE function -

Walk-in transactions, as percent of total active accounts, from Chapter 4:

1.	25.5%
2.	4.5%
3.	6.2%
4.	2.8%
5.	5.5%
6.	5.1%
7.	.9%
Total -	50.5%

Each transaction type, expressed as percent of transactions coming into branch office:

	percent	cumulative percent
1.	50.5	50.5
2.	8.9	59.4
3.	12.3	71.7
4.	5.5	77.2
5.	10.9	88.1
6.	10.1	98.2
7.	1.9	100.1

The cumulative percent above was used to define the TTYPE function in the model.

Model Validation

Each table was compared against its generation function for statistical equality. In addition, the following three areas were investigated.

A. Warm-Up Period

One definition of warm-up time, or time required for normal queues to build up, is to simulate enough time such that the least frequent transaction occurs at least five times.

Using this definition, the warm-up time for the GPSS 1100 model was calculated.

Least frequent city = 1.5%

Least frequent transaction type = .9%

So: $(.015)\ (.009) * X = 5$

or $X = 5/0.000135$

where X equals the number of transactions that must be generated during the warm-up period.

Then: X = 37,037. At average intergenerate time of two seconds, warm-up time = 37,037*2 seconds, or 20.6 hours.

A warm-up time of 20.6 hours is not meaningful. The peak period being simulated is only one hour. The actual computer time used for a 20.6-hour simulation warm-up would be extensive.

Therefore, a warm-up time of 30 minutes, one-half the time being simulated, was chosen. Actual computer time usage was still better than two hours for the simulation as shown in Appendix E.

B. Simulation Period

The simulation period, or length of each simulated time period, should also be long enough for the least frequent transaction to occur five times. It was chosen to simulate two hours, or 1/10th of the 20.6 hours, as an appropriate trade-off between actual computer usage and complete statistical validity, according to the definition. In actual practice, it is doubtful that there would be statistically meaningful difference between a two-hour and a twenty-hour simulation for this model. The next section will explore this further.

C. Number of Runs

It is necessary to make more than one model run to ensure results are not due to one particular sequence of pseudo-random numbers, and that the model is stabilized. Since the simulated time period is only 1/10th that calculated for run time, it is important to assure that the model has reached stabilization.

To decide if the model has stabilized, the customer time in office in the smallest city in each run will be compared. If the time in office is statistically equivalent in each run, it will be assumed that the model is stabilized.

Following are the results of one particular set of runs:

Run Number	Reported Mean Time in Office	Standard Deviation
1	117.18	93.48
2	123.10	92.11
3	120.86	93.08

Due to the closeness of these numbers, it appears the model is near the stabilization point with three runs. As the three runs plus the warm-up period require better than two and one-half hours actual CPU time, and four to five hours elapsed time, it was decided not to increase the number of runs above three.

Other Notes

A. Model Errors

Appendix E contains the results of a typical execution of the distributed configuration model. One error in the output should be pointed out.

An exponential function is used to calculate intergenerate time for transactions coming into a branch office. The intergenerate time is then tabulated, in GPSS table T81, as a check on function validity.

The printout showing value distribution for T81 appears to validate the function: all the characteristics of an exponential function appear to be met.

However, in the printout showing the mean and standard deviation for T81, the numbers are considerably different than what is expected. This appears to be an error in the GPSS simulator itself, in not resetting IA type tables at a RESET command. The non-weighted sum of arguments over the three runs appears to validate this contention.

All other values appear to be valid. There is no reason to doubt the correctness of the rest of the model.

B. Model Notes

Cities 4 and 14 were deliberately under-designed to see what effect this would have on performance (and cost).

City 4 was given only one clerk in the local office. LIFO response time was not affected, and, naturally, with only one clerk, queue time for the terminal in that city was zero. However, queue time for the clerk averaged 181 seconds, almost five times the average clerk queue time over the 19 cities.

City 14 was given only one terminal when, very likely, two would be required. Again, this did not affect LIFO response time. However, queue time for the terminal averaged 74 seconds, while the average over the 19 cities was 18 seconds. This also affected clerk queue time, averaging 80 seconds, while the 19-city average was 37 seconds.

It is recommended that the IPL Company place two terminals in city 14, and at least two clerks in city 4, in order to get 90% of their customers out of the office within the six-minute goal.

APPENDIX E

GPSS Model Listing

Following is a listing of the GPSS 1100 model of the distributed configuration, and the results of a representative execution of the model on the Univac 1108 at the University of Houston.

The model was coded such that differences in code between the centralized model and the distributed model were minimized. For this reason, a listing of the centralized model is not included.

The centralized model differs from the distributed model only in the definition of four GPSS functions:

CPPT, the CPU assignment function;

LINE, the line assignment function;

CPUSPD, the CPU speed assignment function; and

CRSFN, the function to assign the amount of communication between multiple CPUs in the configuration.

```
IN,R    DISSML,          ,            ,180,400     . R. L. MORRISON
CORE 57K
.9
TA         ,,U29 . 029 CONVERSION PROCESSOR, VERSION OF 30 MAY 1973
G,A   GPSSS.,F
G,A    CENMDL.,F
SSS.GPSS,L CENMDL.SRC
SS 3.1    -03/29-07:49-(000)

              JOB
      *
              ORDER,P     P1,P2,P3,P4,P5,P6,P7,P8,P9
              ORDER,S     S1,S2,S3,S4,S5,S6,S7,S8,S9,S10,S11,S12,S13,S14,S15
              ORDER,S     15,S16,S17,S18,S19
              ORDER,S     30,S31,S32,S33,S34,S35,S36,S37,S38,S39,S40,S41,S42
              ORDER,S     42,S43,S44,S45,S46,S47,S48,S49
              ORDER,S     55
              ORDER,F     F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,F11,F12,F13,F14,F15
              ORDER,F     15,F16,F17,F18,F19,F20,F21,F22,F23,F24,F25,F26,F27
              ORDER,F     27,F28,F29,F30
              ORDER,F     75,F76,F77
              ORDER,F     85,F86,F87
              ORDER,F     90,F91,F92,F93,F94,F95
              ORDER,F     99
              ORDER,T     T1,T2,T3,T4,T5,T6,T7,T8,T9,T10,T11,T12,T13,T14,T15
              ORDER,T     15,T16,T17,T18,T19
              ORDER,T     30,T31,T32,T33,T34,T35,T36,T37,T38,T39,T40,T41,T42
              ORDER,T     42,T43,T44,T45,T46,T47,T48,T49
              ORDER,T     60,T61,T62,T63,T64,T65,T66,T67,T68,T69,T70,T71,T72
              ORDER,T     72,T73,T74,T75,T76,T77,T78,T79
              ORDER,T     80,T81,T82,TYPE,CITY
              ORDER,T     99
              ORDER,Q     Q1,Q2,Q3,Q4,Q5,Q6,Q7,Q8,Q9,Q10,Q11,Q12,Q13,Q14,Q15
              ORDER,Q     15,Q16,Q17,Q18,Q19,Q20,Q21,Q22,Q23,Q24,Q25
              ORDER,Q     30,Q31,Q32,Q33,Q34,Q35,Q36,Q37,Q38,Q39,Q40
              ORDER,Q     40,Q41,Q42,Q43,Q44,Q45,Q46,Q47,Q48,Q49,Q50
              ORDER,Q     50,Q51,Q52,Q53,Q54,Q55
              ORDER,Q     75,Q76,Q77
              ORDER,Q     85,Q86,Q87
              ORDER,Q     90,Q91,Q92,Q93,Q94,Q95,Q96,Q97,Q98,Q99
              ORDER,Q     99
      *
      *
      *
      *****    PLEASE NOTE:  TIME UNIT ASSUMED IS 1 CENTISECOND   *****
      *
      *
      *
      *   PARAMETER VALUES ASSIGNED
      *
      *
      *   P1    BRANCH OFFICE
      *
      *   P2    TRANSACTION TYPE
      *
      *       1=CASH PAYMENT
      *       2=A/R INQUIRY AND PAY
      *       3=A/R INQUIRY, NO PAY
      *       4=HISTORY INQUIRY
      *       5=TURN ON SERVICE
      *       6=TURN OFF SERVICE
      *       7=BILLING ADJUSTMENT
```

```
*
*   P3   NUMBER OF TRANSMISSIONS REQUIRED FOR TRANSACTION
*
*   P4   MARK FOR TIME AWAY FROM CUSTOMER
*
*   P5   TERMINAL NUMBER
*
*   P6   INPUT MESSAGE LENGTH
*
*   P7   WORKING MESSAGE TYPE--WILL BE ALTERED AS TRANSACTION PROGRESS
*
*      1=CASH PAYMENT
*      2=A/R INQUIRY AND PAY
*      3=A/R INQUIRY, NO PAY
*      4=HISTORY INQUIRY
*      5=TURN ON SERVICE,     TRANSMISSION NO.1
*      6=TURN OFF SERVICE,    TRANSMISSION NO. 1
*      7=BILLING ADJUSTMENT, TRANSMISSION NO. 1
*      8=TURN ON,     TRANSMISSION NO. 2
*      9=TURN OFF,    TRANSMISSION NO. 2
*     10=ADJUSTMENT, TRANSMISSION NO. 2
*
*   P8   MARK TIME FOR L I F O
*
*   P9   OUTPUT MESSAGE LENGTH
*
*
*
*   VALUES ASSIGNED TO STORAGES
*
*      1-25  CLERK POOLS IN OFFICES
*      31-55 TERMINAL POOLS IN OFFICES
*
*   STORAGE SIZE DEFINITIONS
*
S1      CAPACITY   3
S2      CAPACITY   2
S3      CAPACITY   2
S4      CAPACITY   1
S5      CAPACITY   2
S6      CAPACITY   3
S7      CAPACITY   5
S8      CAPACITY   4
S9      CAPACITY   3
S10     CAPACITY   5
S11     CAPACITY   3
S12     CAPACITY   6
S13     CAPACITY   3
S14     CAPACITY   8
S15     CAPACITY   7
S16     CAPACITY   8
S17     CAPACITY   9
S18     CAPACITY   3
S19     CAPACITY   16
*
S31     CAPACITY   1
S32     CAPACITY   1
S33     CAPACITY   1
S34     CAPACITY   1
S35     CAPACITY   1
S36     CAPACITY   1
S37     CAPACITY   1
```

```
        S38     CAPACITY    1
        S39     CAPACITY    1
        S40     CAPACITY    1
        S41     CAPACITY    1
        S42     CAPACITY    1
        S43     CAPACITY    1
        S44     CAPACITY    1
        S45     CAPACITY    1
        S46     CAPACITY    2
        S47     CAPACITY    1
        S48     CAPACITY    1
        S49     CAPACITY    4
        *
        *
        *   VALUES ASSIGNED TO FACILITIES
        *
        *      1-75  TERMINALS
        *      76-80 DATA BASE
        *      86-90 CPU (PARTITION)
        *      91-99 TRANSMISSION LINES
        *
        *
        *
        *   VALUES ASSIGNED TO TABLES
        *
        *      1-25  LIFO RESPONSE BY BRANCH OFFICE
        *      31-55 TIME AWAY FROM CUSTOMER, BY BRANCH OFFICE
        *      61-85 TIME IN BRANCH OFFICE
        *
        *
        *   TABLE DEFINITION CARDS
        *
        T1      TABLE       P$WORK,600.,100.,2
        T2      TABLE       P$WORK,600.,100.,2
        T3      TABLE       P$WORK,600.,100.,2
        T4      TABLE       P$WORK,600.,100.,2
        T5      TABLE       P$WORK,600.,100.,2
        T6      TABLE       P$WORK,600.,100.,2
        T7      TABLE       P$WORK,600.,100.,2
        T8      TABLE       P$WORK,600.,100.,2
        T9      TABLE       P$WORK,600.,100.,2
        T10     TABLE       P$WORK,600.,100.,2
        T11     TABLE       P$WORK,600.,100.,2
        T12     TABLE       P$WORK,600.,100.,2
        T13     TABLE       P$WORK,600.,100.,2
        T14     TABLE       P$WORK,600.,100.,2
        T15     TABLE       P$WORK,600.,100.,2
        T16     TABLE       P$WORK,600.,100.,2
        T17     TABLE       P$WORK,600.,100.,2
        T18     TABLE       P$WORK,600.,100.,2
        T19     TABLE       P$WORK,600.,100.,2
        *
        T31     TABLE       P$WORK,17000.,1000.,2
        T32     TABLE       P$WORK,17000.,1000.,2
        T33     TABLE       P$WORK,17000.,1000.,2
        T34     TABLE       P$WORK,17000.,1000.,2
        T35     TABLE       P$WORK,17000.,1000.,2
        T36     TABLE       P$WORK,17000.,1000.,2
        T37     TABLE       P$WORK,17000.,1000.,2
        T38     TABLE       P$WORK,17000.,1000.,2
        T39     TABLE       P$WORK,17000.,1000.,2
        T40     TABLE       P$WORK,17000.,1000.,2
```

```
       T41     TABLE       P$WORK,17000.,1000.,2
       T42     TABLE       P$WORK,17000.,1000.,2
       T43     TABLE       P$WORK,17000.,1000.,2
       T44     TABLE       P$WORK,17000.,1000.,2
       T45     TABLE       P$WORK,17000.,1000.,2
       T46     TABLE       P$WORK,17000.,1000.,2
       T47     TABLE       P$WORK,17000.,1000.,2
       T48     TABLE       P$WORK,17000.,1000.,2
       T49     TABLE       P$WORK,17000.,1000.,2
       *
       *
       *
       T61     TABLE       M$1,30000,6000,2
       T62     TABLE       M$1,30000,6000,2
       T63     TABLE       M$1,30000,6000,2
       T64     TABLE       M$1,30000,6000,2
       T65     TABLE       M$1,30000,6000,2
       T66     TABLE       M$1,30000,6000,2
       T67     TABLE       M$1,30000,6000,2
       T68     TABLE       M$1,30000,6000,2
       T69     TABLE       M$1,30000;6000,2
       T70     TABLE       M$1,30000,6000,2
       T71     TABLE       M$1,30000,6000,2
       T72     TABLE       M$1,30000,6000,2
       T73     TABLE       M$1,30000,6000,2
       T74     TABLE       M$1,30000,6000,2
       T75     TABLE       M$1,30000,6000,2
       T76     TABLE       M$1,30000,6000,2
       T77     TABLE       M$1,30000,6000,2
       T78     TABLE       M$1,30000,6000,2
       T79     TABLE       M$1,30000,6000,2
       *
       T81     TABLE       IA,100,20,25
       T82     TABLE       IA,100,20,25
       *
       TYPE    TABLE       P$P2,1,1,8                                @ MSG TYPE DIST
       CITY    TABLE       P$P1,1,1,20                               @ CITY DIST
       *
       *
       *   VALUES ASSIGNED TO QUEUE NUMBERS
       *
       *        1-25  CLERKS IN THE OFFICES
       *        31-55 TERMINALS IN THE OFFICES
       *        76-80 DATA BASE
       *        86-90 CPU
       *        91-99 TRANSMISSION LINES
       *
       *
       *
       *   FUNCTION DEFINITIONS
       *
       *
       *
       EXPON   FUNCTION,C RE$1,0,0 .1,.104 .2,.222 .3,.355 .4,.509 .5,.690
       +       .6,.915 .7,1.2 .75,1.38 .8,1.6 .84,1.93 .88,2.12 .9,2.3
       +       .92,2.52 .94,2.81 .95,2.99 .96,3.2 .97,3.5 .98,3.9
       +       .99,4.6 .995,5.3 .998,6.2 .999,7.000 .9997,8.000 1.0,10.0
       *
       *          BRANCH OFFICE (CITY) ASSINGMENT
       BOFF    FUNCTION,D RE$1,.031,1 .046,2 .061,3 .076,4 .091,5 .118,6
       +       .179,7 .221,8 .252,9 .306,10 .340,11 .401,12 .428,13 .501,14
       +       .570,15 .658,16 .727,17 .750,18 1.0,19
```

```
       *         TRANSACTION TYPE
       TTYPE  FUNCTION,D RN$1,.505,1 .594,2 .717,3 .772,4 .881,5 .982,6 1.0,7
       *         NUMBER OF TRANSMISSIONS PER TRANS TYPE
       XMIS   FUNCTION,D P$P2,1,1 2,1 3,1 4,1 5,2 6,2 7,2
       *         CLERK TALK TIME BEFORE INQUIRY
       TTIM1  FUNCTION,D P$P2,1,3000 2,3000 3,3000 4,6000 5,12000 6,3000
       +      7,18000
       *         CLERK TALK TIME AFTER INQUIRY
       TTIM2  FUNCTION,D P$P2,1,1500 2,3000 3,1500 4,9000 5,1500 6,1000
       +      7,2500
       *         INPUT MESSAGE LENGTH
       INLNG  FUNCTION,D P$P7,1,31 2,24 3,24 4,21 5,28 6,24 7,24 8,51 9,33
       +      10,17
       *         OUTPUT MESSAGE LENGTH
       OLNT   FUNCTION,D P$P7,1,33 2,90 3,90 4,413 5,28 6,77 7,69 8,82
       +      9,80 10,88
       *         INPUT PROCESS TIME
       INPRO  FUNCTION,D P$P7,1,80 2,80 3,80 4,80 5,80 6,80 7,80
       +      8,50 9,50 10,50
       *         OUTPUT PROCESS TIME
       OTPRO  FUNCTION,D P$P7,1,50 2,50 3,50 4,95 5,50 6,50 7,50
       +      8,50 9,50 10,50
       *         CPU (PARTITION) ASSIGNMENT BY CITY
       *           86 = LOS ANGELES
       *           87 = SAN FRANCISCO
       CPPT   FUNCTION,D P$P1,1,86 2,87 3,86 4,87 5,87 6,86 7,86 8,86 9,86
       +      10,87 11,87 12,87 13,87 14,86 15,86 16,87 17,87 18,87 19,86
       *        LINE ASSIGNMENT BY CITY
       *          91,92 = LOS ANGELES
       *          93,94 = SAN FRANCISCO
       LINE   FUNCTION,D P$P1,1,91 2,93 3,91 4,93 5,93 6,91 7,91 8,91 9,91
       +      10,93 11,93 12,93 13,93 14,91 15,91 16,94 17,93 18,93 19,92
       *         TERMINAL ASSIGNMENT BY CITY
       TERML  FUNCTION,D P$P1,1,1 2,2 3,3 4,4 5,5 6,6 7,7 8,8 9,9 10,10
       +      11,11 12,12 13,13 14,14 15,15 16,16 17,18 18,19 19,20
       *         RELATIVE CPU SPEEDS
       *      S/360 M30  1.0
       *      S/370 M135 .7
       *      S/370 M145 .5
       *      S/370 M158 .2
       CPUSPD FUNCTION,D P$CPUNUM,86,.7 87,.7
       *         DATA BASE NUMBER
       DATBAS FUNCTION,D P$CPUNUM,86,76 87,77 88,78 89,79 90,80
       *         NUMBER OF TRAILER RECORDS
       NTRAI  FUNCTION,D RN$1,.75,1 .85,2 .93,3 .97,4 .99,5 1.0,6
       *
       SEEK   FUNCTION,C RN$1,1,4
       *
       SERCH  FUNCTION,C RN$1,1,1
       *
       READD  FUNCTION,C RN$1,1,0
       *         DETERMINE AMOUNT OF CROSS-TALK
       CRSEN  FUNCTION,D RN$1,999,0 1000,1
       *         SWITCH CPU FOR CROSS-TALK
       SWITH  FUNCTION,D P$CPUNUM,86,87 87,86
       *
       *
       *
       *   VARIABLE DEFINITIONS
       *
       *
       TERM   VARIABLE,I P$P1+30                                @ TERM POOL NO.
```

```
        TAB     VARIABLE,I P$P1+60                          @ TABLE NUMBER
        *
        EXGEN1 VARIABLE    FN$EXPON*208
        EXGEN2 VARIABLE    FN$EXPON*210
        ADVTME VARIABLE    FN$EXPON*P$WORK1
        *
        SPEED  VARIABLE    600                              @ LINE SPEED (CPS)
        TATIME VARIABLE    .05                              @ TURN-AROUND TIME
        POLLD  VARIABLE    (V$TATIME+10/V$SPEED)*100        @ POLLING DELAY
        TXTIN  VARIABLE    FN$INLNG*1.1                     @ INPUT TEXT LENGTH
        KEY    VARIABLE    (V$TXTIN/2)*100                  @ KEY - IN TIME
        LININ  VARIABLE    V$POLLD+(V$TXTIN/V$SPEED)*100    @ LINE-IN TIME
        CPLIN  VARIABLE    V$POLLD+(FN$INLNG/V$SPEED)*100   @ LINE-IN TIME
        TXTOU  VARIABLE    FN$OLNT*1.1                      @ OUTPUT TEXT LENGTH
        LIOUT  VARIABLE    V$POLLD+(V$TXTOU/V$SPEED)*100    @ LINE-OUT TIME
        CPOUT  VARIABLE    V$POLLD+(FN$OLNT/V$SPEED)*100    @ LINE-OUT TIME
        PRIN   VARIABLE    V$LIOUT/15                       @ BUFFER PRINT TIME
        *
               INITIAL     SAVE1,0
        *
        *
        *
        *      MODEL FLOW
        *
     1 BEGIN   ORIGINATE   0 TIME(V$EXGEN1)                 @ WALK IN PAYMENTS
     2         TABULATE    T81                              @ INTERARRIVAL TIME
     3         SAVEX       SAVE1,X$SAVE1+1 GOTO(+1,ABORT)   @ COUNT XACTS
     4         COMPARE     X$SAVE1 LE 200                   @ ABORT IF TOO MANY
     5         ASSIGN      P1,FN$BOFF                       @ ASSIGN CITY
     6         ASSIGN      P2,FN$TTYPE                      @ ASSIGN XACT TYPE
     7         TABULATE    TYPE                             @ MSG TYPE DIST
     8         TABULATE    CITY                             @ CITY DIST
     9         ASSIGN      P3,FN$XMIS                       @ NO. OF MESSAGES
    10         ASSIGN      CRSTKP,FN$CRSFN                  @ ASSIGN CROSS-TALK
    11         INQUEUE     Q(P$P1),QUE.TIME                 @ QUE FOR CLERK
    12         ENTER       S(P$P1)                          @ GRAB A CLERK
    13         OUTQUEUE    Q(P$P1),QUE.TIME
    14         ADVANCE     TIME(1500)                       @ INITIAL CLERK TALK
    15 TOT     ADVANCE
    16         ASSIGN      WORK1,FN$TTIM1                   @ MEAN TALK TIME
    17         ADVANCE     TIME(V$ADVTME)                   @ TALK BEFORE INQUIRY
    18 AGAIN   ADVANCE
    19         MARK        P4                               @ TIME FROM CUSTOMER
    20         INQUEUE     Q(V$TERM),QUE.TIME               @ QUE FOR TERMINAL
    21         ENTER       S(V$TERM)                        @ GRAB TERM FROM POOL
    22         OUTQUEUE    Q(V$TERM),QUE.TIME
    23         ASSIGN      P5,FN$TERML                      @ FIRST TERM IN OFFIC
    24 BACK    ADVANCE     GOTO(+1,HERE)                    @ FIND FIRST NON-BUSY
    25         GATE        U,F(P$P5)                        @   TERM IN OFFICE
    26         ASSIGN      P5,1+P$P5 GOTO(BACK)             @ NEXT TERMINAL
    27 HERE    SEIZE       F(P$P5)                          @ GET STATS BY TERM
    28         ASSIGN      P7,P$P2                          @ WORKING MSG TYPE
    29 LOOPP   ADVANCE
    30         ASSIGN      P6,FN$INLNG                      @ INPUT MSG LENGTH
    31         ADVANCE     TIME(V$KEY)                      @ KEY-IN TIME
    32         MARK        P8                               @ LIFO RESPONSE TIME
    33         INQUEUE     Q(FN$LINE),QUE.TIME              @ QUE FOR LINE
    34         SEIZE       F(FN$LINE)                       @ GRAB LINE
    35         OUTQUEUE    Q(FN$LINE),QUE.TIME
    36         ADVANCE     TIME(V$LININ)                    @ INPUT XMISSION TIME
    37         RELEASE     F(FN$LINE)                       @ RELEASE LINE
        *
```

```
        *
        *     START CPU PROCESSING
        *
  38          ASSIGN      CPUNUM,FN$CPPT                @ ASSIGN CPU NUMBER
  39          INQUEUE     Q(P$CPUNUM),QUE.TIME          @ QUE FOR CPU
  40          SEIZE       F(P$CPUNUM)                   @ GRAB CPU
  41          OUTQUEUE    Q(P$CPUNUM),QUE.TIME
  42          ADVANCE     TIME(FN$INPRO*FN$CPUSPD)      @ INPUT PROCESS TIME
  43          ADVANCE     GOTO(+1,CRSTLK)
  44          COMPARE     P$CRSTKP EQ 0                 @ ANY CROSS-TALK
  45          ASSIGN      RTN,MNRTN                     @ RETURN POINT
  46          ADVANCE     GOTO(CPUPRC)
        *
  47 MNRTN    ADVANCE     TIME(FN$OTPRO*FN$CPUSPD)      @ OUTPUT PROCESS TIM
  48          RELEASE     F(P$CPUNUM)                   @ RELEASE CPU
        *
        *
        *     END CPU PROCESSING
        *
        *
  49.         INQUEUE     Q(FN$LINE),QUE.TIME           @ QUE FOR LINE
  50          SEIZE       F(FN$LINE)                    @ GRAB LINE
  51          OUTQUEUE    Q(FN$LINE),QUE.TIME
  52          ASSIGN      P9,FN$OLNT                    @ OUTPUT MSG LENGTH
  53          ADVANCE     TIME(V$LIOUT)                 @ OUTPUT XMIT TIME
  54          RELEASE     F(FN$LINE)                    @ RELEASE LINE
  55          ASSIGN      WORK,MP$P8                    @ GET LIFO TIME
  56          TABULATE    T(P$P1)                       @ LIFO RESPONSE TIME
  57          ADVANCE     TIME(V$PRIN)                  @ BUFFER PRINT TIME
  58          ADVANCE     GOTO(+1,THERE)
  59          COMPARE     P$P3 GT 1                     @ MORE XMITS?
  60          ASSIGN      P7,P$P7+3                     @ MSG TYPE
  61          ASSIGN      P3,P$P3-1 GOTO(LOOPP)         @ DO NEXT MSG
        *
  62 THERE    RELEASE     F(P$P5)                       @ RELEASE TERMINAL
  63          LEAVE       S(V$TERM)                     @ LEAVE TERM STORAGE
  64          ASSIGN      WORK,MP$P4                    @ GET TIME FROM CUST
  65          TABULATE    T(V$TERM)                     @ TIME FROM CUSTOMER
  66 OUT      ASSIGN      WORK1,FN$TTIM2                @ MEAN TALK TIME
  67          ADVANCE     TIME(V$ADVTME)                @ TALK AFTER INQUIRY
  68          ADVANCE     GOTO(+1,OUTT)                 @ IF THIS WAS INQ AN
  69          COMPARE     P$P2 EQ 2                     @   PAY THEN DO CASH
  70          ASSIGN      P2,1                          @   PAY TRANSACTION
  71          ADVANCE     GOTO(AGAIN)
  72 OUTT     ADVANCE
  73          LEAVE       S(P$P1)                       @ LEAVE CLERK POOL
  74          TABULATE    T(V$TAB)                      @ TIME IN OFFICE
  75          SAVEX       SAVE1,X$SAVE1-1               @ DECREMENT CLOG CTR
  76          TABULATE    T82                           @ INTERDEPARTURE TIM
  77          TERMINATE
        *
        *
  78          ORIGINATE   0 TIME(V$EXGEN2)              @ MAIL IN PAYMENTS
  79          SAVEX       SAVE1,X$SAVE1+1
  80          ASSIGN      P1,FN$BOFF                    @ CITY
  81          ASSIGN      P2,1                          @ XACT TYPE
  82          ASSIGN      P3,1                          @ NO. OF XMITS
  83          ASSIGN      CRSTKP,FN$CRSEN               @ ASSIGN CROSS-TALK
  84          ADVANCE     GOTO(+1,GTOUT)
  85          COMPARE     R$S(P$P1) GT 0                @ IS A CLERK AVAILAB
  86          ENTER       S(P$P1) GOTO(TOT)             @ TAKE CLERK - DO IT
        *
```

```
 87 GTOUT  SAVEX       SAVE1,X$SAVE1-1
 88               TERMINATE
        *
        *
        *        CPU PROCESS SUBROUTINE
        *
 89 CPUPRC ADVANCE     TIME(4*FN$CPUSPD)                  @ DBM + IOS TIME
 90        ADVANCE     GOTO(+1,NODSK)                     @ GO TO DISK ON FIRST
 91        COMPARE     P$P2 LE 7                          @   XMISSION ONLY
 92        RELEASE     F(P$CPUNUM)                        @ RELEASE CPU
 93        ASSIGN      DBNUM,FN$DATBAS                    @ DATA BASE NUMBER
 94        INQUEUE     Q(P$DBNUM),QUE.TIME                @ QUE FOR DATA BASE
 95        SEIZE       F(P$DBNUM)                         @ GRAB DATA BASE
 96        OUTQUEUE    Q(P$DBNUM),QUE.TIME
 97        ASSIGN      NSEEK,FN$NTRAI                     @ NO OF TRAILER RCDS
 98 TRAL   ADVANCE
 99        ADVANCE     TIME(FN$SEEK)                      @ SEEK TIME
100        ADVANCE     TIME(FN$SERCH)                     @ SEARCH TIME
101        ADVANCE     TIME(FN$READD)                     @ READ TIME
102        ASSIGN      NSEEK,P$NSEEK-1 GOTO(+1,TRAL)      @ ANY MORE RECORDS?
103        COMPARE     P$NSEEK EQ 0
104        RELEASE     F(P$DBNUM)                         @ RELEASE DATA BASE
105        INQUEUE     Q(P$CPUNUM),QUE.TIME               @ QUE FOR CPU
106        SEIZE       F(P$CPUNUM)                        @ GRAB CPU
107        OUTQUEUE    Q(P$CPUNUM),QUE.TIME
108 NODSK  ADVANCE
109        ADVANCE     GOTO(*RTN)                         @ RETURN TO CALLER
        *
        *
        *
        *
        *        CROSS-TALK SUBROUTINE
        *
110 CRSTLK ASSIGN      RTN,CRSTK1                         @ RETURN POINT
111        RELEASE     F(P$CPUNUM)                        @ RELEASE THIS CPU
112        ADVANCE     TIME(V$CPLIN)                      @ LINE - IN TIME
113        ASSIGN      CPUNUM,FN$SWITH                    @ SWITCH CPU
114        INQUEUE     Q(P$CPUNUM),QUE.TIME               @ QUE FOR OTHER CPU
115        SEIZE       F(P$CPUNUM)                        @ GRAB OTHER CPU
116        OUTQUEUE    Q(P$CPUNUM),QUE.TIME
117        ADVANCE     TIME(FN$INPRO*FN$CPUSPD)           @ INPUT PROCESS TIME
118        ADVANCE     GOTO(CPUPRC)                       @ COMMON LOGIC
        *
119 CRSTK1 ADVANCE     TIME(FN$OTPRO*FN$CPUSPD)           @ OUTPUT PROCESS TIM
120        RELEASE     F(P$CPUNUM)                        @ RELEASE OTHER CPU
121        ADVANCE     TIME(V$CPOUT)                      @ LINE - OUT TIME
122        ASSIGN      CPUNUM,FN$SWITH                    @ SWITCH BACK TO FIR
123        INQUEUE     Q(P$CPUNUM),QUE.TIME               @ QUEUE FOR THIS CPU
124        SEIZE       F(P$CPUNUM)                        @ SEIZE THIS CPU
125        OUTQUEUE    Q(P$CPUNUM),QUE.TIME
126        ADVANCE     GOTO(MNRTN)
        *
        *
        *
        *
        *
127 ABORT  STOP,F      1
        *
        *
        *        TIMING LOOP
        *
128        ORIGINATE,  0 TIME(6000)                       @ ONCE A MINUTE
```

```
  129        TERMINATE,R
       *
       *
       *     CONTROL SECTION
       *
       *
             START,NP    30                                   @ 30 MIN WARM-UP


CILITIES:
              F2             F3             F4             F5
              F7             F8             F9             F10
1             F12            F13            F14            F15
6             F17            F18            F19            F20
1             F22            F23            F24            F25
6             F27            F28            F29            F30
6             F77            F86            F87            F91
2             F93            F94            F95


ORAGES:
              S2             S3             S4             S5
              S7             S8             S9             S10
1             S12            S13            S14            S15
6             S17            S18            S19            S31
2             S33            S34            S35            S36
7             S38            S39            S40            S41
2             S43            S44            S45            S46
7             S48            S49


EUES:
              Q2             Q3             Q4             Q5
              Q7             Q8             Q9             Q10
1             Q12            Q13            Q14            Q15
6             Q17            Q18            Q19            Q20
1             Q22            Q23            Q24            Q25
1             Q32            Q33            Q34            Q35
6             Q37            Q38            Q39            Q40
1             Q42            Q43            Q44            Q45
6             Q47            Q48            Q49            Q50
2             Q52            Q53            Q54            Q55
6             Q77            Q86            Q87            Q91
2             Q93            Q94            Q95            Q96
7             Q98            Q99


RAMETERS:
              P2             P3             P4             P5
              P7             P8             P9             CRSTKP
E.TIME        WORK1          CPUNUM         RTN            WORK
NUM           NSEEK


BLES:
              T2             T3             T4             T5
              T7             T8             T9             T10
1             T12            T13            T14            T15
6             T17            T18            T19            T31
2             T33            T34            T35            T36
7             T38            T39            T40            T41
```

```
2           T43         T44         T45         T46
7           T48         T49         T61         T62
3           T64         T65         T66         T67
8           T69         T70         T71         T72
3           T74         T75         T76         T77
8           T79         T81         T82         TYPE
TY


VEXS:
VE1


NCTIONS:
PON         BOFF        TTYPE       XMIS        TTIM1
IM2         INLNG       OLNT        INPRO       OTPRO
PT          LINE        TERML       CPUSPD      DATBAS
RAI         SEEK        SERCH       READD       CRSEN
ITH


RIABLES:
RM          IAB         EXGEN1      EXGEN2      ADVTME
EED         IATIME      POLLD       TXTIN       KEY
NIN         CPLIN       TXTOU       LIOUT       CPOUT
IN


OCKS:
  1 BEGIN          15 TOT           18 AGAIN
 24 BACK           27 HERE          29 LOOPP
 47 MNRTN          62 THERE         66 OUT
 72 OUTT           87 GTOUT         89 CPUPRC
 98 TRAI          108 NODSK        110 CRSTLK
119 CRSTK1        127 ABORT

MBER OF TRANSACTIONS ALLOWED:    226



95              RESET
96              RESET       T(81-82)
97              START       120


CILITIES:
            F2          F3          F4          F5
            F7          F8          F9          F10
1           F12         F13         F14         F15
6           F17         F18         F19         F20
1           F22         F23         F24         F25
6           F27         F28         F29         F30
6           F77         F86         F87         F91
2           F93         F94         F95

ORAGES:
            S2          S3          S4          S5
```

6	S7	S8	S9	S10
1	S12	S13	S14	S15
16	S17	S18	S19	S31
32	S33	S34	S35	S36
37	S38	S39	S40	S41
42	S43	S44	S45	S46
47	S48	S49		

UEUES:

	Q2	Q3	Q4	Q5
	Q7	Q8	Q9	Q10
11	Q12	Q13	Q14	Q15
16	Q17	Q18	Q19	Q20
21	Q22	Q23	Q24	Q25
31	Q32	Q33	Q34	Q35
36	Q37	Q38	Q39	Q40
41	Q42	Q43	Q44	Q45
46	Q47	Q48	Q49	Q50
51	Q52	Q53	Q54	Q55
76	Q77	Q86	Q87	Q91
92	Q93	Q94	Q95	Q96
97	Q98	Q99		

RAMETERS:

	P2	P3	P4	P5
6	P7	P8	P9	CRSTKP
E.TIME	WORK1	CPUNUM	RTN	WORK
NUM	NSEEK			

BLES:

	T2	T3	T4	T5
6	T7	T8	T9	T10
1	T12	T13	T14	T15
6	T17	T18	T19	T31
32	T33	T34	T35	T36
37	T38	T39	T40	T41
42	T43	T44	T45	T46
47	T48	T49	T61	T62
63	T64	T65	T66	T67
68	T69	T70	T71	T72
73	T74	T75	T76	T77
78	T79	T81	T82	TYPE
TY				

AVEXS:
AVE1

UNCTIONS:

PON	BOFF	TTYPE	XMIS	TTIM1
TIM2	INLNG	OLNT	INPRO	OTPRO
PPT	LINE	TERML	CPUSPD	DATBAS
RAT	SEEK	SERCH	READD	CRSEN
ITH				

RIABLES:

RM	IAB	EXGEN1	EXGEN2	ADVTME

SPEED   PALINE   POLID   TXTIN   KEY
LINIM   CPLIN   TXTOU   LIOUT   CPOUT
PRIN

BLOCKS:

1 [illegible]	15 TOT	19 AGAIN
24 [illegible]	27 HERE	29 LOOPP
47 [illegible]	62 THERE	64 OUT
72 [illegible]	87 GTOUT	89 CPUPRC
98 [illegible]	108 NODSK	110 CRSTLK
119 [illegible]	127 ABORT	

NUMBER OF TRANSACTIONS ALLOWED: 226

RELATIVE CLOCK TIME	ABSOLUTE CLOCK TIME	TERMINATION COUNT
221.00	894000	120

BLOCK #	CURR TRAN	TOTAL TRAN	BLOCK #	CURR TRAN	TOTAL TRAN	BLOCK #	CURR TRAN	TOTAL TRAN	BLOCK #	CURR TRAN	TOTAL TRAN	BLOCK #	CURR TRAN	TOTAL TRAN
1	0	3488	2	0	3488	3	0	3488	4	0	3488	5	0	3488
6	0	3488	7	0	3488	8	0	3488	9	0	3488	10	0	3488
11	28	3520	12	0	3492	13	0	3492	14	9	3504	15	0	4854
16	0	4854	17	34	4881	18	0	5141	19	0	5141	20	12	5155
21	0	5143	22	0	5143	23	0	5143	24	0	7096	25	0	1953
26	0	1953	27	0	5143	28	0	5143	29	0	5952	30	0	5952
31	14	5963	32	0	5949	33	0	5949	34	0	5949	35	0	5949
36	1	5950	37	0	5950	38	0	5950	39	0	5950	40	0	5950
41	0	5950	42	0	5950	43	0	5950	44	0	5919	45	0	5919
46	0	5919	47	0	5950	48	0	5950	49	0	5950	50	0	5950
51	0	5950	52	0	5950	53	0	5950	54	0	5950	55	0	5950
56	0	5950	57	0	5950	58	0	5950	59	0	809	60	0	809
61	0	809	62	0	5141	63	0	5141	64	0	5141	65	0	5141
66	0	5141	67	15	5151	68	0	5136	69	0	294	70	0	294
71	0	294	72	0	4892	73	0	4842	74	0	4842	75	0	4842
76	0	4842	77	0	4892	78	0	3300	79	0	3300	80	0	3300
81	0	3300	82	0	3300	83	0	3300	84	0	3300	85	0	1359
86	0	1359	87	0	1941	88	0	1941	89	0	5950	90	0	5950
91	0	5950	92	0	5950	93	0	5950	94	0	5950	95	0	5950
96	0	5950	97	0	5950	98	0	9025	99	0	9025	100	0	9025
101	0	9025	102	0	9025	103	0	5950	104	0	5950	105	0	5950
106	0	5950	107	0	5950	108	0	5950	109	0	5950	110	0	31
111	0	31	112	0	31	113	0	31	114	0	31	115	0	31
116	0	31	117	0	31	118	0	31	119	0	31	120	0	31
121	0	31	122	0	31	123	0	31	124	0	31	125	0	31
126	0	31	127	0	0	128	0	120	129	0	120			

SAVEX NAME	SAVEX VALUE	SAVEX NAME	SAVEX VALUE	SAVEX NAME	SAVEX VALUE	SAVEX NAME	SAVEX VALUE
SAVE1	112						

FACILITY NAME	AVERAGE UTILIZATION	NUMBER ENTRIES	AVERAGE TIME/TRANS
F1	.5130	168	2198.74
F2	[illegible]	96	2117.65

)	.3120	103	2181.21
)	.1873	67	2012.25
)	.2719	98	1997.99
)	.4341	144	2170.27
)	.8808	284	2233.12
)	.6804	238	2058.50
)	.4691	161	2097.69
0	.8342	290	2071.05
1	.4747	167	2046.56
2	.9274	324	2060.93
3	.4538	149	2192.91
4	1.0000	340	2117.65
5	.9867	337	2108.14
6	.7693	279	1985.39
7	.6845	235	2097.23
8	.9764	331	2123.91
9	.4324	155	2008.36
0	.9317	316	2122.79
1	.9081	300	2179.43
2	.8648	295	2110.69
3	.8277	278	2143.59
4	.0000	0	.00
5	.0000	0	.00
6	.0000	0	.00
7	.0000	0	.00
8	.0000	0	.00
9	.0000	0	.00
0	.0000	0	.00
(31)	.0000	0	.00
(32)	.0000	0	.00
(33)	.0000	0	.00
(34)	.0000	0	.00
(35)	.0000	0	.00
(36)	.0000	0	.00
(37)	.0000	0	.00
(38)	.0000	0	.00
(39)	.0000	0	.00
(40)	.0000	0	.00
(41)	.0000	0	.00
(42)	.0000	0	.00
(43)	.0000	0	.00
(44)	.0000	0	.00
(45)	.0000	0	.00
(46)	.0000	0	.00
(47)	.0000	0	.00
(48)	.0000	0	.00
(49)	.0000	0	.00
(50)	.0000	0	.00
(51)	.0000	0	.00
(52)	.0000	0	.00
(53)	.0000	0	.00
(54)	.0000	0	.00
(55)	.0000	0	.00
(56)	.0000	0	.00
(57)	.0000	0	.00
(58)	.0000	0	.00
(59)	.0000	0	.00
(60)	.0000	0	.00
(61)	.0000	0	.00
(62)	.0000	0	.00
(63)	.0000	0	.00
(64)	.0000	0	.00

F (65)	.0000	0	.00
F (66)	.0000	0	.00
F (67)	.0000	0	.00
F (68)	.0000	0	.00
F (69)	.0000	0	.00
F (70)	.0000	0	.00
F (71)	.0000	0	.00
F (72)	.0000	0	.00
F (73)	.0000	0	.00
F (74)	.0000	0	.00
F (75)	.0000	0	.00
F76	.0345	3455	7.61
F77	.0261	2495	7.54
F (78)	.0000	0	.00
F (79)	.0000	0	.00
F (80)	.0000	0	.00
F (81)	.0000	0	.00
F (82)	.0000	0	.00
F (83)	.0000	0	.00
F (84)	.0000	0	.00
F (85)	.0000	0	.00
F86	.4294	6944	44.52
F87	.3113	5018	44.65
F (88)	.0000	0	.00
F (89)	.0000	0	.00
F (90)	.0000	0	.00
F91	.0852	4130	14.85
F92	.0571	2786	14.77
F93	.0776	3838	14.55
F94	.0221	1146	13.90
F95	.0000	0	.00
F (96)	.0000	0	.00
F (97)	.0000	0	.00
F (98)	.0000	0	.00
F (99)	.0000	0	.00

STORAGE NAME	MAXIMUM CONTENTS	AVERAGE CONTENTS	MAXIMUM CAPACITY	AVERAGE CAPACITY	AVERAGE UTILIZATION	TOTAL ENTRIES	TOTAL TRANS	AVERAGE ENT/TRANS	AVERAGE TIME/ENT	CURRENT CONTENTS
S1	3	2.19	3	3.00	.7299	163	163	1.00	9672.67	3
S2	2	1.20	2	2.00	.5992	91	91	1.00	9481.56	2
S3	2	1.25	2	2.00	.6239	100	100	1.00	8984.17	2
S4	1	.96	1	1.00	.9568	60	60	1.00	11481.20	1
S5	2	1.11	2	2.00	.5548	95	95	1.00	8440.48	1
S6	3	1.86	3	3.00	.6190	138	138	1.00	9689.22	0
S7	5	4.69	5	5.00	.9383	269	269	1.00	12557.09	5
S8	4	2.95	4	4.00	.7387	228	228	1.00	9330.75	2
S9	3	2.10	3	3.00	.6993	158	158	1.00	9559.42	3
S10	5	4.26	5	5.00	.8520	279	279	1.00	10993.77	5
S11	3	2.24	3	3.00	.7468	158	158	1.00	10209.36	2
S12	6	5.22	6	6.00	.8703	313	313	1.00	12012.49	6
S13	3	1.90	3	3.00	.6318	142	142	1.00	9611.24	3
S14	8	7.46	8	8.00	.9329	332	332	1.00	16185.96	8
S15	7	6.48	7	7.00	.9256	319	319	1.00	14624.52	7
S16	8	6.29	8	8.00	.7863	488	488	1.00	9281.42	8
S17	9	7.82	9	9.00	.8689	325	325	1.00	17314.79	9
S18	3	1.75	3	3.00	.5850	145	145	1.00	8714.09	1
S19	16	15.48	16	16.00	.9674	1123	1123	1.00	9925.45	16
S (20)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (21)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (22)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (23)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (24)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (25)	[illegible]	[illegible]	0	[illegible]	.0000	0	[illegible]	[illegible]	.00	0

S (26)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (27)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (28)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (29)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (30)	0	.00	0	.00	.0000	0	0	.00	.00	0
S31	1	.51	1	1.00	.5130	168	168	1.00	2198.74	0
S32	1	.29	1	1.00	.2850	96	96	1.00	2137.65	0
S33	1	.31	1	1.00	.3120	103	103	1.00	2181.21	1
S34	1	.19	1	1.00	.1873	67	67	1.00	2012.25	0
S35	1	.27	1	1.00	.2719	98	98	1.00	1997.99	0
S36	1	.43	1	1.00	.4341	144	144	1.00	2170.27	0
S37	1	.88	1	1.00	.8808	284	284	1.00	2233.12	1
S38	1	.68	1	1.00	.6804	238	238	1.00	2058.50	0
S39	1	.47	1	1.00	.4691	161	161	1.00	2097.69	0
S40	1	.83	1	1.00	.8342	290	290	1.00	2071.05	1
S41	1	.47	1	1.00	.4767	167	167	1.00	2046.56	0
S42	1	.93	1	1.00	.9274	324	324	1.00	2060.93	1
S43	1	.45	1	1.00	.4538	149	149	1.00	2192.91	1
S44	1	1.00	1	1.00	1.0000	340	340	1.00	2117.65	1
S45	1	.99	1	1.00	.9867	337	337	1.00	2108.14	1
S46	2	1.45	2	2.00	.7269	514	514	1.00	2036.53	2
S47	1	.98	1	1.00	.9764	331	331	1.00	2123.91	1
S48	1	.43	1	1.00	.4324	155	155	1.00	2008.36	0
S49	4	3.53	4	4.00	.8831	1189	1189	1.00	2138.94	4
S (50)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (51)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (52)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (53)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (54)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (55)	0	.00	0	.00	.0000	0	0	.00	.00	0

QUEUE NAME	MAXIMUM CONTENTS	AVERAGE CONTENTS	TOTAL ENTRIES	ZERO ENTRIES	ZEROS PERCENT	AV. TIME/ENT (ALL)	AV. TIME/ENT (NON ZERO)	CURRENT CONTENTS	TABLE NAME
Q1	3	.27	114	60	52.63	1690.01	3567.80	2	
Q2	2	.11	65	42	64.62	1230.40	3477.22	0	
Q3	2	.22	66	38	57.58	2404.17	5666.86	0	
Q4	11	3.57	62	2	3.23	41499.24	42882.55	7	
Q5	3	.14	60	40	66.67	1699.25	5094.75	0	
Q6	4	.18	85	56	65.88	1566.64	4591.86	0	
Q7	9	2.17	226	45	19.91	6971.76	8642.64	1	
Q8	3	.21	135	76	56.30	1142.07	2613.20	0	
Q9	5	.53	111	49	44.14	3456.05	6187.44	0	
Q10	7	.59	192	82	42.71	2206.81	3851.99	3	
Q11	5	.46	115	52	45.22	2806.14	5296.60	0	
Q12	12	1.29	227	105	46.26	4083.30	7597.61	1	
Q13	3	.14	81	55	67.90	1251.21	3898.00	1	
Q14	6	.82	255	93	36.47	2303.89	3626.49	0	
Q15	6	.86	249	87	34.94	2473.13	3801.30	2	
Q16	4	.21	286	195	68.18	529.19	1663.15	0	
Q17	7	.80	228	98	42.98	2514.71	4410.47	4	
Q18	5	.27	88	55	62.50	2174.69	5804.57	0	
Q19	27	2.42	875	242	27.66	1985.21	2749.69	7	
Q20	0	.00	0	0	.00	.00	.00	0	
Q21	0	.00	0	0	.00	.00	.00	0	
Q22	0	.00	0	0	.00	.00	.00	0	
Q23	0	.00	0	0	.00	.00	.00	0	
Q24	0	.00	0	0	.00	.00	.00	0	
Q25	0	.00	0	0	.00	.00	.00	0	
Q (26)	0	.00	0	0	.00	.00	.00	0	
Q (27)	0	.00	0	0	.00	.00	.00	0	
Q (28)	0	.00	0	0	.00	.00	.00	0	
Q (29)	0	.00	0	0	.00	.00	.00	0	

9(30)	0	.00	0	0	.00	.00	.00	0
931	2	.19	168	93	55.36	835.09	1870.60	0
932	1	.04	96	77	80.21	306.66	1549.47	0
933	1	.02	103	89	86.41	142.32	1194.21	0
934	1	.00	67	67	100.00	.00	.00	0
935	1	.02	99	84	85.71	170.05	1190.36	0
936	2	.12	144	98	68.06	580.79	1818.13	0
937	4	.90	285	63	22.11	2290.22	2927.31	2
938	3	.38	237	99	41.77	1162.54	1996.54	0
939	2	.13	161	102	63.35	543.52	1537.75	0
940	4	.83	289	71	24.57	2056.90	2726.81	0
941	2	.12	167	106	63.47	520.86	1425.97	0
942	5	1.45	324	39	12.04	3224.17	3665.37	1
943	2	.11	149	96	64.43	535.85	1506.45	0
944	7	3.07	341	0	.00	6480.81	6480.81	2
945	6	2.24	336	9	2.68	4798.79	4930.86	0
946	5	.54	514	232	45.14	758.91	1383.26	1
947	8	3.74	335	8	2.39	8038.52	8235.18	5
948	2	.09	155	108	69.68	395.31	1303.68	0
949	7	.97	1186	433	36.51	589.93	929.16	1
950	0	.00	0	0	.00	.00	.00	0
951	0	.00	0	0	.00	.00	.00	0
952	0	.00	0	0	.00	.00	.00	0
953	0	.00	0	0	.00	.00	.00	0
954	0	.00	0	0	.00	.00	.00	0
955	0	.00	0	0	.00	.00	.00	0
9(56)	0	.00	0	0	.00	.00	.00	0
9(57)	0	.00	0	0	.00	.00	.00	0
9(58)	0	.00	0	0	.00	.00	.00	0
9(59)	0	.00	0	0	.00	.00	.00	0
9(60)	0	.00	0	0	.00	.00	.00	0
9(61)	0	.00	0	0	.00	.00	.00	0
9(62)	0	.00	0	0	.00	.00	.00	0
9(63)	0	.00	0	0	.00	.00	.00	0
9(64)	0	.00	0	0	.00	.00	.00	0
9(65)	0	.00	0	0	.00	.00	.00	0
9(66)	0	.00	0	0	.00	.00	.00	0
9(67)	0	.00	0	0	.00	.00	.00	0
9(68)	0	.00	0	0	.00	.00	.00	0
9(69)	0	.00	0	0	.00	.00	.00	0
9(70)	0	.00	0	0	.00	.00	.00	0
9(71)	0	.00	0	0	.00	.00	.00	0
9(72)	0	.00	0	0	.00	.00	.00	0
9(73)	0	.00	0	0	.00	.00	.00	0
9(74)	0	.00	0	0	.00	.00	.00	0
9(75)	0	.00	0	0	.00	.00	.00	0
976	1	.00	3455	3455	100.00	.00	.00	0
977	1	.00	2495	2495	100.00	.00	.00	0
9(78)	0	.00	0	0	.00	.00	.00	0
9(79)	0	.00	0	0	.00	.00	.00	0
9(80)	0	.00	0	0	.00	.00	.00	0
9(81)	0	.00	0	0	.00	.00	.00	0
9(82)	0	.00	0	0	.00	.00	.00	0
9(83)	0	.00	0	0	.00	.00	.00	0
9(84)	0	.00	0	0	.00	.00	.00	0
9(85)	0	.00	0	0	.00	.00	.00	0
986	5	.20	6944	3885	55.95	20.83	47.28	0
987	4	.09	5018	3484	69.43	12.30	40.22	0
9(88)	0	.00	0	0	.00	.00	.00	0
9(89)	0	.00	0	0	.00	.00	.00	0
9(90)	0	.00	0	0	.00	.00	.00	0
991	[illegible]	.00	8129	3955	[illegible]	.85	[illegible]	0

992	1	.00	2786	2705	97.09	.40	13.65	0
993	2	.00	3838	3698	95.05	.61	12.40	0
994	1	.00	1146	1139	99.39	.10	15.57	0
995	0	.00	0	0	.00	.00	.00	0
996	0	.00	0	0	.00	.00	.00	0
997	0	.00	0	0	.00	.00	.00	0
998	0	.00	0	0	.00	.00	.00	0
999	0	.00	0	0	.00	.00	.00	0

TABLE NAME	NON-WEIGHTED NO. OF ENTRIES	NON-WEIGHTED SUM OF ARGUMENTS	NON-WEIGHTED MEAN ARGUMENT	NON-WEIGHTED STD. DEV.	WEIGHTED NO. OF ENTRIES	WEIGHTED SUM OF ARGUMENTS	WEIGHTED MEAN ARGUMENT	WEIGHTED STD. DEV.
T1	198	33643.0000	169.914	59.146	198	33643.0000	169.914	59.146
T2	114	18367.0000	161.114	52.583	114	18367.0000	161.114	52.583
T3	121	21743.0000	179.694	65.641	121	21743.0000	179.694	65.641
T4	76	12897.0000	169.697	54.404	76	12897.0000	169.697	54.404
T5	111	16827.0000	151.595	44.694	111	16827.0000	151.595	44.694
T6	169	29139.0000	172.420	56.639	169	29139.0000	172.420	56.639
T7	343	58076.0000	169.318	62.049	343	58076.0000	169.318	62.049
T8	266	45170.0000	169.812	57.419	266	45170.0000	169.812	57.419
T9	184	33478.0000	181.946	64.859	184	33478.0000	181.946	64.859
T10	329	50286.0000	152.845	46.588	329	50286.0000	152.845	46.588
T11	191	29234.0000	153.058	47.360	191	29234.0000	153.058	47.360
T12	368	54707.0000	148.660	41.431	368	54707.0000	148.660	41.431
T13	174	26235.0000	150.776	41.195	174	26235.0000	150.776	41.195
T14	396	67167.0000	169.614	57.303	396	67167.0000	169.614	57.303
T15	388	64393.0000	165.961	55.675	388	64393.0000	165.961	55.675
T16	573	85924.0000	149.955	39.991	573	85924.0000	149.955	39.991
T17	384	57492.0000	149.719	44.877	384	57492.0000	149.719	44.877
T18	172	26935.0000	156.599	49.272	172	26935.0000	156.599	49.272
T19	1393	235167.0000	168.821	56.619	1393	235167.0000	168.821	56.619
T (20)	0	.0000	.000	.000	0	.0000	.000	.000
T (21)	0	.0000	.000	.000	0	.0000	.000	.000
T (22)	0	.0000	.000	.000	0	.0000	.000	.000
T (23)	0	.0000	.000	.000	0	.0000	.000	.000
T (24)	0	.0000	.000	.000	0	.0000	.000	.000
T (25)	0	.0000	.000	.000	0	.0000	.000	.000
T (26)	0	.0000	.000	.000	0	.0000	.000	.000
T (27)	0	.0000	.000	.000	0	.0000	.000	.000
T (28)	0	.0000	.000	.000	0	.0000	.000	.000
T (29)	0	.0000	.000	.000	0	.0000	.000	.000
T (30)	0	.0000	.000	.000	0	.0000	.000	.000
T31	168	509683.0000	3033.827	1658.542	168	509683.0000	3033.827	1658.542
T32	96	234653.0000	2444.302	1213.737	96	234653.0000	2444.302	1213.737
T33	102	240414.0000	2357.000	1071.493	102	240414.0000	2357.000	1071.493
T34	67	134821.0000	2012.254	823.917	67	134821.0000	2012.254	823.917
T35	98	212468.0000	2168.041	845.143	98	212468.0000	2168.041	845.143
T36	144	396153.0000	2751.062	1364.510	144	396153.0000	2751.062	1364.510
T37	283	1278024.0000	4515.986	2563.729	283	1278024.0000	4515.986	2563.729
T38	238	773245.0000	3248.929	1715.719	238	773245.0000	3248.929	1715.719
T39	161	428455.0000	2661.211	1416.858	161	428455.0000	2661.211	1416.858
T40	289	1196981.0000	4141.803	2017.219	289	1196981.0000	4141.803	2017.219
T41	167	428760.0000	2567.425	1140.934	167	428760.0000	2567.425	1140.934
T42	323	1711995.0000	5300.294	2705.437	323	1711995.0000	5300.294	2705.437
T43	148	402511.0000	2719.669	1480.267	148	402511.0000	2719.669	1480.267
T44	339	2943292.0000	8682.277	3069.607	339	2943292.0000	8682.277	3069.607
T45	336	2333196.0000	6944.036	3045.922	336	2333196.0000	6944.036	3045.922
T46	512	1434044.0000	2800.867	1305.112	512	1434044.0000	2800.867	1305.112
T47	330	3439562.0000	10422.915	4398.049	330	3439562.0000	10422.915	4398.049
T48	155	372569.0000	2403.671	1147.564	155	372569.0000	2403.671	1147.564
T49	1185	3241881.0000	2735.765	1115.525	1185	3241881.0000	2735.765	1115.525
T (50)	0	.0000	.000	.000	0	.0000	.000	.000
T (51)	0	[illegible]	.000	.000	[illegible]	.0000	.000	.000

T(52)	0	.0000	.000	.000	0	.0000	.000	.000
T(53)	0	.0000	.000	.000	0	.0000	.000	.000
T(54)	0	.0000	.000	.000	0	.0000	.000	.000
T(55)	0	.0000	.000	.000	0	.0000	.000	.000
T(56)	0	.0000	.000	.000	0	.0000	.000	.000
T(57)	0	.0000	.000	.000	0	.0000	.000	.000
T(58)	0	.0000	.000	.000	0	.0000	.000	.000
T(59)	0	.0000	.000	.000	0	.0000	.000	.000
T(60)	0	.0000	.000	.000	0	.0000	.000	.000
T61	160	1772834.0000	11080.212	5759.142	160	1772834.0000	11080.212	5759.142
T62	89	910933.0000	10235.202	6203.296	89	910933.0000	10235.202	6203.296
T63	98	1051924.0000	10733.918	7881.023	98	1051924.0000	10733.918	7881.023
T64	59	2987054.0000	50628.034	31598.677	59	2987054.0000	50628.034	31598.677
T65	94	903504.0000	9611.745	6043.510	94	903504.0000	9611.745	6043.510
T66	138	1474744.0000	10686.551	7287.558	138	1474744.0000	10686.551	7287.558
T67	264	5028345.0000	19046.761	10879.040	264	5028345.0000	19046.761	10879.040
T68	226	2279856.0000	10087.858	5202.706	226	2279856.0000	10087.858	5202.706
T69	155	1865075.0000	12032.742	8389.118	155	1865075.0000	12032.742	8389.118
T70	274	3446217.0000	12577.434	7699.401	274	3446217.0000	12577.434	7699.401
T71	156	1947405.0000	12483.365	9559.789	156	1947405.0000	12483.365	9559.789
T72	307	4670972.0000	15214.892	9296.685	307	4670972.0000	15214.892	9296.685
T73	139	1434400.0000	10319.424	9063.897	139	1434400.0000	10319.424	9063.897
T74	324	5934179.0000	18315.367	8490.614	324	5934179.0000	18315.367	8490.614
T75	312	5266374.0000	16879.404	10245.998	312	5266374.0000	16879.404	10245.998
T76	480	4671852.0000	9733.025	5632.453	480	4671852.0000	9733.025	5632.453
T77	316	6330717.0000	20033.915	10436.109	316	6330717.0000	20033.915	10436.109
T78	144	1460565.0000	10142.812	8439.281	144	1460565.0000	10142.812	8439.281
T79	1107	************	11926.705	8432.140	1107	************	11926.705	8432.140
T(80)	0	.0000	.000	.000	0	.0000	.000	.000
T81	3488	893961.0000	256.296	2952.205	3488	893961.0000	256.296	2952.205
T82	4842	893878.0000	184.609	2502.965	4842	893878.0000	184.609	2502.965
TYPE	3488	9026.0000	2.588	1.918	3488	9026.0000	2.588	1.918
CITY	3488	45595.0000	13.072	5.350	3488	45595.0000	13.072	5.350
T(85)	0	.0000	.000	.000	0	.0000	.000	.000
T(86)	0	.0000	.000	.000	0	.0000	.000	.000
T(87)	0	.0000	.000	.000	0	.0000	.000	.000
T(88)	0	.0000	.000	.000	0	.0000	.000	.000
T(89)	0	.0000	.000	.000	0	.0000	.000	.000
T(90)	0	.0000	.000	.000	0	.0000	.000	.000
T(91)	0	.0000	.000	.000	0	.0000	.000	.000
T(92)	0	.0000	.000	.000	0	.0000	.000	.000
T(93)	0	.0000	.000	.000	0	.0000	.000	.000
T(94)	0	.0000	.000	.000	0	.0000	.000	.000
T(95)	0	.0000	.000	.000	0	.0000	.000	.000
T(96)	0	.0000	.000	.000	0	.0000	.000	.000
T(97)	0	.0000	.000	.000	0	.0000	.000	.000
T(98)	0	.0000	.000	.000	0	.0000	.000	.000
T(99)	0	.0000	.000	.000	0	.0000	.000	.000

TABLE NAME: T1

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	198	100.00	100.00	.00	3.531	7.272

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T2

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	119	100.00	100.00	.00	3.724	8.346

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T3

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	121	100.00	100.00	.00	3.339	6.403

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T4

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	76	100.00	100.00	.00	3.536	7.909

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T5

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	111	100.00	100.00	.00	3.958	10.033

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T6

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	169	100.00	100.00	.00	3.480	7.549

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T7

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	343	100.00	100.00	.00	3.544	6.941

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T8

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	266	100.00	100.00	.00	3.533	7.492

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T9

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	184	100.00	100.00	.00	3.298	6.446

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T10

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	329	100.00	100.00	.00	3.926	9.598

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T11

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	191	100.00	100.00	.00	3.920	9.437

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T12

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	368	100.00	100.00	.00	4.036	10.894

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T13

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	174	100.00	100.00	.00	3.979	10.905

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T14

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	396	100.00	100.00	.00	3.537	7.511

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T15

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	388	100.00	100.00	.00	3.615	7.796

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T16

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	573	100.00	100.00	.00	4.001	11.254

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T17

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	384	100.00	100.00	.00	4.008	10.034

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T18

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	172	100.00	100.00	.00	3.831	8.999

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T19

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	1393	100.00	100.00	.00	3.554	7.615

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T (20)

ABLE NAME: T (21)

BLE NAME: T (22)

ABLE NAME: T (23)

ABLE NAME: T (24)

ABLE NAME: T (25)

ABLE NAME: T (26)

ABLE NAME: T (27)

ABLE NAME: T (28)

ABLE NAME: T (29)

ABLE NAME: T (30)

ABLE NAME: T31

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	168	100.00	100.00	.00	5.603	8.421

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T32

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	96	100.00	100.00	.00	6.955	11.992

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T33

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	102	100.00	100.00	.00	7.213	13.666

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T34

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	67	100.00	100.00	.00	8.448	18.191

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T35

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	98	100.00	100.00	.00	7.841	17.550

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T36

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	144	100.00	100.00	.00	6.179	10.443

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T37

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	283	100.00	100.00	.00	3.764	4.869

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T38

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	238	100.00	100.00	.00	5.232	8.015

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T39

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	161	100.00	100.00	.00	6.388	10.120

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T40

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	289	100.00	100.00	.00	4.104	6.374

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T41

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	167	100.00	100.00	.00	6.621	12.650

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T42

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	323	100.00	100.00	.00	3.207	4.325

EMAINING FREQUENCIES ARE ALL ZERO

BLE NAME: T43

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	148	100.00	100.00	.00	6.251	9.647

EMAINING FREQUENCIES ARE ALL ZERO

BLE NAME: T44

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	335	98.82	98.82	1.18	1.958	2.710
8000.0000	2	.59	99.41	.59	2.073	3.035

*OVERFLOW*** OBSERVED FREQUENCY: 2

BLE NAME: T45

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	335	99.70	99.70	.30	2.448	3.301
8000.0000	1	.30	100.00	.00	2.592	3.630

EMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T46

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	512	100.00	100.00	.00	6.070	10.880

EMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T47

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	308	93.33	93.33	6.67	1.631	1.495
8000.0000	9	2.73	96.06	3.94	1.727	1.723

OVERFLOW* OBSERVED FREQUENCY: 13

ABLE NAME: T48

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	155	100.00	100.00	.00	7.073	12.719

EMAINING FREQUENCIES ARE ALL ZERO

BLE NAME: T49

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	1185	100.00	100.00	.00	6.214	12.787

EMAINING FREQUENCIES ARE ALL ZERO

BLE NAME: T (50)

BLE NAME: T (51)

BLE NAME: T (52)

BLE NAME: T (53)

BLE NAME: T (54)

BLE NAME: T (55)

BLE NAME: T (56)

BLE NAME: T (57)

BLE NAME: T (58)

BLE NAME: T (59)

BLE NAME: T (60)

BLE NAME: T61

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
0000.0000	157	98.12	98.12	1.88	2.708	3.285
6000.0000	3	1.88	100.00	.00	3.249	4.327

EMAINING FREQUENCIES ARE ALL ZERO

BLE NAME: T62

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	87	97.75	97.75	2.25	2.931	3.186
36000.0000	1	1.12	98.88	1.12	3.517	4.153

OVERFLOW* OBSERVED FREQUENCY: 1

ABLE NAME: T63

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	95	96.94	96.94	3.06	2.795	2.445
36000.0000	1	1.02	97.96	2.04	3.354	3.206

OVERFLOW* OBSERVED FREQUENCY: 2

ABLE NAME: T64

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	21	35.59	35.59	64.41	.593	-.653
36000.0000	1	1.69	37.29	62.71	.711	-.463

OVERFLOW* OBSERVED FREQUENCY: 37

ABLE NAME: T65

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	93	98.94	98.94	1.06	3.121	3.374
36000.0000	0	.00	98.94	1.06	3.745	4.366

OVERFLOW* OBSERVED FREQUENCY: 1

ABLE NAME: T66

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	135	97.83	97.83	2.17	2.807	2.650
36000.0000	0	.00	97.83	2.17	3.369	3.474

OVERFLOW* OBSERVED FREQUENCY: 3

ABLE NAME: T67

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	236	89.39	89.39	10.61	1.575	1.007
36000.0000	14	5.30	94.70	5.30	1.890	1.558

OVERFLOW* OBSERVED FREQUENCY: 14

ABLE NAME: T68

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	224	99.12	99.12	.88	2.974	3.827
36000.0000	2	.88	100.00	.00	3.569	4.981

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T69

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	149	96.13	96.13	3.87	2.493	2.142
36000.0000	3	1.94	98.06	1.94	2.992	2.857

OVERFLOW* OBSERVED FREQUENCY: 3

ABLE NAME: T/0

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	264	96.35	96.35	3.65	2.385	2.263
36000.0000	6	2.19	98.54	1.46	2.862	3.042

OVERFLOW OBSERVED FREQUENCY: 4

ABLE NAME: T/1

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	149	95.51	95.51	4.49	2.403	1.832
36000.0000	2	1.28	96.79	3.21	2.884	2.460

OVERFLOW OBSERVED FREQUENCY: 5

ABLE NAME: T/2

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	278	90.55	90.55	9.45	1.972	1.590
36000.0000	13	4.23	94.79	5.21	2.366	2.236

OVERFLOW OBSERVED FREQUENCY: 16

BLE NAME: T/3

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	135	97.12	97.12	2.88	2.907	2.171
36000.0000	1	.72	97.84	2.16	3.489	2.833

OVERFLOW OBSERVED FREQUENCY: 3

ABLE NAME: T/4

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	296	91.36	91.36	8.64	1.638	1.376
36000.0000	15	4.63	95.99	4.01	1.966	2.083

OVERFLOW OBSERVED FREQUENCY: 13

ABLE NAME: T/5

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	289	92.63	92.63	7.37	1.777	1.281
36000.0000	11	3.53	96.15	3.85	2.133	1.866

OVERFLOW OBSERVED FREQUENCY: 12

ABLE NAME: T/6

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	475	98.96	98.96	1.04	3.082	3.598
36000.0000	2	.42	99.37	.63	3.699	4.664

OVERFLOW OBSERVED FREQUENCY: 3

ABLE NAME: T/7

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	271	85.76	85.76	14.24	1.497	.955
36000.0000	21	6.65	92.41	7.59	1.797	1.530

OVERFLOW OBSERVED FREQUENCY: 24

BLE NAME: T/8

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	138	95.83	95.83	4.17	2.958	2.353
36000.0000	3	2.08	97.92	2.08	3.549	3.064

OVERFLOW OBSERVED FREQUENCY: 3

BLE NAME: T/9

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	1067	96.39	96.39	3.61	2.515	2.143
36000.0000	18	1.63	98.01	1.99	3.018	2.855

OVERFLOW OBSERVED FREQUENCY: 22

BLE NAME: T (80)

BLE NAME: T81

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
100.0000	1330	38.13	38.13	61.87	.390	-.053
120.0000	196	5.62	43.75	56.25	.468	-.046
140.0000	190	5.45	49.20	50.80	.546	-.039
160.0000	168	4.82	54.01	45.99	.624	-.033
180.0000	149	4.27	58.29	41.71	.702	-.026
200.0000	139	3.99	62.27	37.73	.780	-.019
220.0000	131	3.76	66.03	33.97	.858	-.012
240.0000	110	3.15	69.18	30.82	.936	-.006
260.0000	107	3.07	72.25	27.75	1.014	.001
280.0000	87	2.49	74.74	25.26	1.092	.008
300.0000	86	2.47	77.21	22.79	1.171	.015
320.0000	74	2.12	79.33	20.67	1.249	.022
340.0000	68	1.95	81.28	18.72	1.327	.028
360.0000	54	1.55	82.83	17.17	1.405	.035
380.0000	52	1.49	84.32	15.68	1.483	.042
400.0000	39	1.12	85.44	14.56	1.561	.049
420.0000	49	1.40	86.84	13.16	1.639	.055
440.0000	48	1.38	88.22	11.78	1.717	.062
460.0000	50	1.43	89.65	10.35	1.795	.069
480.0000	37	1.06	90.71	9.29	1.873	.076
500.0000	24	.69	91.40	8.60	1.951	.083
520.0000	33	.95	92.35	7.65	2.029	.089
540.0000	20	.57	92.92	7.08	2.107	.096
560.0000	28	.80	93.72	6.28	2.185	.103
580.0000	16	.46	94.18	5.82	2.263	.110

OVERFLOW OBSERVED FREQUENCY: 203

BLE NAME: T82

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
100.0000	2350	48.53	48.53	51.47	.542	-.034
120.0000	294	6.07	54.61	45.39	.650	-.026
140.0000	277	5.72	60.33	39.67	.758	-.018
160.0000	257	5.31	65.63	34.37	.867	-.010
180.0000	216	4.46	70.10	29.90	.975	-.002
200.0000	202	4.17	74.27	25.73	1.083	.006
220.0000	131	2.71	76.97	23.03	1.192	.014

240.0000	143	2.95	79.93	20.07	1.300	.022
260.0000	143	2.95	82.88	17.12	1.408	.030
280.0000	108	2.23	85.11	14.89	1.517	.038
300.0000	97	2.00	87.11	12.89	1.625	.046
320.0000	85	1.76	88.87	11.13	1.733	.054
340.0000	60	1.24	90.11	9.89	1.842	.062
360.0000	70	1.45	91.55	8.45	1.950	.070
380.0000	54	1.12	92.67	7.33	2.058	.078
400.0000	44	.91	93.58	6.42	2.167	.086
420.0000	33	.68	94.26	5.74	2.275	.094
440.0000	34	.70	94.96	5.04	2.383	.102
460.0000	32	.66	95.62	4.38	2.492	.110
480.0000	26	.54	96.16	3.84	2.600	.118
500.0000	19	.39	96.55	3.45	2.708	.126
520.0000	21	.43	96.98	3.02	2.817	.134
540.0000	19	.39	97.38	2.62	2.925	.142
560.0000	23	.48	97.85	2.15	3.033	.150
580.0000	19	.39	98.24	1.76	3.142	.158

OVERFLOW* OBSERVED FREQUENCY: 85

ABLE NAME: TYPE

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1.0000	1740	49.89	49.89	50.11	.386	-.828
2.0000	298	8.54	58.43	41.57	.773	-.306
3.0000	441	12.64	71.07	28.93	1.159	.215
4.0000	190	5.45	76.52	23.48	1.546	.736
5.0000	378	10.84	87.36	12.64	1.932	1.258
6.0000	370	10.61	97.96	2.04	2.319	1.779
7.0000	71	2.04	100.00	.00	2.705	2.300

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: CITY

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1.0000	114	3.27	3.27	96.73	.076	-2.257
2.0000	65	1.86	5.13	94.87	.153	-2.070
3.0000	66	1.89	7.02	92.98	.229	-1.883
4.0000	62	1.78	8.80	91.20	.306	-1.696
5.0000	60	1.72	10.52	89.48	.382	-1.509
6.0000	85	2.44	12.96	87.04	.459	-1.322
7.0000	219	6.28	19.24	80.76	.535	-1.135
8.0000	135	3.87	23.11	76.89	.612	-.948
9.0000	111	3.18	26.29	73.71	.688	-.761
10.0000	192	5.50	31.79	68.21	.765	-.574
11.0000	115	3.30	35.09	64.91	.841	-.387
12.0000	225	6.45	41.54	58.46	.918	-.200
13.0000	81	2.32	43.86	56.14	.994	-.013
14.0000	255	7.31	51.18	48.82	1.071	.173
15.0000	247	7.08	58.26	41.74	1.147	.360
16.0000	286	8.20	66.46	33.54	1.224	.547
17.0000	224	6.42	72.88	27.12	1.300	.734
18.0000	88	2.52	75.40	24.60	1.377	.921
19.0000	858	24.60	100.00	.00	1.453	1.108

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T (85)

ABLE NAME: T (86)

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ABLE NAME: T ( 87)

ABLE NAME: T ( 88)

ABLE NAME: T ( 89)

ABLE NAME: T ( 90)

ABLE NAME: T ( 91)

ABLE NAME: T ( 92)

ABLE NAME: T ( 93)

ABLE NAME: T ( 94)

ABLE NAME: T ( 95)

ABLE NAME: T ( 96)

ABLE NAME: T ( 97)

ABLE NAME: T ( 98)

ABLE NAME: T ( 99)
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RANDOM ENERATOR	RANDOM MULTIPLIER	RANDOM INCREMENT	RANDOM SEED
1	1220703125	0	1662078573
2	3141592653	2718281829	3141592653
3	2718281829	3141592653	2718281829
4	10604499373	7261067085	10604499373
5	17249876309	7261067085	17249876309
6	30517578125	7261067085	30517578125
7	2565727293	35981228	2565727293
8	107936437	4292354	107936437
9	22438762221	6891	22438762221
10	621444377	92111326	621444377

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498          RESET
499          RESET      T(81-82)
500          START      120
```

ACILITIES:

1	F2	F3	F4	F5
6	F7	F8	F9	F10
11	F12	F13	F14	F15
16	F17	F18	F19	F20
21	F22	F23	F24	F25
26	F27	F28	F29	F30
76	F77	F86	F87	F91
92	F93	F94	F95	

TORAGES:

1	S2	S3	S4	S5
6	S7	S8	S9	S10
11	S12	S13	S14	S15
16	S17	S18	S19	S31
32	S33	S34	S35	S36

37	S38	S39	S40	S41
42	S43	S44	S45	S46
47	S48	S49		

JEUES:

1	Q2	Q3	Q4	Q5
6	Q7	Q8	Q9	Q10
11	Q12	Q13	Q14	Q15
16	Q17	Q18	Q19	Q20
21	Q22	Q23	Q24	Q25
31	Q32	Q33	Q34	Q35
36	Q37	Q38	Q39	Q40
41	Q42	Q43	Q44	Q45
46	Q47	Q48	Q49	Q50
51	Q52	Q53	Q54	Q55
76	Q77	Q86	Q87	Q91
92	Q93	Q94	Q95	Q96
97	Q98	Q99		

ARAMETERS:

1	P2	P3	P4	P5
6	P7	P8	P9	CRSTKP
IE,TIME	WORK1	CPUNUM	RTN	WORK
3NUM	NSEEK			

ABLES:

1	T2	T3	T4	T5
6	T7	T8	T9	T10
11	T12	T13	T14	T15
16	T17	T18	T19	T31
32	T33	T34	T35	T36
37	T38	T39	T40	T41
42	T43	T44	T45	T46
47	T48	T49	T61	T62
63	T64	T65	T66	T67
68	T69	T70	T71	T72
73	T74	T75	T76	T77
78	T79	T81	T82	TYPE
ITY				

AVEYS:

AVE1

UNCTIONS:

XPON	BOFF	TTYPE	XMIS	TTIM1
TIM2	INLNG	OLNT	INPRO	OTPRO
PPT	LINE	TERML	CPUSPD	DATBAS
TRAT	SEEK	SERCH	READD	CRSEN
WITH				

ARIABLES:

TRM	IAB	EXGEN1	EXGEN2	ADVTME
PEED	IATIME	POLLD	TXTIN	KEY
ININ	CPLIN	TXTOU	LIOUT	CPOUT
RIN				

BLOCKS:

1 BEGIN	15 TOT	18 AGAIN
24 BACK	27 HERE	29 LOOPP
47 [illegible]	62 THERE	66 OUT
72 QUIT	87 GTOUT	89 CPUPRC
98 TRAL	108 NODSK	110 CRSTLK
119 CRSTK1	127 ABORT	

NUMBER OF TRANSACTIONS ALLOWED: 226

RELATIVE CLOCK TIME	ABSOLUTE CLOCK TIME	TERMINATION COUNT
720000	1614000	120

BLOCK #	CURR TRAN	TOTAL TRAN	BLOCK #	CURR TRAN	TOTAL TRAN	BLOCK #	CURR TRAN	TOTAL TRAN	BLOCK #	CURR TRAN	TOTAL TRAN	BLOCK #	CURR TRAN	TOTAL TRAN
1	0	3531	2	0	3531	3	0	3531	4	0	3531	5	0	3531
6	0	3531	7	0	3531	8	0	3531	9	0	3531	10	0	3531
11	35	3559	12	0	3524	13	0	3524	14	3	3533	15	0	4855
16	0	4855	17	23	4889	18	0	5186	19	0	5186	20	17	5198
21	0	5181	22	0	5181	23	0	5181	24	0	7137	25	0	1956
26	0	1956	27	0	5181	28	0	5181	29	0	5972	30	0	5972
31	13	5986	32	0	5973	33	0	5973	34	0	5973	35	0	5973
36	0	5973	37	0	5973	38	0	5973	39	0	5973	40	0	5973
41	0	5973	42	1	5973	43	0	5972	44	0	5940	45	0	5940
46	0	5940	47	0	5972	48	0	5972	49	0	5972	50	0	5972
51	0	5972	52	0	5972	53	0	5972	54	0	5972	55	0	5972
56	0	5972	57	0	5972	58	0	5972	59	0	791	60	0	791
61	0	791	62	0	5181	63	0	5181	64	0	5181	65	0	5181
66	0	5181	67	18	5196	68	0	5178	69	0	320	70	0	320
71	0	320	72	0	4858	73	0	4858	74	0	4858	75	0	4858
76	0	4858	77	0	4858	78	0	3434	79	0	3434	80	0	3434
81	0	3434	82	0	3434	83	0	3434	84	0	3434	85	0	1325
86	0	1325	87	0	2109	88	0	2109	89	0	5972	90	0	5972
91	0	5972	92	0	5972	93	0	5972	94	0	5972	95	0	5972
96	0	5972	97	0	5972	98	0	9154	99	0	9154	100	0	9154
101	0	9154	102	0	9154	103	0	5972	104	0	5972	105	0	5972
106	0	5972	107	0	5972	108	0	5972	109	0	5972	110	0	32
111	0	32	112	0	32	113	0	32	114	0	32	115	0	32
116	0	32	117	0	32	118	0	32	119	0	32	120	0	32
121	0	32	122	0	32	123	0	32	124	0	32	125	0	32
126	0	32	127	0	0	128	0	120	129	0	120			

SAVEX NAME	SAVEX VALUE	SAVEX NAME	SAVEX VALUE	SAVEX NAME	SAVEX VALUE	SAVEX NAME	SAVEX VALUE
SAVE1	110						

FACILITY NAME	AVERAGE UTILIZATION	NUMBER ENTRIES	AVERAGE TIME/TRANS
F1	.5176	179	2141.88
F2	.2463	86	2062.26
F3	.2568	89	2077.76
F4	.2309	78	2131.28
F5	.2562	86	2145.23
F6	.4279	154	2000.96

7	.8830	299	2126.20
8	.6268	225	2005.80
9	.5048	169	2150.57
10	.8335	292	2055.13
11	.5520	191	2081.02
12	.9479	308	2215.80
13	.4576	165	1996.67
14	.9981	341	2107.44
15	.9800	338	2087.53
16	.7645	272	2023.81
17	.6499	219	2136.51
18	.9990	347	2072.85
19	.5051	169	2151.82
20	.9163	315	2094.42
21	.9040	296	2199.04
22	.8712	298	2104.93
23	.8458	284	2144.31
24	.0000	0	.00
25	.0000	0	.00
26	.0000	0	.00
27	.0000	0	.00
28	.0000	0	.00
29	.0000	0	.00
30	.0000	0	.00
(31)	.0000	0	.00
(32)	.0000	0	.00
(33)	.0000	0	.00
(34)	.0000	0	.00
(35)	.0000	0	.00
(36)	.0000	0	.00
(37)	.0000	0	.00
(38)	.0000	0	.00
(39)	.0000	0	.00
(40)	.0000	0	.00
(41)	.0000	0	.00
(42)	.0000	0	.00
(43)	.0000	0	.00
(44)	.0000	0	.00
(45)	.0000	0	.00
(46)	.0000	0	.00
(47)	.0000	0	.00
(48)	.0000	0	.00
(49)	.0000	0	.00
(50)	.0000	0	.00
(51)	.0000	0	.00
(52)	.0000	0	.00
(53)	.0000	0	.00
(54)	.0000	0	.00
(55)	.0000	0	.00
(56)	.0000	0	.00
(57)	.0000	0	.00
(58)	.0000	0	.00
(59)	.0000	0	.00
(60)	.0000	0	.00
(61)	.0000	0	.00
(62)	.0000	0	.00
(63)	.0000	0	.00
(64)	.0000	0	.00
(65)	.0000	0	.00
(66)	.0000	0	.00
(67)	.0000	0	.00
(68)	.0000	0	.00

F (69)	.0000	0	.00
F (70)	.0000	0	.00
F (71)	.0000	0	.00
F (72)	.0000	0	.00
F (73)	.0000	0	.00
F (74)	.0000	0	.00
F (75)	.0000	0	.00
F76	.0368	3435	7.72
F77	.0267	2537	7.59
F (78)	.0000	0	.00
F (79)	.0000	0	.00
F (80)	.0000	0	.00
F (81)	.0000	0	.00
F (82)	.0000	0	.00
F (83)	.0000	0	.00
F (84)	.0000	0	.00
F (85)	.0000	0	.00
F86	.4271	6904	44.54
F87	.3172	5105	44.74
F (88)	.0000	0	.00
F (89)	.0000	0	.00
F (90)	.0000	0	.00
F91	.0833	4092	14.65
F92	.0562	2782	14.56
F93	.0809	3955	14.73
F94	.0223	1116	14.42
F95	.0000	0	.00
F (96)	.0000	0	.00
F (97)	.0000	0	.00
F (98)	.0000	0	.00
F (99)	.0000	0	.00

STORAGE NAME	MAXIMUM CONTENTS	AVERAGE CONTENTS	MAXIMUM CAPACITY	AVERAGE CAPACITY	AVERAGE UTILIZATION	TOTAL ENTRIES	TOTAL TRANS	AVERAGE ENT/TRANS	AVERAGE TIME/ENT	CURRENT CONTENTS
S1	3	2.21	3	3.00	.7368	164	164	1.00	9704.16	3
S2	2	1.10	2	2.00	.5479	85	85	1.00	9282.62	2
S3	2	1.07	2	2.00	.5089	84	84	1.00	8724.26	1
S4	1	.85	1	1.00	.8465	71	71	1.00	8584.32	1
S5	2	.99	2	2.00	.4973	85	85	1.00	8474.14	2
S6	3	1.90	3	3.00	.6337	149	149	1.00	9186.90	2
S7	5	4.37	5	5.00	.8734	290	290	1.00	10841.69	5
S8	4	3.15	4	4.00	.7864	215	215	1.00	10534.13	3
S9	3	2.07	3	3.00	.6899	161	161	1.00	9242.97	2
S10	5	4.53	5	5.00	.9050	274	274	1.00	11891.02	5
S11	3	2.29	3	3.00	.7649	183	183	1.00	9028.66	3
S12	6	5.47	6	6.00	.9115	297	297	1.00	13258.21	4
S13	3	2.01	3	3.00	.6701	159	159	1.00	9102.68	1
S14	8	7.77	8	8.00	.9709	324	324	1.00	17260.89	8
S15	7	6.60	7	7.00	.9427	370	370	1.00	14839.72	7
S16	8	6.33	8	8.00	.7911	471	471	1.00	9674.55	1
S17	9	8.37	9	9.00	.9305	336	336	1.00	17944.44	8
S18	3	1.96	3	3.00	.6539	162	162	1.00	8718.78	1
S19	16	15.53	16	16.00	.9705	1103	1103	1.00	10135.87	16
S (20)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (21)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (22)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (23)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (24)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (25)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (26)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (27)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (28)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (29)	0	.00	0	.00	.0000	0	0	.00	.00	0

S (30)	0	.00	0	.00	.0000	0	0	.00	.00	0
S31	1	.52	1	1.00	.5176	174	174	1.00	2141.88	0
S32	1	.25	1	1.00	.2463	86	86	1.00	2062.76	0
S33	1	.26	1	1.00	.2568	89	89	1.00	2077.26	0
S34	1	.23	1	1.00	.2309	78	78	1.00	2131.28	0
S35	1	.26	1	1.00	.2567	86	86	1.00	2145.23	1
S36	1	.43	1	1.00	.4279	154	154	1.00	2000.46	0
S37	1	.88	1	1.00	.8830	299	299	1.00	2126.20	1
S38	1	.63	1	1.00	.6268	225	225	1.00	2005.80	1
S39	1	.50	1	1.00	.5048	169	169	1.00	2150.57	1
S40	1	.83	1	1.00	.8335	292	292	1.00	2055.13	0
S41	1	.55	1	1.00	.5520	191	191	1.00	2081.02	1
S42	1	.95	1	1.00	.9479	308	308	1.00	2215.80	1
S43	1	.46	1	1.00	.4576	165	165	1.00	1996.67	0
S44	1	1.00	1	1.00	.9981	341	341	1.00	2107.44	1
S45	1	.98	1	1.00	.9600	338	338	1.00	2087.53	1
S46	2	1.41	2	2.00	.7072	491	491	1.00	2074.08	1
S47	1	1.00	1	1.00	.9990	347	347	1.00	2072.85	1
S48	1	.51	1	1.00	.5051	169	169	1.00	2151.82	0
S49	4	3.54	4	4.00	.8843	1193	1193	1.00	2134.88	4
S (50)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (51)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (52)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (53)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (54)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (55)	0	.00	0	.00	.0000	0	0	.00	.00	0

QUEUE NAME	MAXIMUM CONTENTS	AVERAGE CONTENTS	TOTAL ENTRIES	ZERO ENTRIES	ZEROS PERCENT	AV. TIME/ENT (ALL)	AV. TIME/ENT (NON ZERO)	CURRENT CONTENTS	TABLE NAME
Q1	6	.37	110	70	63.64	2438.81	6706.72	2	
Q2	2	.09	50	31	62.00	1320.52	3475.05	1	
Q3	3	.12	56	38	67.86	1520.27	4729.72	0	
Q4	7	1.50	60	8	13.33	18055.12	20832.83	0	
Q5	3	.15	42	24	57.14	2494.24	5819.89	0	
Q6	4	.31	94	46	48.94	2349.12	4600.35	0	
Q7	8	.99	198	74	37.37	3586.52	5726.86	1	
Q8	4	.31	144	78	54.17	1530.35	3338.95	0	
Q9	6	.34	104	54	51.92	2343.29	4874.04	0	
Q10	10	1.86	215	51	23.72	6234.07	8172.71	0	
Q11	6	.55	125	56	44.80	3177.82	5756.91	1	
Q12	7	.86	220	82	37.27	2800.14	4463.99	0	
Q13	4	.26	92	47	51.09	2053.91	4199.11	0	
Q14	15	3.31	297	39	13.13	8024.75	9237.80	15	
Q15	11	1.81	258	48	18.60	5332.36	6551.19	9	
Q16	6	.37	291	174	59.79	913.25	2271.42	0	
Q17	7	.86	233	78	33.48	2642.74	4002.70	0	
Q18	4	.18	90	56	62.22	1965.66	3879.68	0	
Q19	13	1.69	880	227	25.80	1378.68	1857.95	6	
Q20	0	.00	0	0	.00	.00	.00	0	
Q21	0	.00	0	0	.00	.00	.00	0	
Q22	0	.00	0	0	.00	.00	.00	0	
Q23	0	.00	0	0	.00	.00	.00	0	
Q24	0	.00	0	0	.00	.00	.00	0	
Q25	0	.00	0	0	.00	.00	.00	0	
Q (26)	0	.00	0	0	.00	.00	.00	0	
Q (27)	0	.00	0	0	.00	.00	.00	0	
Q (28)	0	.00	0	0	.00	.00	.00	0	
Q (29)	0	.00	0	0	.00	.00	.00	0	
Q (30)	0	.00	0	0	.00	.00	.00	0	
Q31	2	.13	174	106	60.92	556.25	1423.35	0	
Q32	1	.02	86	73	84.88	206.26	1364.46	0	
Q33	1	.02	88	77	87.50	184.36	1474.91	0	

Q34	1	.00	78	78	100.00	.00	.00	0
Q35	1	.03	87	71	81.61	250.78	1363.62	1
Q36	2	.09	154	102	66.23	432.70	1281.46	0
Q37	4	.89	300	51	17.00	2132.79	2569.62	2
Q38	3	.29	225	98	43.56	916.31	1623.38	0
Q39	2	.13	170	110	64.71	534.76	1515.15	1
Q40	4	.80	291	69	23.71	1974.16	2587.75	0
Q41	2	.17	192	115	59.90	639.95	1595.73	1
Q42	5	1.48	308	33	10.71	3450.93	3865.04	1
Q43	2	.09	164	103	62.80	410.55	1103.77	0
Q44	7	3.52	342	1	.29	7418.26	7440.02	2
Q45	6	2.31	338	14	4.14	4910.55	5122.73	1
Q46	4	.40	489	250	51.12	586.09	1199.15	0
Q47	8	4.07	351	1	.28	8356.17	8380.04	5
Q48	2	.15	169	101	59.76	627.27	1558.94	0
Q49	7	1.07	1192	441	37.00	686.56	1026.24	3
Q50	0	.00	0	0	.00	.00	.00	0
Q51	0	.00	0	0	.00	.00	.00	0
Q52	0	.00	0	0	.00	.00	.00	0
Q53	0	.00	0	0	.00	.00	.00	0
Q54	0	.00	0	0	.00	.00	.00	0
Q55	0	.00	0	0	.00	.00	.00	0
Q(56)	0	.00	0	0	.00	.00	.00	0
Q(57)	0	.00	0	0	.00	.00	.00	0
Q(58)	0	.00	0	0	.00	.00	.00	0
Q(59)	0	.00	0	0	.00	.00	.00	0
Q(60)	0	.00	0	0	.00	.00	.00	0
Q(61)	0	.00	0	0	.00	.00	.00	0
Q(62)	0	.00	0	0	.00	.00	.00	0
Q(63)	0	.00	0	0	.00	.00	.00	0
Q(64)	0	.00	0	0	.00	.00	.00	0
Q(65)	0	.00	0	0	.00	.00	.00	0
Q(66)	0	.00	0	0	.00	.00	.00	0
Q(67)	0	.00	0	0	.00	.00	.00	0
Q(68)	0	.00	0	0	.00	.00	.00	0
Q(69)	0	.00	0	0	.00	.00	.00	0
Q(70)	0	.00	0	0	.00	.00	.00	0
Q(71)	0	.00	0	0	.00	.00	.00	0
Q(72)	0	.00	0	0	.00	.00	.00	0
Q(73)	0	.00	0	0	.00	.00	.00	0
Q(74)	0	.00	0	0	.00	.00	.00	0
Q(75)	0	.00	0	0	.00	.00	.00	0
Q76	1	.00	3435	3435	100.00	.00	.00	0
Q77	1	.00	2537	2537	100.00	.00	.00	0
Q(78)	0	.00	0	0	.00	.00	.00	0
Q(79)	0	.00	0	0	.00	.00	.00	0
Q(80)	0	.00	0	0	.00	.00	.00	0
Q(81)	0	.00	0	0	.00	.00	.00	0
Q(82)	0	.00	0	0	.00	.00	.00	0
Q(83)	0	.00	0	0	.00	.00	.00	0
Q(84)	0	.00	0	0	.00	.00	.00	0
Q(85)	0	.00	0	0	.00	.00	.00	0
Q86	5	.18	6904	4043	58.56	18.79	45.34	0
Q87	4	.09	5105	3474	68.05	13.10	41.01	0
Q(88)	0	.00	0	0	.00	.00	.00	0
Q(89)	0	.00	0	0	.00	.00	.00	0
Q(90)	0	.00	0	0	.00	.00	.00	0
Q91	2	.00	4092	3893	95.13	.67	13.79	0
Q92	2	.00	2782	2684	96.48	.40	11.36	0
Q93	2	.00	3955	3776	95.47	.64	14.18	0
Q94	1	.00	1116	1106	99.10	.13	14.20	0
Q95	0	.00	0	0	.00	.00	.00	0

996	0	.00	0	0	.00	.00	.00	0
997	0	.00	0	0	.00	.00	.00	0
998	0	.00	0	0	.00	.00	.00	0
999	0	.00	0	0	.00	.00	.00	0

TABLE NAME	NON-WEIGHTED NO. OF ENTRIES	NON-WEIGHTED SUM OF ARGUMENTS	NON-WEIGHTED MEAN ARGUMENT	NON-WEIGHTED STD. DEV.	WEIGHTED NO. OF ENTRIES	WEIGHTED SUM OF ARGUMENTS	WEIGHTED MEAN ARGUMENT	WEIGHTED STD. DEV.
T1	204	33663.0000	165.015	56.832	204	33663.0000	165.015	56.832
T2	95	15218.0000	160.189	42.758	95	15218.0000	160.189	42.758
T3	99	17120.0000	172.929	66.600	99	17120.0000	172.929	66.600
T4	92	14364.0000	156.130	48.399	92	14364.0000	156.130	48.399
T5	99	15607.0000	157.646	48.645	99	15607.0000	157.646	48.645
T6	170	27942.0000	164.365	55.644	170	27942.0000	164.365	55.644
T7	343	56343.0000	164.265	55.376	343	56343.0000	164.265	55.376
T8	250	41163.0000	164.652	54.071	250	41163.0000	164.652	54.071
T9	197	33779.0000	171.467	54.831	197	33779.0000	171.467	54.831
T10	334	51674.0000	154.713	49.630	334	51674.0000	154.713	49.630
T11	218	34262.0000	157.165	44.242	218	34262.0000	157.165	44.242
T12	367	56179.0000	153.076	49.062	367	56179.0000	153.076	49.062
T13	183	28148.0000	153.814	46.610	183	28148.0000	153.814	46.610
T14	396	63124.0000	159.404	50.521	396	63124.0000	159.404	50.521
T15	387	64983.0000	167.915	58.030	387	64983.0000	167.915	58.030
T16	558	86428.0000	154.889	47.393	558	86428.0000	154.889	47.393
T17	394	60309.0000	153.069	47.706	394	60309.0000	153.069	47.706
T18	195	29713.0000	152.374	42.409	195	29713.0000	152.374	42.409
T19	1391	230396.0000	165.633	53.341	1391	230396.0000	165.633	53.341
T (20)	0	.0000	.000	.000	0	.0000	.000	.000
T (21)	0	.0000	.000	.000	0	.0000	.000	.000
T (22)	0	.0000	.000	.000	0	.0000	.000	.000
T (23)	0	.0000	.000	.000	0	.0000	.000	.000
T (24)	0	.0000	.000	.000	0	.0000	.000	.000
T (25)	0	.0000	.000	.000	0	.0000	.000	.000
T (26)	0	.0000	.000	.000	0	.0000	.000	.000
T (27)	0	.0000	.000	.000	0	.0000	.000	.000
T (28)	0	.0000	.000	.000	0	.0000	.000	.000
T (29)	0	.0000	.000	.000	0	.0000	.000	.000
T (30)	0	.0000	.000	.000	0	.0000	.000	.000
T31	174	469475.0000	2698.132	1355.451	174	469475.0000	2698.132	1355.451
T32	86	195092.0000	2268.512	1097.549	86	195092.0000	2268.512	1097.549
T33	89	202070.0000	2270.449	1037.398	89	202070.0000	2270.449	1037.398
T34	78	166240.0000	2131.282	893.398	78	166240.0000	2131.282	893.398
T35	85	202413.0000	2381.329	1036.849	85	202413.0000	2381.329	1036.849
T36	154	374707.0000	2433.162	1116.918	154	374707.0000	2433.162	1116.918
T37	298	1285961.0000	4315.305	2196.613	298	1285961.0000	4315.305	2196.613
T38	224	657395.0000	2934.799	1320.935	224	657395.0000	2934.799	1320.935
T39	168	453112.0000	2697.095	1399.619	168	453112.0000	2697.095	1399.619
T40	292	1176065.0000	4027.620	2027.664	292	1176065.0000	4027.620	2027.664
T41	190	517077.0000	2721.458	1380.178	190	517077.0000	2721.458	1380.178
T42	307	1749749.0000	5699.508	2823.110	307	1749749.0000	5699.508	2823.110
T43	165	400854.0000	2429.418	953.427	165	400854.0000	2429.418	953.427
T44	340	3244853.0000	9543.685	3197.453	340	3244853.0000	9543.685	3197.453
T45	337	2362474.0000	7010.309	2736.837	337	2362474.0000	7010.309	2736.837
T46	490	1304754.0000	2662.763	1209.788	490	1304754.0000	2662.763	1209.788
T47	346	3643247.0000	10529.616	2697.415	346	3643247.0000	10529.616	2697.415
T48	169	469666.0000	2779.089	1367.106	169	469666.0000	2779.089	1367.106
T49	1189	3320466.0000	2792.654	1152.552	1189	3320466.0000	2792.654	1152.552
T (50)	0	.0000	.000	.000	0	.0000	.000	.000
T (51)	0	.0000	.000	.000	0	.0000	.000	.000
T (52)	0	.0000	.000	.000	0	.0000	.000	.000
T (53)	0	.0000	.000	.000	0	.0000	.000	.000
T (54)	0	.0000	.000	.000	0	.0000	.000	.000
T (55)	0	.0000	.000	.000	0	.0000	.000	.000

T(56)	0	.0000	.000	.000	0	.0000	.000	.000
T(57)	0	.0000	.000	.000	0	.0000	.000	.000
T(58)	0	.0000	.000	.000	0	.0000	.000	.000
T(59)	0	.0000	.000	.000	0	.0000	.000	.000
T(60)	0	.0000	.000	.000	0	.0000	.000	.000
T61	161	1827725.0000	11352.329	7621.663	161	1827725.0000	11352.329	7621.663
T62	83	871377.0000	10498.518	8505.413	83	871377.0000	10498.518	8505.413
T63	83	824806.0000	9937.422	5752.399	83	824806.0000	9937.422	5752.399
T64	70	1974311.0000	28204.443	22416.205	70	1974311.0000	28204.443	22416.205
T65	83	812436.0000	9788.385	7096.144	83	812436.0000	9788.385	7096.144
T66	147	1571200.0000	10688.435	7559.477	147	1571200.0000	10688.435	7559.477
T67	285	3859547.0000	13542.270	9253.421	285	3859547.0000	13542.270	9253.421
T68	212	2497294.0000	11779.689	10013.703	212	2497294.0000	11779.689	10013.703
T69	159	1739112.0000	10937.811	7187.566	159	1739112.0000	10937.811	7187.566
T70	269	4652612.0000	17295.955	10327.057	269	4652612.0000	17295.955	10327.057
T71	180	2018529.0000	11214.050	7021.785	180	2018529.0000	11214.050	7021.785
T72	293	4615145.0000	15751.348	8827.588	293	4615145.0000	15751.348	8827.588
T73	158	1666759.0000	10549.108	5971.267	158	1666759.0000	10549.108	5971.267
T74	316	7601788.0000	24056.291	12313.720	316	7601788.0000	24056.291	12313.720
T75	313	6032699.0000	19273.799	9509.892	313	6032699.0000	19273.799	9509.892
T76	470	4859229.0000	10338.785	8041.278	470	4859229.0000	10338.785	8041.278
T77	328	6655829.0000	20292.161	7681.239	328	6655829.0000	20292.161	7681.239
T78	161	1540418.0000	9567.814	5540.144	161	1540418.0000	9567.814	5540.144
T79	1087	************	11364.498	7081.963	1087	************	11364.498	7081.963
T(80)	0	.0000	.000	.000	0	.0000	.000	.000
T81	3531	1613783.0000	457.033	15040.807	3531	1613783.0000	457.033	15040.807
T82	4858	1613901.0000	332.215	12824.370	4858	1613901.0000	332.215	12824.370
TYPE	3531	8978.0000	2.543	1.876	3531	8978.0000	2.543	1.876
CITY	3531	46889.0000	13.279	5.181	3531	46889.0000	13.279	5.181
T(85)	0	.0000	.000	.000	0	.0000	.000	.000
T(86)	0	.0000	.000	.000	0	.0000	.000	.000
T(87)	0	.0000	.000	.000	0	.0000	.000	.000
T(88)	0	.0000	.000	.000	0	.0000	.000	.000
T(89)	0	.0000	.000	.000	0	.0000	.000	.000
T(90)	0	.0000	.000	.000	0	.0000	.000	.000
T(91)	0	.0000	.000	.000	0	.0000	.000	.000
T(92)	0	.0000	.000	.000	0	.0000	.000	.000
T(93)	0	.0000	.000	.000	0	.0000	.000	.000
T(94)	0	.0000	.000	.000	0	.0000	.000	.000
T(95)	0	.0000	.000	.000	0	.0000	.000	.000
T(96)	0	.0000	.000	.000	0	.0000	.000	.000
T(97)	0	.0000	.000	.000	0	.0000	.000	.000
T(98)	0	.0000	.000	.000	0	.0000	.000	.000
T(99)	0	.0000	.000	.000	0	.0000	.000	.000

TABLE NAME: T1

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	704	100.00	100.00	.00	3.636	7.654

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T2

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	95	100.00	100.00	.00	3.746	10.286

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T3

UPPER OBSERVED PERCENT CUMULATIVE CUMULATIVE MULTIPLE DEVIATION

LIMIT	FREQUENCY	OF TOTAL	PERCENTAGE	REMAINDER	OF MEAN	FROM MEAN
600.0000	99	100.00	100.00	.00	3.470	6.412

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T4

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	92	100.00	100.00	.00	3.843	9.171

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T5

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	99	100.00	100.00	.00	3.806	9.094

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T6

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	170	100.00	100.00	.00	3.650	7.829

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T7

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	343	100.00	100.00	.00	3.653	7.869

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T8

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	250	100.00	100.00	.00	3.644	8.051

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T9

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	197	100.00	100.00	.00	3.499	7.815

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T10

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	334	100.00	100.00	.00	3.878	8.972

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T11

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	218	100.00	100.00	.00	3.818	10.009

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T12

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	367	100.00	100.00	.00	3.920	9.109

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T13

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	183	100.00	100.00	.00	3.901	9.573

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T14

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	396	100.00	100.00	.00	3.764	8.721

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T15

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	387	100.00	100.00	.00	3.573	7.446

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T16

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	558	100.00	100.00	.00	3.874	9.392

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T17

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	394	100.00	100.00	.00	3.920	9.368

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T18

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	195	100.00	100.00	.00	3.938	10.555

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T19

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	1391	100.00	100.00	.00	3.622	8.143

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T (20)

ABLE NAME: T (21)

ABLE NAME: T (22)

ABLE NAME: T (23)

ABLE NAME: T (24)

ABLE NAME: T (25)

ABLE NAME: T (26)

ABLE NAME: T (27)

ABLE NAME: T (28)

ABLE NAME: T (29)

ABLE NAME: T (30)

ABLE NAME: T31

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	174	100.00	100.00	.00	6.301	10.550

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T32

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	86	100.00	100.00	.00	7.494	13.422

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T33

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	89	100.00	100.00	.00	7.488	14.199

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T34

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	78	100.00	100.00	.00	7.976	16.643

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T35

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	85	100.00	100.00	.00	7.139	14.099

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T36

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	154	100.00	100.00	.00	6.987	13.048

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T37

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
7000.0000	298	100.00	100.00	.00	3.939	5.775

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T38

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	224	100.00	100.00	.00	5.793	10.648

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T39

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	168	100.00	100.00	.00	6.303	10.219

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T40

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	292	100.00	100.00	.00	4.221	6.398

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T41

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	190	100.00	100.00	.00	6.247	10.345

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T42

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	307	100.00	100.00	.00	2.983	4.003

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T43

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	165	100.00	100.00	.00	6.998	15.282

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T44

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	336	98.82	98.82	1.18	1.781	2.332
18000.0000	1	.29	99.12	.88	1.886	2.645

OVERFLOW OBSERVED FREQUENCY: 3

ABLE NAME: T45

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	337	100.00	100.00	.00	2.425	3.650

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T46

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN

7000.0000	490	100.00	100.00	.00	6.384	11.851

EMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T47

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	340	98.27	98.27	1.73	1.614	2.399
18000.0000	4	1.16	99.42	.58	1.709	2.769

OVERFLOW* OBSERVED FREQUENCY: 2

ABLE NAME: T48

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	169	100.00	100.00	.00	6.117	10.402

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T49

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	1189	100.00	100.00	.00	6.087	12.327

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T (50)

ABLE NAME: T (51)

ABLE NAME: T (52)

ABLE NAME: T (53)

ABLE NAME: T (54)

ABLE NAME: T (55)

ABLE NAME: T (56)

ABLE NAME: T (57)

ABLE NAME: T (58)

ABLE NAME: T (59)

ABLE NAME: T (60)

ABLE NAME: T61

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	153	95.03	95.03	4.97	2.643	2.447
36000.0000	5	3.11	98.14	1.86	3.171	3.234

OVERFLOW* OBSERVED FREQUENCY: 3

ABLE NAME: T62

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	81	97.59	97.59	2.41	2.858	2.293
36000.0000	0	.00	97.59	2.41	3.429	2.998

OVERFLOW* OBSERVED FREQUENCY: 2

ABLE NAME: T63

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	82	98.80	98.80	1.20	3.019	3.488
36000.0000	1	1.20	100.00	.00	3.623	4.531

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T64

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	45	64.29	64.29	35.71	1.064	.080
36000.0000	3	4.29	68.57	31.43	1.276	.348

OVERFLOW OBSERVED FREQUENCY: 22

ABLE NAME: T65

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	81	97.59	97.59	2.41	3.065	2.848
36000.0000	1	1.20	98.80	1.20	3.678	3.694

OVERFLOW OBSERVED FREQUENCY: 1

ABLE NAME: T66

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	143	97.28	97.28	2.72	2.807	2.555
36000.0000	0	.00	97.28	2.72	3.368	3.398

OVERFLOW OBSERVED FREQUENCY: 4

ABLE NAME: T67

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT F TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	266	93.33	93.33	6.67	2.215	1.779
36000.0000	11	3.86	97.19	2.81	2.658	2.427

OVERFLOW OBSERVED FREQUENCY: 8

ABLE NAME: T68

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	205	96.70	96.70	3.30	2.547	1.820
36000.0000	2	.94	97.64	2.36	3.056	2.419

OVERFLOW OBSERVED FREQUENCY: 5

ABLE NAME: T69

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	154	96.86	96.86	3.14	2.743	2.652
36000.0000	3	1.89	98.74	1.26	3.291	3.487

OVERFLOW OBSERVED FREQUENCY: 2

ABLE NAME: T70

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	240	89.22	89.22	10.78	1.735	1.230

36000.0000	16	5.95	95.17	4.83	2.081	1.811

OVERFLOW* OBSERVED FREQUENCY: 13

ABLE NAME: T/1

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	174	96.67	96.67	3.33	2.675	2.675
36000.0000	4	2.22	98.89	1.11	3.210	3.530

OVERFLOW* OBSERVED FREQUENCY: 2

ABLE NAME: T/2

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	275	93.86	93.86	6.14	1.905	1.614
36000.0000	9	3.07	96.93	3.07	2.286	2.294

OVERFLOW* OBSERVED FREQUENCY: 9

ABLE NAME: T/3

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	155	98.10	98.10	1.90	2.844	3.257
36000.0000	3	1.90	100.00	.00	3.413	4.262

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T/4

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	240	75.95	75.95	24.05	1.247	.483
36000.0000	32	10.13	86.08	13.92	1.496	.970

OVERFLOW* OBSERVED FREQUENCY: 44

ABLE NAME: T/5

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	275	87.86	87.86	12.14	1.557	1.128
36000.0000	21	6.71	94.57	5.43	1.868	1.759

OVERFLOW* OBSERVED FREQUENCY: 17

ABLE NAME: T/6

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	457	97.23	97.23	2.77	2.902	2.445
36000.0000	4	.85	98.09	1.91	3.482	3.191

OVERFLOW* OBSERVED FREQUENCY: 9

ABLE NAME: T/7

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	290	88.41	88.41	11.59	1.478	1.264
36000.0000	23	7.01	95.43	4.57	1.774	2.045

OVERFLOW* OBSERVED FREQUENCY: 15

ABLE NAME: T/8

UPPER OBSERVED PERCENT CUMULATIVE CUMULATIVE MULTIPLE DEVIATION

LIMIT	FREQUENCY	OF TOTAL	PERCENTAGE	REMAINDER	OF MEAN	FROM MEAN
30000.0000	159	98.76	98.76	1.24	3.136	3.688
36000.0000	1	.62	99.38	.62	3.763	4.771

OVERFLOW* OBSERVED FREQUENCY: 1

ABLE NAME: T79

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	1060	97.52	97.52	2.48	2.640	2.631
36000.0000	11	1.01	98.53	1.47	3.168	3.479

OVERFLOW* OBSERVED FREQUENCY: 16

ABLE NAME: T (80)

ABLE NAME: T81

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
100.0000	1371	38.83	38.83	61.17	.219	-.024
120.0000	181	5.13	43.95	56.05	.263	-.022
140.0000	189	5.35	49.31	50.69	.306	-.021
160.0000	164	4.64	53.95	46.05	.350	-.020
180.0000	161	4.56	58.51	41.49	.394	-.018
200.0000	139	3.94	62.45	37.55	.438	-.017
220.0000	117	3.31	65.76	34.24	.481	-.016
240.0000	126	3.57	69.33	30.67	.525	-.014
260.0000	114	3.23	72.56	27.44	.569	-.013
280.0000	97	2.75	75.30	24.70	.613	-.012
300.0000	85	2.41	77.71	22.29	.656	-.010
320.0000	70	1.98	79.69	20.31	.700	-.009
340.0000	77	2.18	81.87	18.13	.744	-.008
360.0000	60	1.70	83.57	16.43	.788	-.006
380.0000	55	1.56	85.13	14.87	.831	-.005
400.0000	40	1.13	86.26	13.74	.875	-.004
420.0000	44	1.25	87.51	12.49	.919	-.002
440.0000	50	1.42	88.93	11.07	.963	-.001
460.0000	23	.65	89.58	10.42	1.006	.000
480.0000	39	1.10	90.68	9.32	1.050	.002
500.0000	28	.79	91.48	8.52	1.094	.003
520.0000	35	.99	92.47	7.53	1.138	.004
540.0000	31	.88	93.34	6.66	1.182	.006
560.0000	22	.62	93.97	6.03	1.225	.007
580.0000	14	.40	94.36	5.64	1.269	.008

OVERFLOW* OBSERVED FREQUENCY: 199

ABLE NAME: T82

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
100.0000	2321	47.78	47.78	52.22	.301	-.018
120.0000	309	6.36	54.14	45.86	.361	-.017
140.0000	272	5.60	59.74	40.26	.421	-.015
160.0000	269	5.54	65.27	34.73	.482	-.013
180.0000	222	4.57	69.84	30.16	.542	-.012
200.0000	184	3.79	73.63	26.37	.602	-.010
220.0000	158	3.25	76.88	23.12	.662	-.009
240.0000	149	3.07	79.95	20.05	.722	-.007
260.0000	134	2.76	82.71	17.29	.783	-.006
280.0000	115	2.37	85.08	14.92	.843	-.004
300.0000	105	2.16	87.24	12.76	.903	-.003
320.0000	67	1.38	88.62	11.38	.963	-.001

340.0000	68	1.40	90.02	9.98	1.023	.001
360.0000	66	1.36	91.38	8.62	1.084	.002
380.0000	59	1.21	92.59	7.41	1.144	.004
400.0000	52	1.07	93.66	6.34	1.204	.005
420.0000	41	.84	94.50	5.50	1.264	.007
440.0000	29	.60	95.10	4.90	1.324	.008
460.0000	37	.76	95.86	4.14	1.385	.010
480.0000	30	.62	96.48	3.52	1.445	.012
500.0000	18	.37	96.85	3.15	1.505	.013
520.0000	21	.43	97.28	2.72	1.565	.015
540.0000	25	.51	97.80	2.20	1.625	.016
560.0000	14	.29	98.09	1.91	1.686	.018
580.0000	13	.27	98.35	1.65	1.746	.019

OVERFLOW* OBSERVED FREQUENCY: 80

ABLE NAME: TYPE

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1.0000	1768	50.07	50.07	49.93	.393	-.822
2.0000	314	8.89	58.96	41.04	.787	-.289
3.0000	468	13.25	72.22	27.78	1.180	.244
4.0000	194	5.49	77.71	22.29	1.573	.777
5.0000	369	10.45	88.16	11.84	1.966	1.310
6.0000	369	10.45	98.61	1.39	2.360	1.843
7.0000	49	1.39	100.00	.00	2.753	2.376

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: CITY

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1.0000	108	3.06	3.06	96.94	.075	-2.370
2.0000	50	1.42	4.47	95.53	.151	-2.177
3.0000	56	1.59	6.06	93.94	.226	-1.984
4.0000	53	1.50	7.56	92.44	.301	-1.791
5.0000	42	1.19	8.75	91.25	.377	-1.598
6.0000	94	2.66	11.41	88.59	.452	-1.405
7.0000	197	5.58	16.99	83.01	.527	-1.212
8.0000	144	4.08	21.07	78.93	.602	-1.019
9.0000	104	2.95	24.02	75.98	.678	-.826
10.0000	212	6.00	30.02	69.98	.753	-.633
11.0000	125	3.54	33.56	66.44	.828	-.440
12.0000	219	6.20	39.76	60.24	.904	-.247
13.0000	91	2.58	42.34	57.66	.979	-.054
14.0000	297	8.41	50.75	49.25	1.054	.139
15.0000	256	7.25	58.00	42.00	1.130	.332
16.0000	291	8.24	66.24	33.76	1.205	.525
17.0000	229	6.49	72.73	27.27	1.280	.718
18.0000	90	2.55	75.28	24.72	1.355	.911
19.0000	873	24.72	100.00	.00	1.431	1.104

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T (85)

ABLE NAME: T (86)

ABLE NAME: T (87)

ABLE NAME: T (88)

ABLE NAME: T (89)

ABLE NAME: T (90)

ABLE NAME: T (91)

ABLE NAME: T (92)

ABLE NAME: T (93)

ABLE NAME: T (94)

ABLE NAME: T (95)

ABLE NAME: T (96)

ABLE NAME: T (97)

ABLE NAME: T (98)

ABLE NAME: T (99)

RANDOM ENERATOR	RANDOM MULTIPLIER	RANDOM INCREMENT	RANDOM SEED
1	1220703125	0	13161580685
2	3141592653	2718281829	3141592653
3	2718281829	3141592653	2718281829
4	10604499373	7261067085	10604499373
5	17249876309	7261067085	17249876309
6	30517578125	7261067085	30517578125
7	2565727293	35981228	2565727293
8	107936437	4292354	107936437
9	22438762221	6891	22438762221
10	621444377	92111326	621444377

```
501            RESET
502            RESET       T(81-82)
503            START       120
```

ACILITIES:

1	F2	F3	F4	F5
6	F7	F8	F9	F10
11	F12	F13	F14	F15
16	F17	F18	F19	F20
21	F22	F23	F24	F25
26	F27	F28	F29	F30
76	F77	F86	F87	F91
92	F93	F94	F95	

TORAGES:

1	S2	S3	S4	S5
6	S7	S8	S9	S10
11	S12	S13	S14	S15
16	S17	S18	S19	S31
32	S33	S34	S35	S36
37	S38	S39	S40	S41
42	S43	S44	S45	S46
47	S48	S49		

HEUES:

1	Q2	Q3	Q4	Q5
6	Q7	Q8	Q9	Q10
11	Q12	Q13	Q14	Q15
16	Q17	Q18	Q19	Q20
21	Q22	Q23	Q24	Q25
31	Q32	Q33	Q34	Q35
36	Q37	Q38	Q39	Q40
41	Q42	Q43	Q44	Q45
46	Q47	Q48	Q49	Q50
51	Q52	Q53	Q54	Q55
76	Q77	Q86	Q87	Q91
92	Q93	Q94	Q95	Q96
97	Q98	Q99		

ARAMETERS:

1	P2	P3	P4	P5
6	P7	P8	P9	CRSTKP
UE.TIME	WORK1	CPUNUM	RTN	WORK
RNUM	NSEEK			

ABLES:

T1	T2	T3	T4	T5
T6	T7	T8	T9	T10
T11	T12	T13	T14	T15
T16	T17	T18	T19	T31
T32	T33	T34	T35	T36
T37	T38	T39	T40	T41
T42	T43	T44	T45	T46
T47	T48	T49	T61	T62
T63	T64	T65	T66	T67
T68	T69	T70	T71	T72
T73	T74	T75	T76	T77
T78	T79	T81	T82	TYPE
CITY				

SAVEXS:

SAVE1

FUNCTIONS:

EXPON	BOFF	TTYPE	XMIS	TTIM1
TTIM2	INLNG	OLNT	INPRO	OTPRO
CPPT	LINE	TERML	CPUSPD	DATBAS
NTRPT	SEEK	SERCH	READD	CRSEN
SMITH				

VARIABLES:

TERM	TAB	EXGEN1	EXGEN2	ADVTME
SPEED	TATIME	POLLD	TXTIN	KEY
LININ	CPLIN	TXTOU	LIOUT	CPOUT
PWIN				

BLOCKS:

1 BEGIN	15 TOT	18 AGAIN
24 BACK	27 HERE	29 LOOPP
47 MORTN	62 THERE	66 OUT

72 OUTT 87 GTOUT 89 CPUPRC
98 TRAL 108 NODSK 110 CRSTLK
119 CRSTKI 127 ABORT

NUMBER OF TRANSACTIONS ALLOWED: 226

RELATIVE CLOCK TIME	ABSOLUTE CLOCK TIME	TERMINATION COUNT
720000	2334000	120

BLOCK #	CURR TRAN	TOTAL TRAN	BLOCK #	CURR TRAN	TOTAL TRAN	BLOCK #	CURR TRAN	TOTAL TRAN	BLOCK #	CURR TRAN	TOTAL TRAN	BLOCK #	CURR TRAN	TOTAL TRAN
1	0	3448	2	0	3448	3	0	3448	4	0	3448	5	0	3448
6	0	3448	7	0	3448	8	0	3448	9	0	3448	10	0	3448
11	9	3483	12	0	3474	13	0	3474	14	7	3477	15	0	4793
16	0	4793	17	24	4816	18	0	5097	19	0	5097	20	17	5114
21	0	5097	22	0	5097	23	0	5097	24	0	6969	25	0	1872
26	0	1872	27	0	5097	28	0	5097	29	0	5870	30	0	5870
31	13	5883	32	0	5870	33	0	5870	34	0	5870	35	0	5870
36	0	5870	37	0	5870	38	0	5870	39	0	5870	40	0	5870
41	0	5870	42	0	5871	43	0	5871	44	0	5826	45	0	5826
46	0	5826	47	0	5869	48	0	5869	49	0	5869	50	0	5869
51	0	5869	52	0	5869	53	0	5869	54	0	5869	55	0	5869
56	0	5869	57	0	5869	58	0	5869	59	0	773	60	0	773
61	0	773	62	0	5096	63	0	5096	64	0	5096	65	0	5096
66	0	5096	67	17	5114	68	0	5097	69	0	305	70	0	305
71	0	305	72	0	4792	73	0	4792	74	0	4792	75	0	4792
76	0	4792	77	0	4792	78	0	3377	79	0	3377	80	0	3377
81	0	3377	82	0	3377	83	0	3377	84	0	3377	85	0	1323
86	0	1323	87	0	2054	88	0	2054	89	0	5871	90	0	5871
91	0	5871	92	0	5871	93	0	5871	94	0	5871	95	0	5871
96	0	5871	97	0	5871	98	0	8815	99	1	8815	100	0	8814
101	0	8814	102	0	8814	103	0	5870	104	0	5870	105	0	5870
106	0	5870	107	0	5870	108	0	5870	109	0	5870	110	0	45
111	0	45	112	0	45	113	0	45	114	0	45	115	0	45
116	0	45	117	0	45	118	0	45	119	1	45	120	0	44
121	0	44	122	0	44	123	0	44	124	0	44	125	0	44
126	0	44	127	0	0	128	0	120	129	0	120			

SAVEX NAME	SAVEX VALUE	SAVEX NAME	SAVEX VALUE	SAVEX NAME	SAVEX VALUE	SAVEX NAME	SAVEX VALUE
SAVE1	89						

FACILITY NAME	AVERAGE UTILIZATION	NUMBER ENTRIES	AVERAGE TIME/TRANS
F1	.5434	192	2037.75
F2	.2824	93	2186.09
F3	.2446	89	2190.38
F4	.1924	64	2164.09
F5	.2573	91	2035.47
F6	.4930	167	2125.71
F7	.8551	286	2152.71
F8	.6243	223	2015.70
F9	.5179	175	2128.91
F10	.8155	292	2010.90
F11	.5261	193	1962.65

12	.9228	314	2116.09
13	.4250	151	2026.37
14	1.0000	335	2149.25
15	.9655	326	2132.44
16	.8024	277	2085.57
17	.6873	239	2070.44
18	.9996	342	2104.41
19	.3407	123	1994.07
20	.9019	305	2129.05
21	.8822	294	2160.42
22	.8353	275	2186.94
23	.7973	265	2166.21
24	.0000	0	.00
25	.0000	0	.00
26	.0000	0	.00
27	.0000	0	.00
28	.0000	0	.00
29	.0000	0	.00
30	.0000	0	.00
(31)	.0000	0	.00
(32)	.0000	0	.00
(33)	.0000	0	.00
(34)	.0000	0	.00
(35)	.0000	0	.00
(36)	.0000	0	.00
(37)	.0000	0	.00
(38)	.0000	0	.00
(39)	.0000	0	.00
(40)	.0000	0	.00
(41)	.0000	0	.00
(42)	.0000	0	.00
(43)	.0000	0	.00
(44)	.0000	0	.00
(45)	.0000	0	.00
(46)	.0000	0	.00
(47)	.0000	0	.00
(48)	.0000	0	.00
(49)	.0000	0	.00
(50)	.0000	0	.00
(51)	.0000	0	.00
(52)	.0000	0	.00
(53)	.0000	0	.00
(54)	.0000	0	.00
(55)	.0000	0	.00
(56)	.0000	0	.00
(57)	.0000	0	.00
(58)	.0000	0	.00
(59)	.0000	0	.00
(60)	.0000	0	.00
(61)	.0000	0	.00
(62)	.0000	0	.00
(63)	.0000	0	.00
(64)	.0000	0	.00
(65)	.0000	0	.00
(66)	.0000	0	.00
(67)	.0000	0	.00
(68)	.0000	0	.00
(69)	.0000	0	.00
(70)	.0000	0	.00
(71)	.0000	0	.00
(72)	.0000	0	.00
(73)	.0000	0	.00

F (74)	.0000	0	.00
F (75)	.0000	0	.00
F76	.0356	3406	7.53
F77	.0256	2465	7.48
F (78)	.0000	0	.00
F (79)	.0000	0	.00
F (80)	.0000	0	.00
F (81)	.0000	0	.00
F (82)	.0000	0	.00
F (83)	.0000	0	.00
F (84)	.0000	0	.00
F (85)	.0000	0	.00
F86	.4246	6862	44.55
F87	.3084	4968	44.69
F (88)	.0000	0	.00
F (89)	.0000	0	.00
F (90)	.0000	0	.00
F91	.0833	4118	14.57
F92	.0568	2706	15.11
F93	.0743	3745	14.29
F94	.0233	1170	14.33
F95	.0000	0	.00
F (96)	.0000	0	.00
F (97)	.0000	0	.00
F (98)	.0000	0	.00
F (99)	.0000	0	.00

STORAGE NAME	MAXIMUM CONTENTS	AVERAGE CONTENTS	MAXIMUM CAPACITY	AVERAGE CAPACITY	AVERAGE UTILIZATION	TOTAL ENTRIES	TOTAL TRANS	AVERAGE ENT/TRANS	AVERAGE TIME/ENT	CURRENT CONTENTS
S1	3	2.36	3	3.00	.7879	180	180	1.00	9454.61	2
S2	2	1.09	2	2.00	.5453	90	90	1.00	8724.38	0
S3	2	1.10	2	2.00	.5475	87	87	1.00	9062.10	2
S4	1	.76	1	1.00	.7649	62	62	1.00	8882.40	1
S5	2	.92	2	2.00	.4614	88	88	1.00	7549.40	1
S6	3	2.30	3	3.00	.7682	159	159	1.00	10435.62	3
S7	5	4.52	5	5.00	.9037	273	273	1.00	11917.20	4
S8	4	3.01	4	4.00	.7513	214	214	1.00	10110.85	3
S9	3	2.37	3	3.00	.7884	166	166	1.00	10259.16	3
S10	5	4.09	5	5.00	.8188	282	282	1.00	10453.14	5
S11	3	2.17	3	3.00	.7241	182	182	1.00	8593.68	3
S12	6	4.98	6	6.00	.8298	295	295	1.00	12152.11	5
S13	3	1.92	3	3.00	.6402	145	145	1.00	9536.29	1
S14	8	7.71	8	8.00	.9643	323	323	1.00	17196.31	8
S15	7	6.35	7	7.00	.9069	318	318	1.00	14373.52	5
S16	8	6.48	8	8.00	.8097	481	481	1.00	9695.99	8
S17	9	8.51	9	9.00	.9452	323	323	1.00	18962.16	8
S18	3	1.35	3	3.00	.4517	118	118	1.00	8267.70	2
S19	16	15.69	16	16.00	.9809	1086	1086	1.00	10404.82	16
S (20)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (21)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (22)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (23)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (24)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (25)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (26)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (27)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (28)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (29)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (30)	0	.00	0	.00	.0000	0	0	.00	.00	0
S31	1	.54	1	1.00	.5434	192	192	1.00	2037.75	1
S32	1	.28	1	1.00	.2824	93	93	1.00	2186.09	0
S33	1	.26	1	1.00	.2646	89	89	1.00	2140.38	0
S34	1	.19	1	1.00	.1924	64	64	1.00	2164.09	0

S35	1	.26	1	1.00	.2573	91	91	1.00	2035.47	1
S36	1	.49	1	1.00	.4930	167	167	1.00	2125.71	1
S37	1	.86	1	1.00	.8551	286	286	1.00	2152.71	1
S38	1	.62	1	1.00	.6243	223	223	1.00	2015.70	1
S39	1	.52	1	1.00	.5174	175	175	1.00	2128.91	0
S40	1	.82	1	1.00	.8155	292	292	1.00	2010.90	1
S41	1	.53	1	1.00	.5261	193	193	1.00	1962.65	1
S42	1	.92	1	1.00	.9228	314	314	1.00	2116.09	1
S43	1	.42	1	1.00	.4250	151	151	1.00	2026.37	0
S44	1	1.00	1	1.00	1.0000	335	335	1.00	2149.25	1
S45	1	.97	1	1.00	.9655	326	326	1.00	2132.44	1
S46	2	1.49	2	2.00	.7448	516	516	1.00	2078.56	2
S47	1	1.00	1	1.00	.9996	342	342	1.00	2104.41	1
S48	1	.34	1	1.00	.3407	123	123	1.00	1994.07	0
S49	4	3.42	4	4.00	.8542	1139	1139	1.00	2159.77	2
S (50)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (51)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (52)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (53)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (54)	0	.00	0	.00	.0000	0	0	.00	.00	0
S (55)	0	.00	0	.00	.0000	0	0	.00	.00	0

QUEUE NAME	MAXIMUM CONTENTS	AVERAGE CONTENTS	TOTAL ENTRIES	ZERO ENTRIES	ZEROS PERCENT	AV. TIME/ENT (ALL)	AV. TIME/ENT (NON ZERO)	CURRENT CONTENTS	TABLE NAME
Q1	4	.34	120	57	47.50	2034.83	3875.87	0	
Q2	3	.11	57	39	68.42	1332.89	4220.83	0	
Q3	2	.07	56	38	67.86	922.18	2869.00	0	
Q4	8	1.24	54	18	33.33	16580.98	24871.47	2	
Q5	2	.09	49	29	59.18	1364.90	3344.00	0	
Q6	6	.82	116	48	41.38	5063.72	8638.10	2	
Q7	7	.86	202	73	36.14	3058.25	4788.88	0	
Q8	4	.32	135	72	53.33	1680.05	3600.11	0	
Q9	4	.40	126	55	43.65	2288.75	4061.73	0	
Q10	4	.31	180	115	63.89	1231.62	3410.63	0	
Q11	4	.29	112	62	55.36	1840.42	4122.54	0	
Q12	7	.72	201	104	51.74	2504.54	5376.31	0	
Q13	2	.13	85	51	60.00	1089.89	2724.74	0	
Q14	15	1.48	251	58	23.11	4238.09	5511.71	1	
Q15	9	1.13	232	68	29.31	3518.89	4977.95	0	
Q16	5	.25	304	200	65.79	591.05	1727.67	2	
Q17	17	2.94	254	65	25.59	8327.38	11191.29	0	
Q18	1	.02	59	52	88.14	233.56	1968.57	0	
Q19	12	2.19	890	183	20.56	1770.53	2228.82	2	
Q20	0	.00	0	0	.00	.00	.00	0	
Q21	0	.00	0	0	.00	.00	.00	0	
Q22	0	.00	0	0	.00	.00	.00	0	
Q23	0	.00	0	0	.00	.00	.00	0	
Q24	0	.00	0	0	.00	.00	.00	0	
Q25	0	.00	0	0	.00	.00	.00	0	
Q (26)	0	.00	0	0	.00	.00	.00	0	
Q (27)	0	.00	0	0	.00	.00	.00	0	
Q (28)	0	.00	0	0	.00	.00	.00	0	
Q (29)	0	.00	0	0	.00	.00	.00	0	
Q (30)	0	.00	0	0	.00	.00	.00	0	
Q31	2	.13	192	124	64.58	495.15	1398.06	0	
Q32	1	.02	93	78	83.87	193.44	1199.33	0	
Q33	1	.03	89	75	84.27	230.21	1463.50	0	
Q34	1	.00	64	64	100.00	.00	.00	0	
Q35	1	.02	90	72	80.00	162.57	812.61	0	
Q36	2	.11	167	114	68.26	468.04	1474.77	0	
Q37	4	.95	287	61	21.25	2132.51	2708.10	2	
Q38	3	.28	223	110	49.33	803.51	1763.30	1	

939	2	.16	174	98	56.32	642.05	1469.96	0
940	3	.70	294	70	23.81	1710.81	2245.44	2
941	2	.12	192	119	61.98	451.41	1187.26	0
942	5	1.33	316	41	12.97	3037.69	3490.59	3
943	2	.09	151	101	66.89	414.91	1253.02	0
944	7	3.61	337	0	.00	7716.14	7716.14	3
945	6	2.46	327	11	3.36	5411.94	5600.33	2
946	5	.53	517	230	44.49	738.19	1329.76	2
947	8	3.98	343	2	.58	8344.73	8393.67	2
948	2	.06	123	93	75.61	343.45	1408.13	0
949	9	.89	1135	514	45.29	564.23	1031.24	0
950	0	.00	0	0	.00	.00	.00	0
951	0	.00	0	0	.00	.00	.00	0
952	0	.00	0	0	.00	.00	.00	0
953	0	.00	0	0	.00	.00	.00	0
954	0	.00	0	0	.00	.00	.00	0
955	0	.00	0	0	.00	.00	.00	0
9 (56)	0	.00	0	0	.00	.00	.00	0
9 (57)	0	.00	0	0	.00	.00	.00	0
9 (58)	0	.00	0	0	.00	.00	.00	0
9 (59)	0	.00	0	0	.00	.00	.00	0
9 (60)	0	.00	0	0	.00	.00	.00	0
9 (61)	0	.00	0	0	.00	.00	.00	0
9 (62)	0	.00	0	0	.00	.00	.00	0
9 (63)	0	.00	0	0	.00	.00	.00	0
9 (64)	0	.00	0	0	.00	.00	.00	0
9 (65)	0	.00	0	0	.00	.00	.00	0
9 (66)	0	.00	0	0	.00	.00	.00	0
9 (67)	0	.00	0	0	.00	.00	.00	0
9 (68)	0	.00	0	0	.00	.00	.00	0
9 (69)	0	.00	0	0	.00	.00	.00	0
9 (70)	0	.00	0	0	.00	.00	.00	0
9 (71)	0	.00	0	0	.00	.00	.00	0
9 (72)	0	.00	0	0	.00	.00	.00	0
9 (73)	0	.00	0	0	.00	.00	.00	0
9 (74)	0	.00	0	0	.00	.00	.00	0
9 (75)	0	.00	0	0	.00	.00	.00	0
976	1	.00	3406	3406	100.00	.00	.00	0
977	1	.00	2465	2465	100.00	.00	.00	0
9 (78)	0	.00	0	0	.00	.00	.00	0
9 (79)	0	.00	0	0	.00	.00	.00	0
9 (80)	0	.00	0	0	.00	.00	.00	0
9 (81)	0	.00	0	0	.00	.00	.00	0
9 (82)	0	.00	0	0	.00	.00	.00	0
9 (83)	0	.00	0	0	.00	.00	.00	0
9 (84)	0	.00	0	0	.00	.00	.00	0
9 (85)	0	.00	0	0	.00	.00	.00	0
986	5	.19	6862	3950	57.56	19.51	45.96	0
987	4	.09	4967	3475	69.96	12.95	43.13	0
9 (88)	0	.00	0	0	.00	.00	.00	0
9 (89)	0	.00	0	0	.00	.00	.00	0
9 (90)	0	.00	0	0	.00	.00	.00	0
991	3	.01	4118	3889	94.44	.92	16.57	0
992	1	.00	2706	2639	97.52	.34	13.72	0
993	2	.00	3745	3574	95.43	.54	11.81	0
994	1	.00	1170	1159	99.06	.12	13.00	0
995	0	.00	0	0	.00	.00	.00	0
996	0	.00	0	0	.00	.00	.00	0
997	0	.00	0	0	.00	.00	.00	0
998	0	.00	0	0	.00	.00	.00	0
999	0	.00	0	0	.00	.00	.00	0

TABLE NAME	NON-WEIGHTED NO. OF ENTRIES	NON-WEIGHTED SUM OF ARGUMENTS	NON-WEIGHTED MEAN ARGUMENT	NON-WEIGHTED STD. DEV.	WEIGHTED NO. OF ENTRIES	WEIGHTED SUM OF ARGUMENTS	WEIGHTED MEAN ARGUMENT	WEIGHTED STD. DEV.
T1	213	35803.0000	168.089	54.089	213	35803.0000	168.089	54.089
T2	107	16327.0000	152.589	49.283	107	16327.0000	152.589	49.283
T3	106	19207.0000	181.198	68.849	106	19207.0000	181.198	68.849
T4	74	11219.0000	151.608	43.886	74	11219.0000	151.608	43.886
T5	102	16128.0000	158.118	56.259	102	16128.0000	158.118	56.259
T6	192	32803.0000	170.849	65.996	192	32803.0000	170.849	65.996
T7	330	56340.0000	170.727	59.834	330	56340.0000	170.727	59.834
T8	249	42236.0000	169.622	63.174	249	42236.0000	169.622	63.174
T9	200	34602.0000	173.010	55.533	200	34602.0000	173.010	55.533
T10	322	47944.0000	148.894	41.331	322	47944.0000	148.894	41.331
T11	210	33413.0000	159.110	60.461	210	33413.0000	159.110	60.461
T12	360	53185.0000	147.736	42.000	360	53185.0000	147.736	42.000
T13	168	25929.0000	154.339	49.850	168	25929.0000	154.339	49.850
T14	390	63814.0000	163.626	52.785	390	63814.0000	163.626	52.785
T15	379	63640.0000	167.916	57.719	379	63640.0000	167.916	57.719
T16	585	89697.0000	153.328	48.170	585	89697.0000	153.328	48.170
T17	396	62176.0000	157.010	54.788	396	62176.0000	157.010	54.788
T18	134	21516.0000	160.567	50.077	134	21516.0000	160.567	50.077
T19	1352	223058.0000	164.984	53.844	1352	223058.0000	164.984	53.844
T (20)	0	.0000	.000	.000	0	.0000	.000	.000
T (21)	0	.0000	.000	.000	0	.0000	.000	.000
T (22)	0	.0000	.000	.000	0	.0000	.000	.000
T (23)	0	.0000	.000	.000	0	.0000	.000	.000
T (24)	0	.0000	.000	.000	0	.0000	.000	.000
T (25)	0	.0000	.000	.000	0	.0000	.000	.000
T (26)	0	.0000	.000	.000	0	.0000	.000	.000
T (27)	0	.0000	.000	.000	0	.0000	.000	.000
T (28)	0	.0000	.000	.000	0	.0000	.000	.000
T (29)	0	.0000	.000	.000	0	.0000	.000	.000
T (30)	0	.0000	.000	.000	0	.0000	.000	.000
T31	191	486310.0000	2546.126	1140.247	191	486310.0000	2546.126	1140.247
T32	93	221296.0000	2379.527	1192.262	93	221296.0000	2379.527	1192.262
T33	89	210983.0000	2370.595	1120.548	89	210983.0000	2370.595	1120.548
T34	64	138502.0000	2164.094	950.673	64	138502.0000	2164.094	950.673
T35	90	202265.0000	2247.389	885.291	90	202265.0000	2247.389	885.291
T36	166	432032.0000	2602.602	1256.525	166	432032.0000	2602.602	1256.525
T37	285	1212394.0000	4254.014	2193.784	285	1212394.0000	4254.014	2193.784
T38	222	639251.0000	2879.509	1557.066	222	639251.0000	2879.509	1557.066
T39	175	485519.0000	2774.394	1309.675	175	485519.0000	2774.394	1309.675
T40	291	1080662.0000	3713.615	1943.122	291	1080662.0000	3713.615	1943.122
T41	192	467157.0000	2433.109	1095.161	192	467157.0000	2433.109	1095.161
T42	313	1608586.0000	5139.252	2418.218	313	1608586.0000	5139.252	2418.218
T43	151	368633.0000	2441.278	1085.641	151	368633.0000	2441.278	1085.641
T44	334	3309743.0000	9909.410	3084.937	334	3309743.0000	9909.410	3084.937
T45	325	2461632.0000	7574.252	3201.316	325	2461632.0000	7574.252	3201.316
T46	514	1451668.0000	2824.257	1298.840	514	1451668.0000	2824.257	1298.840
T47	341	3604535.0000	10570.484	3315.837	341	3604535.0000	10570.484	3315.837
T48	123	287514.0000	2337.512	994.427	123	287514.0000	2337.512	994.427
T49	1137	3104508.0000	2730.438	1213.294	1137	3104508.0000	2730.438	1213.294
T (50)	0	.0000	.000	.000	0	.0000	.000	.000
T (51)	0	.0000	.000	.000	0	.0000	.000	.000
T (52)	0	.0000	.000	.000	0	.0000	.000	.000
T (53)	0	.0000	.000	.000	0	.0000	.000	.000
T (54)	0	.0000	.000	.000	0	.0000	.000	.000
T (55)	0	.0000	.000	.000	0	.0000	.000	.000
T (56)	0	.0000	.000	.000	0	.0000	.000	.000
T (57)	0	.0000	.000	.000	0	.0000	.000	.000
T (58)	0	.0000	.000	.000	0	.0000	.000	.000
T (59)	0	.0000	.000	.000	0	.0000	.000	.000
T (60)	0	.0000	.000	.000	0	.0000	.000	.000

T61	178	1995751.0000	11212.084	7678.870	178	1995751.0000	11212.084	7678.870
T62	90	881332.0000	9792.578	5879.117	90	881332.0000	9792.578	5879.117
T63	85	838281.0000	9862.129	5922.212	85	838281.0000	9862.129	5922.212
T64	61	1402456.0000	22991.082	22040.154	61	1402456.0000	22991.082	22040.154
T65	87	735898.0000	8458.598	4929.143	87	735898.0000	8458.598	4929.143
T66	156	2187335.0000	14021.378	11726.289	156	2187335.0000	14021.378	11726.289
T67	269	3858879.0000	14345.275	9276.266	269	3858879.0000	14345.275	9276.266
T68	211	2336837.0000	11075.057	9114.785	211	2336837.0000	11075.057	9114.785
T69	163	1951272.0000	11970.687	7902.901	163	1951272.0000	11970.687	7902.901
T70	277	3148839.0000	11367.650	7129.602	277	3148839.0000	11367.650	7129.602
T71	179	1799972.0000	10055.709	6202.152	179	1799972.0000	10055.709	6202.152
T72	290	4101387.0000	14142.714	7753.689	290	4101387.0000	14142.714	7753.689
T73	144	1475703.0000	10247.937	6623.681	144	1475703.0000	10247.937	6623.681
T74	315	6996186.0000	22210.114	11372.298	315	6996186.0000	22210.114	11372.298
T75	313	5580650.0000	17829.552	8751.336	313	5580650.0000	17829.552	8751.336
T76	473	4771132.0000	10086.960	6998.384	473	4771132.0000	10086.960	6998.384
T77	315	8283254.0000	26296.044	14630.279	315	8283254.0000	26296.044	14630.279
T78	116	990745.0000	8540.905	6717.453	116	990745.0000	8540.905	6717.453
T79	1070	*************	12035.038	8058.415	1070	*************	12035.038	8058.415
T (80)	0	.0000	.000	.000	0	.0000	.000	.000
T81	3448	2333391.0000	676.738	27489.070	3448	2333391.0000	676.738	27489.070
T82	4792	2333856.0000	487.032	23312.796	4792	2333856.0000	487.032	23312.796
TYPE	3448	8687.0000	2.519	1.884	3448	8687.0000	2.519	1.884
CITY	3448	45403.0000	13.168	5.347	3448	45403.0000	13.168	5.347
T (85)	0	.0000	.000	.000	0	.0000	.000	.000
T (86)	0	.0000	.000	.000	0	.0000	.000	.000
T (87)	0	.0000	.000	.000	0	.0000	.000	.000
T (88)	0	.0000	.000	.000	0	.0000	.000	.000
T (89)	0	.0000	.000	.000	0	.0000	.000	.000
T (90)	0	.0000	.000	.000	0	.0000	.000	.000
T (91)	0	.0000	.000	.000	0	.0000	.000	.000
T (92)	0	.0000	.000	.000	0	.0000	.000	.000
T (93)	0	.0000	.000	.000	0	.0000	.000	.000
T (94)	0	.0000	.000	.000	0	.0000	.000	.000
T (95)	0	.0000	.000	.000	0	.0000	.000	.000
T (96)	0	.0000	.000	.000	0	.0000	.000	.000
T (97)	0	.0000	.000	.000	0	.0000	.000	.000
T (98)	0	.0000	.000	.000	0	.0000	.000	.000
T (99)	0	.0000	.000	.000	0	.0000	.000	.000

TABLE NAME: T1

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	213	100.00	100.00	.00	3.570	7.985

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T2

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	167	100.00	100.00	.00	3.932	9.079

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T3

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	106	100.00	100.00	.00	3.311	6.083

REMAINING FREQUENCIES ARE ALL ZERO

TAB [illegible]

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	74	100.00	100.00	.00	3.958	10.217

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T5

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	102	100.00	100.00	.00	3.795	7.854

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T6

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	192	100.00	100.00	.00	3.512	6.503

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T7

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	330	100.00	100.00	.00	3.514	7.174

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T8

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	249	100.00	100.00	.00	3.537	6.813

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T9

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	209	100.00	100.00	.00	3.468	7.689

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T10

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	322	100.00	100.00	.00	4.030	10.915

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T11

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	209	99.52	99.52	.48	3.771	7.292
700.0000	1	.48	100.00	.00	4.399	8.946

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T12

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	360	100.00	100.00	.00	4.061	10.768

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T13

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	168	100.00	100.00	.00	3.888	8.940

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T14

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	390	100.00	100.00	.00	3.667	8.267

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T15

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	379	100.00	100.00	.00	3.573	7.486

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T16

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	585	100.00	100.00	.00	3.913	9.273

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T17

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	396	100.00	100.00	.00	3.821	8.086

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T18

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	134	100.00	100.00	.00	3.737	8.776

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T19

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
600.0000	1352	100.00	100.00	.00	3.637	8.079

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T (20)

TABLE NAME: T (21)

TABLE NAME: T (22)

TABLE NAME: T (23)

TABLE NAME: T (24)

TABLE NAME: T (25)

ABLE NAME: T (26)

ABLE NAME: T (27)

ABLE NAME: T (28)

ABLE NAME: T (29)

ABLE NAME: T (30)

ABLE NAME: T31

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	191	100.00	100.00	.00	6.677	12.676

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T32

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	93	100.00	100.00	.00	7.144	12.263

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T33

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	89	100.00	100.00	.00	7.171	13.056

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T34

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	64	100.00	100.00	.00	7.855	15.606

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T35

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	90	100.00	100.00	.00	7.564	16.664

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T36

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	166	100.00	100.00	.00	6.532	11.458

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T37

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	295	100.00	100.00	.00	3.996	5.810

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T38

UPPER OBSERVED PERCENT CUMULATIVE CUMULATIVE MULTIPLE DEVIATION

LIMIT	FREQUENCY	OF TOTAL	PERCENTAGE	REMAINDER	OF MEAN	FROM MEAN
17000.0000	222	100.00	100.00	.00	5.904	9.069

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T39

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	175	100.00	100.00	.00	6.127	10.862

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T40

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	291	100.00	100.00	.00	4.578	6.838

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T41

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	192	100.00	100.00	.00	6.987	13.301

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T42

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	313	100.00	100.00	.00	3.308	4.905

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T43

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	151	100.00	100.00	.00	6.944	13.410

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T44

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	330	98.80	98.80	1.20	1.716	2.298
18000.0000	4	1.20	100.00	.00	1.816	2.623

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T45

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	324	99.69	99.69	.31	2.244	2.944
18000.0000	0	.00	99.69	.31	2.376	3.257

OVERFLOW* OBSERVED FREQUENCY: 1

TABLE NAME: T46

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	514	100.00	100.00	.00	6.019	10.914

REMAINING FREQUENCIES ARE ALL ZERO

...ABLE NAME: T47

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	332	97.36	97.36	2.64	1.608	1.939
18000.0000	5	1.47	98.83	1.17	1.703	2.241

OVERFLOW* OBSERVED FREQUENCY: 4

ABLE NAME: T48

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	123	100.00	100.00	.00	7.273	14.745

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T49

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
17000.0000	1137	100.00	100.00	.00	6.226	11.761

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T (50)

ABLE NAME: T (51)

ABLE NAME: T (52)

ABLE NAME: T (53)

ABLE NAME: T (54)

ABLE NAME: T (55)

ABLE NAME: T (56)

ABLE NAME: T (57)

ABLE NAME: T (58)

ABLE NAME: T (59)

ABLE NAME: T (60)

ABLE NAME: T61

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
3[illegible]000.0000	173	97.19	97.19	2.81	2.676	2.447
36[illegible]00.0000	3	1.69	98.88	1.12	3.211	3.228

OVERFLOW* OBSERVED FREQUENCY: 2

...ABLE NAME: T62

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
[illegible].0000	90	100.00	100.00	.00	3.064	3.437

...MAINING FREQUENCIES ARE ALL ZERO

...ABLE NAME: T63

UPPER	OBSERVED	PERCENT	CUMULATIVE	CUMULATIVE	MULTIPLE	DEVIATION

LIMIT	FREQUENCY	OF TOTAL	PERCENTAGE	REMAINDER	OF MEAN	FROM MEAN
30000.0000	84	98.82	98.82	1.18	3.042	3.4[illegible]
36000.0000	1	1.18	100.00	.00	3.650	4.41[illegible]

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T64

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	44	72.13	72.13	27.87	1.305	.318
36000.0000	6	9.84	81.97	18.03	1.566	.590

OVERFLOW* OBSERVED FREQUENCY: 11

ABLE NAME: T65

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	86	98.85	98.85	1.15	3.547	4.370
36000.0000	1	1.15	100.00	.00	4.256	5.587

REMAINING FREQUENCIES ARE ALL ZERO

ABLE NAME: T66

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	140	89.74	89.74	10.26	2.140	1.363
36000.0000	7	4.49	94.23	5.77	2.568	1.874

OVERFLOW* OBSERVED FREQUENCY: 9

ABLE NAME: T67

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	259	96.28	96.28	3.72	2.091	1.688
36000.0000	2	.74	97.03	2.97	2.510	2.334

OVERFLOW* OBSERVED FREQUENCY: 8

ABLE NAME: T68

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	203	96.21	96.21	3.79	2.709	2.076
36000.0000	4	1.90	98.10	1.90	3.251	2.735

OVERFLOW* OBSERVED FREQUENCY: 4

ABLE NAME: T69

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	155	95.09	95.09	4.91	2.506	2.281
36000.0000	3	1.84	96.93	3.07	3.007	3.041

OVERFLOW* OBSERVED FREQUENCY: 5

ABLE NAME: T70

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
[illegible].0000	269	97.11	97.11	2.89	2.639	2.613
[illegible]0.0000	5	1.81	98.92	1.08	3.167	3.455

[illegible]* OBSERVED FREQUENCY: 3

[illegible] NAME: T71

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	178	99.44	99.44	.56	2.983	3.71[illegible]
36000.0000	0	.00	99.44	.56	3.580	4.18[illegible]

OVERFLOW* OBSERVED FREQUENCY: 1

ABLE NAME: T/2

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	275	94.83	94.83	5.17	2.121	2.046
36000.0000	10	3.45	98.28	1.72	2.545	2.819

OVERFLOW* OBSERVED FREQUENCY: 5

ABLE NAME: T/3

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	142	98.61	98.61	1.39	2.927	2.982
36000.0000	0	.00	98.61	1.39	3.513	3.888

OVERFLOW* OBSERVED FREQUENCY: 2

ABLE NAME: T/4

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	262	83.17	83.17	16.83	1.351	.685
36000.0000	19	6.03	89.21	10.79	1.621	1.213

OVERFLOW* OBSERVED FREQUENCY: 34

ABLE NAME: T/5

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	284	90.73	90.73	9.27	1.683	1.391
36000.0000	17	5.43	96.17	3.83	2.019	2.076

OVERFLOW* OBSERVED FREQUENCY: 12

ABLE NAME: T/6

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	462	97.67	97.67	2.33	2.974	2.84[illegible]
36000.0000	7	1.48	99.15	.85	3.569	3.703

OVERFLOW* OBSERVED FREQUENCY: 4

ABLE NAME: T/7

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	217	68.89	68.89	31.11	1.141	.253
36000.0000	37	11.75	80.63	19.37	1.369	.663

OVERFLOW* OBSERVED FREQUENCY: 61

ABLE NAME: T/8

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	114	98.28	98.28	1.72	3.513	3.196
36000.0000	1	.86	99.14	.86	4.215	4.089

OVERFLOW* OBSERVED FREQUENCY: 1

TABLE NAME: T79

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
30000.0000	1028	96.07	96.07	3.93	2.493	2.2[illegible]
36000.0000	18	1.68	97.76	2.24	2.991	2.974

OVERFLOW OBSERVED FREQUENCY: 24

TABLE NAME: T (80)

TABLE NAME: T81

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
100.0000	1304	37.82	37.82	62.18	.148	-.021
120.0000	198	5.74	43.56	56.44	.177	-.020
140.0000	168	4.87	48.43	51.57	.207	-.020
160.0000	143	4.15	52.58	47.42	.236	-.019
180.0000	162	4.70	57.28	42.72	.266	-.018
200.0000	156	4.52	61.80	38.20	.296	-.017
220.0000	114	3.31	65.11	34.89	.325	-.017
240.0000	115	3.34	68.45	31.55	.355	-.016
260.0000	84	2.44	70.88	29.12	.384	-.015
280.0000	85	2.47	73.35	26.65	.414	-.014
300.0000	89	2.58	75.93	24.07	.443	-.014
320.0000	90	2.61	78.54	21.46	.473	-.013
340.0000	67	1.94	80.48	19.52	.502	-.012
360.0000	40	1.16	81.64	18.36	.532	-.012
380.0000	61	1.77	83.41	16.59	.562	-.011
400.0000	53	1.54	84.95	15.05	.591	-.010
420.0000	55	1.60	86.54	13.46	.621	-.009
440.0000	53	1.54	88.08	11.92	.650	-.009
460.0000	40	1.16	89.24	10.76	.680	-.008
480.0000	34	.99	90.23	9.77	.709	-.007
500.0000	28	.81	91.04	8.96	.739	-.006
520.0000	24	.70	91.73	8.27	.768	-.006
540.0000	27	.78	92.52	7.48	.798	-.005
560.0000	26	.75	93.27	6.73	.827	-.004
580.0000	26	.75	94.03	5.97	.857	-.004

OVERFLOW OBSERVED FREQUENCY: 206

TABLE NAME: T82

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
100.0000	2270	47.37	47.37	52.63	.205	-.017
120.0000	324	6.76	54.13	45.87	.246	-.016
140.0000	277	5.78	59.91	40.09	.287	-.015
160.0000	254	5.30	65.21	34.79	.329	-.014
180.0000	209	4.36	69.57	30.43	.370	-.013
200.0000	153	3.19	72.77	27.23	.411	-.012
220.0000	171	3.57	76.34	23.66	.452	-.011
240.0000	152	3.17	79.51	20.49	.493	-.011
260.0000	141	2.94	82.45	17.55	.534	-.010
280.0000	112	2.34	84.79	15.21	.575	-.009
300.0000	96	2.00	86.79	13.21	.616	-.008
320.0000	90	1.88	88.67	11.33	.657	-.007
340.0000	64	1.34	90.00	10.00	.698	-.006
360.0000	52	1.09	91.09	8.91	.739	-.005
380.0000	60	1.25	92.34	7.66	.780	-.005
400.0000	44	.92	93.26	6.74	.821	-.004

520.0000	49	.92	94.18	5.82	.862	[illegible]
540.0000	47	.98	95.16	4.84	.903	[illegible]
560.0000	32	.67	95.83	4.17	.944	[illegible]
580.0000	27	.56	96.39	3.61	.986	[illegible]
600.0000	17	.35	96.74	3.26	1.027	.000
620.0000	13	.27	97.02	2.98	1.068	.001
640.0000	23	.48	97.50	2.50	1.109	.002
660.0000	27	.56	98.06	1.94	1.150	.003
680.0000	12	.25	98.31	1.69	1.191	.004

OVERFLOW OBSERVED FREQUENCY: 81

TABLE NAME: TYPE

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1.0000	1763	51.13	51.13	48.87	.397	-.807
2.0000	304	8.82	59.95	40.05	.794	-.276
3.0000	433	12.56	72.51	27.49	1.191	.255
4.0000	182	5.28	77.78	22.22	1.588	.786
5.0000	374	10.85	88.63	11.37	1.985	1.317
6.0000	325	9.43	98.06	1.94	2.381	1.848
7.0000	67	1.94	100.00	.00	2.778	2.379

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: CITY

UPPER LIMIT	OBSERVED FREQUENCY	PERCENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1.0000	118	3.42	3.42	96.58	.076	-2.276
2.0000	56	1.62	5.05	94.95	.152	-2.059
3.0000	56	1.62	6.67	93.33	.228	-1.902
4.0000	54	1.57	8.24	91.76	.304	-1.715
5.0000	49	1.42	9.66	90.34	.380	-1.528
6.0000	116	3.36	13.02	86.98	.456	-1.341
7.0000	201	5.83	18.85	81.15	.532	-1.154
8.0000	135	3.92	22.77	77.23	.608	-.966
9.0000	126	3.65	26.42	73.58	.683	-.779
10.0000	180	5.22	31.64	68.36	.759	-.592
11.0000	111	3.22	34.86	65.14	.835	-.405
12.0000	201	5.83	40.69	59.31	.911	-.218
13.0000	85	2.47	43.16	56.84	.987	-.031
14.0000	236	6.84	50.00	50.00	1.063	.156
15.0000	223	6.47	56.47	43.53	1.139	.343
16.0000	304	8.82	65.28	34.72	1.215	.530
17.0000	254	7.37	72.65	27.35	1.291	.717
18.0000	59	1.71	74.36	25.64	1.367	.904
19.0000	884	25.64	100.00	.00	1.443	1.091

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NAME: T (85)

TABLE NAME: T (86)

TABLE NAME: T (87)

TABLE NAME: T (88)

TABLE NAME: T (89)

TABLE NAME: T (90)

TABLE NAME: T (91)

TABLE NAME: T (92)

TABLE NAME: T (93)

TABLE NAME: T (94)

TABLE NAME: T (95)

TABLE NAME: T (96)

TABLE NAME: T (97)

TABLE NAME: T (98)

TABLE NAME: T (99)

RANDOM GENERATOR	RANDOM MULTIPLIER	RANDOM INCREMENT	RANDOM SEED
1	1220703125	0	25937537845
2	3141592653	2718281829	3141592653
3	2718281829	3141592653	2718281829
4	10604499373	7261067085	10604499373
5	17249876309	7261067085	17249876309
6	30517578125	7261067085	30517578125
7	2565727293	35981228	2565727293
8	107936437	4292354	107936437
9	22438762221	6891	22438762221
10	621444377	92111326	621444377

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REFERENCES

CITED REFERENCES

Abbreviations used in the references:

ACM : Association for Computing Machinery

AFIPS : American Federation of Information Processing Societies

FJCC : Fall Joint Computer Conference

SJCC : Spring Joint Computer Conference

References, in order cited:

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