PROJECT INFORMATION SYSTEM

A DATABASE APPROACH

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by

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ABSTRACT

In many organizations, the working activities of individuals are accounted for on the basis of projects to which they are assigned. Usually all such information and the descriptions of the projects are recorded manually during the advancement of each project. This primitive procedure is not efficient to maintain information for enabling ongoing project control and analysis of the allocation of personnel resources. Hence there is a need for a computerized system. Such a system has been designed and partly implemented by employing the CDC DMS-170 Database Management System using COBOL as the host language.

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Finally, I would like to dedicate this work to my wife May-Ying in appreciation of her sacrifices during this year.

TABLE OF CONTENTS

		Page
CHAPTER 1.	INTRODUCTION	1
	1.1 Statement of Problem	2
	1.2 Objectives of the System	2
	1.3 Justification of the System	3
	1.4 Database Facilities	4
CHAPTER 2.	SYSTEM ANALYSIS AND DESIGN	7
	2.1 Investigation of Problem	7
	2.2 Analysis of Facts Gathered	12
	2.3 System Configurations	13
	2.4 System Narrative	13
CHAPTER 3.	IMPLEMENTATION	22
	3.1 Schema of the System	22
	3.2 Program Subschemas	24
	3.3 Program Narrative	26
	3.4 Input and Output Specifications	34
CHAPTER 4.	CONCLUDING REMARKS	47
	4.1 Evaluation of Results	47
	4.2 Discussion of Problems	49
	4.3 Future Enhancements	50
	4.4 Dimensions of the Project	51
APPENDIX A:	System Design Overview	52
APPENDIX B:	Program Flowcharts	67
APPENDIX C:	Input and Output Samples	104
APPENDIX D:	A Listing of the Programs	122

APPENDIX E: User Guide 144

BIBLIOGRAPHY 161

CHAPTER I

INTRODUCTION

In many organizations, the activities of individuals within certain departmental groupings are identified with various projects for which the department is responsible. A project is a time limited activity with the objective of producing a specified product. The specifications for the product are normally provided by the end-user who shall be referred to as the Customer. The Customer is obviously interested in the time and cost estimates for producing the product, the progress of the project at various stages and the actual time and cost of the project. Others that also have a need to monitor the progress of the project are the members of the project team, which may consist of several professional Staff and a Project Leader or may be a single individual for a small project. Also interested in the progress and performance of the project is the professional Staff Manager.

Thus the system designed must be able to meet the information requirements of the Customer, the Manager, the Project Leader and the team members. In many cases, records of such activity are maintained by manual procedures. As is the case with many manual systems, the information about the projects' advancement may lack the

qualities of completeness and timeliness, and be insufficient to judge the success of the project and the performance of the individuals who had participated.

With the invention of computer hardware and sophisticated software, most manual procedural systems can be automated. A computerized system not only promises the role of efficiency and flexibility in handling the large amount of information on individual projects, but also permits the accurate recording of work activities of individual Staff on different ongoing projects.

1.1 Statement of Problem

A computerized system is certainly a solution in handling the large amounts of data. The proposed system should be capable of maintaining all the information concerning current and past projects. It should also be able to record time commitments of the Staff on various projects. Hopefully, it should be a flexible system which is marketable and could be employed by various departments or organizations without the need of adaptation to program software.

1.2 Objectives of the System

Since the end product is going to be a flexible, computerized system which will serve differing user groups; the objectives of the system are as follows:

(a) Maintain information concerning all ongoing and completed projects.

(b) Facilitate the addition of new or revised project definitions.

(c) Record the addition of Staff and their commitments to various projects.

(d) Identify the Customers of each project and the category of service to which it belongs.

(e) Enable the retrieval in batch or interactive mode of project information serving various needs, such as project control and reporting, personnel and service analysis, miscellaneous queries, etc.

(f) Allow the addition and expansion of future applications based on the existing or enhanced database.

1.3 Justification of the System

In viewing the requirements, two development approaches are available; namely a computerized system based on file processing, or a system employing a database management system. The advantages of a database approach are:

(a) Physical data independence, that is, any changes made to the physical organization of the data or to the hardware will only involve changes to the database software and not to the application programs.

(b) Logical data independence - As new fields or new

relations are added to the existing database, the existing application programs should not be affected.

(c) Hence more flexibility in designing new reports.

(d) Capability of adding future applications.

(e) A tightly controlled updating procedure.

(f) Range and value checkings of individual fields done automatically.

Perhaps, the only disadvantage is the overhead of the database software which requires more central memory and normally a longer retrieval time. But the introduction of the virtual machine with high performance central processing unit would overcome these worries as far as memory is concerned.

With all the advantages of using database software over a file system, it has been chosen to develop the proposed system, namely, Project Information System.

1.4 Database Facilities

The available DBMS software is the DMS-170 Data Management System (fig. 1.1), which is supplied by Control Data Corporation [8]. The software package consists of a Data Description Language (DDL), a Data Manipulation Language which is an extension of COBOL, a query language called QUERY/UPDATE, Cyber Database Control System (CDCS) and Cyber Record Manager (CRM).

DDL is used to describe the overall design of the database, its structure and the relationships between all data items. Each database is defined by a Schema, which describes the internal structure of the entire database in detail and its storage formats, data access methods and modification contraints. The database descriptions employed by QUERY/UPDATE users and application programs are called Subschemas. They need to describe only the portions of the database required for the specific application program. The database could be viewed in more than one way by employing different subschemas.

Through QUERY/UPDATE or COBOL programs, the information in the database could be updated or the data could be organized into relations derived from joined files, searching for particular records for the structuring of complex reports. In fact, the database creation, interrogation and updating are carried out by CDCS. It acts as a software monitor and data controller which also protects data integrity and ensures file security. The execution of input or output operations is handled by another module called CRM. It supports various file processing capabilities. The available file organizations are sequential, indexed sequential, direct access, actual key and word addressable.

With this facility, a relational database could be implemented easily.

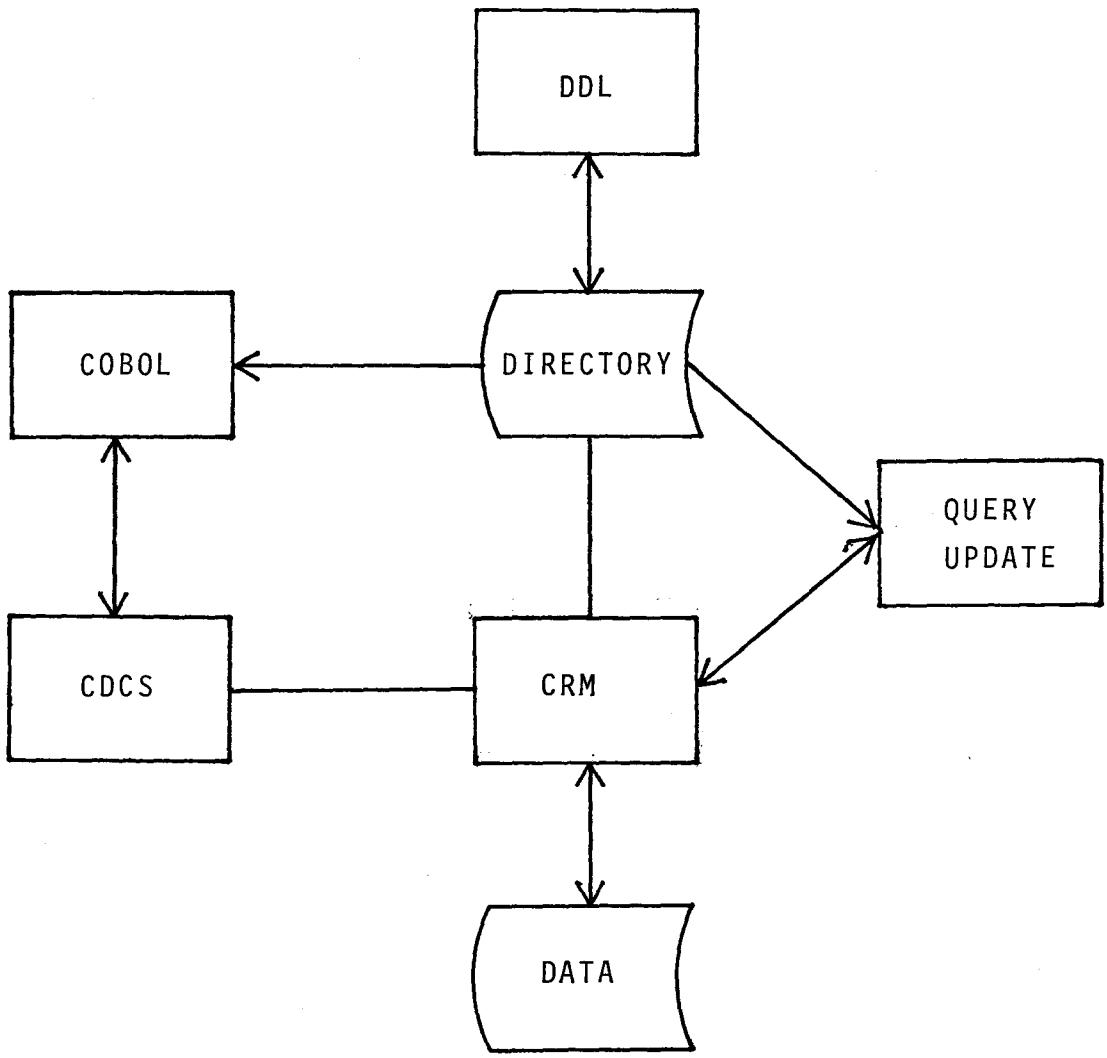


FIG. 1.1 DMS-170 DATA MANAGEMENT SYSTEM

CHAPTER 2

SYSTEM ANALYSIS AND DESIGN

There are many tools in analysing and designing a computer system. Some of these methods have been employed in developing the system, for example, facts gathering, interviewing the potential users, investigating the problems, standard flowcharting and studying a similar existing system, etc. The analysis procedures and results are summarized in the following paragraphs.

2.1 Investigation of Problem

Before the system can be designed, some consideration has to be made of the following areas.

2.1.1 Some definition on the Users of the System.

First we give some thoughts on the potential users of the system and attempt to define their roles and responsibilities with respect to the system.

A Customer is anybody who is interested in certain projects but is not involved in the development work. This person could be the one who proposed the project. He can be uniquely identified by the Customer Code. The Customer Code is assigned by the department which is responsible for the maintenance of the Project Information System. Although he is not generating any input to the System, he is inte-

rested in knowing the status, progress and description of the projects in his area.

A Staff is a person who participates in the development of the projects. Each Staff is uniquely identified by his Staff-ID. He is committed to report weekly time to the system, as allocated to individual projects that he works on. A weekly staff activity report is dispatched to him afterwards.

A Project Leader is classified as a Staff who has the decision power to make technical changes to the projects that he is controlling. He is also required to report his time on various projects as well as the updating of project information.

A Project Manager is a particular Staff who has the right to authorize projects. He is also responsible for defining new projects, revising the estimates on the old ones, and updating all project information in the database.

Both the Project Leader and Manager will obtain reports to indicate the progress of the projects.

2.1.2 Calendar to Be Used in the System

For any computer system which deals with time periods, there is always a problem in determining the Calendar to be followed. The Gregorian Calandar is normally used, but it is an irregular method of keeping track of time. We have some odd figures of three hundred and sixty-five days

in a year or three hundred and sixty-six days in a Leap Year. Each month consists of a different number of days and either four or five complete weeks in a month.

Some organizations have followed an Operating Calendar. An Operating Year begins on Monday of the first week which has four or more days in the Gregorian Calendar Year. Every month will consist of four Operating Weeks with exceptions of January, April, July and October. And there may be four or five weeks in December depending on the Year.

Although the second method is a more systematic approach, it is not readily acceptable by the human being who has been using the Gregorian Calendar throughout his life. A man-machine communication problem may easily arise.

Besides this, there is also a problem in defining the first day of the week. According to the Bible, the first day is Monday. But in Western custom, Sunday is the first day of the week. This will not make too much of a difference to the accumulated weekly subtotals if Sunday is a day of rest from the project concerned. The result will definitely be incorrect if the Staff has to report overtime on Sunday's work.

2.1.3 Time Unit

In normal life, people use hours or minutes as a

unit to record time. For the purpose of accounting, budgeting, and estimating the costs on the project, it is too tedious to use this time unit. Another time unit is used, called a manday, which has been widely used in the business world. A manday is usually equivalent to seven hours of time period, but its definition is vaguely stated. The designed system should be flexible to use different manday to hour conversion factors, according to the interpretation required by the user. Although data will be stored as mandays, many users may wish to report time, as input to the system, in hours, and this should be allowed.

2.1.4 Synchronization of Weekly Time Reporting Inputs and Outputs

For any computer system, if there are many users who are contributing inputs, a procedure has to be followed to collect and submit the inputs. An efficient way is to report time interactively via terminal. This method is only possible if every user can easily access a terminal and the terminal system is a reliable one. Another method is by submitting source documents to a central location before the batch run. The punctual arrival of the source documents is a key factor.

Other than this consideration, the system should also be able to deal with late arrivals and error recovery

with incorrect inputs.

The dispatching of reports back to the user should be soon after the run. Any subsequent changes can be fed back in the next run.

2.1.5 Maintainability of the System

The maintainability of the system refers to the ability of modifying the data in the database, the existing programs and program documentation of the system.

Since database facilities have been employed, all fields and records in the database can be easily accessed and updated. The database approach also enables non-redundancies of data.

If all programs are written in a structured manner and each program is associated with a set of proper docu--mentation, the end product can be easily maintained, and any changes should follow the same principles in programming and documenting.

2.1.6 Query Reporting Considerations

Basically, there are six forms of simple query relating to entities, E, attributes, A, and their attribute values, V. [10]

type 1: $A(E) = ?$ This simply requests the value of an attribute with a given entity

type 2: $A(?) \begin{matrix} = \\ \neq \\ > \\ < \end{matrix} V$ This is an inverted file inquiry.

It requests the entity E for a given attribute A equal to V, not V, greater or less than V.

type 3: $?(E) \begin{matrix} \neq \\ \geq \\ \leq \end{matrix} V$ It requests the attributes of entity E have value V, not V, greater or less than V.

type 4: ?(E) = ? requests the values of all attribute of entity E

type 5: A(?) = ? requests the value of attribute A for all entities

type 6: $?(?) \begin{matrix} \neq \\ \geq \\ \leq \end{matrix} V$ It requests all attribute of all entities having a value V, not V, greater or less than V.

In our database, the number of attributes and entities are large, it is impossible to allow queries with all different kind of combination. In our situation, type 1 and type 2 can be employed extensively. Type 3 is not necessary. Type 4 should be used to get a detailed listing of a given entity. Type 5 may generate too much output. Type 6 is required for a selective listing. One effective method to simplify query reporting is to limit the number of attributes. In our cases, the following attributes are of significance: time period, Staff-ID, Service account, key-words of projects, project number, Customer code.

2.2 Facts Gathering

The current trend of system analysis is to interview the potential users of the system. Some meetings have been arranged during the early development of this project.

Their ideas are valuable and have been implemented in the system design.

Besides this, an old system, which was used by the McMaster Computing Center, has been studied throughly. Some of the ingenious ideas from that file system have been used as the guidance of the new design.

2.3 System Configuration.

The proposed system is to be implemented using the CDC6400 computer system. The required software is the DMS-170 system which includes or interfaces with the following modules: the COBOL 5 compiler, the Data Description Language compiler, the Cyber Record Manager, the Cyber Database Control System and Sort/Merge programs. Some direct access storage is also required for the database files. At least one terminal should be easily accessible for running query reporting and online updating programs.

2.4 System Narrative.

The general design of the Project Information System consists of three basic functional modules. Appendix A contains the system design overview. These three sections are Time Reporting, System Information Updating and Project Status.

2.4.1 Time Reporting

This part of the system is dedicated to the maintaining of staff activities on individual projects. Every week, each Staff is committed to report his time on a project basis. The input can be submitted through a terminal or on transaction source documents which will be collected and input to the system eventually via batch processing. One can only report his activities during the current week. Any correction or late coming transactions should be forwarded to the Project Manager who can make appropriate modification by submitting inputs to the System Information Updating Module.

2.4.1.1 Time Reporting via Terminal

The program which accepts input via terminals is designed to run in a conversational mode. After each line of output, the program will prompt for the input. Each line of input is validated as being compatible with the information stored in the database. Any irregularity will cause the rejection of the input line and the printing of an appropriate message.

The following is an example of the input session:-

```
Date:  1978-06-30
TIME REPORTING SESSION BEGINS
INPUT STAFF-ID
?  7726030
```

```
WOULD YOU LIKE TO ADD, DELETE OR CHANGE
? add
INPUT PROJECT-NO AND TIME SPEND IN HR
? 12345, 2.5
? 45321, 3.75
ERROR - PROJECT DOES NOT EXIST
? 45327, 3.75
? end
```

After the word 'END' is submitted, no other information can be input. The program will print back all transactions that one has submitted during the week. The following is the example of the output on the terminal.

```
DATE:  1978-06-30
TIME REPORTING TRANSACTION
```

PROJECT - NO	PROJECT TITLE	TIME REPORTED
12345	KEYPUNCH MACHINE - MAINTENANCE	2.5
45327	OVERHEAD	3.75
	TOTAL	6.25 HRS.

Any changes to the transactions can be made by entering the Time Reporting Session again. It is important that all updates can be effective only if the weekly batch input program has not been processed.

2.4.1.2 Weekly Time Reporting Using Batch Input

The batch input program is run weekly to accept the transaction file and card inputs that have been accumulated throughout the week. The System Parameter record is read first in order to determine the begin and end dates of the current week, and to signal a year or month change during the week.

The Staff-time record contains information of yearly, monthly and weekly time subtotals of each staff on each project. Since only a fixed number of subtotals are kept, only the most recent subtotals are stored. The numbers of yearly, monthly or weekly subtotals to be stored are the selected options on the System Parameter Record. The oldest weekly subtotal is cycled out so as to free the space for the current input. If there is a month or year change during the week, the weekly subtotals are rotated once again. Similar adjustments are made to the yearly or monthly subtotals' fields.

After the cycling process is completed, time reporting transactions are read, validated and edited. Records are updated in random sequence using the Staff-ID and project-No as the concatenated key. A rejected transaction report is produced at each run to indicate any unsuccessful time reporting.

2.4.2 System Information Updating

This part of the system is run only when the updating

of the database is necessary due to changed circumstances. Every record or field in the database can be added, deleted or modified. The changes can be made through a terminal by running a conversational, system-driven program, or on transaction source documents which are submitted to a batch program. If the amount of updating is large, it is advisable to use the batch program.

2.4.2.1 Record Updating

A variety of transaction types, ranging from 10 to 82, have been designated for updating the various fields in the database records. Basically, there will be one type of add and delete transaction for each kind of record. Then there may be several corresponding types for updating the different data items within the record.

Before any processing is started, all transactions are sorted in sequence of transaction type and action code. The individual transaction is then validated and appropriate maintenance action taken. For each successful updating, an appropriate message appears on the Updating Information Report. Any rejected transaction is printed on the Updating Error Report. Both reports together give a clear view of what happened during the updating run.

2.4.2.2 Terminal Updating

Small amounts of updating can be made through the

terminal. In general, the system displays a number of questions and prompts the user for a simple answer or to choose one from an answer list. The program may ask further questions, if necessary, or request the user to submit the changes. Each qualified update will be made immediately before the next update can be entered. Since the database is being accessed interactively, other users will be locked out from it. The human response is far too slow compared to the speed of the computer; hence this method of updating may be of limited value. Any small urgent change can be made effectively but a large volume of updating should employ the batch updating program.

The following is an example of the terminal updating session:-

```
DATE:  1978-06-03
TERMINAL UPDATING SESSION BEGINS
INPUT STAFF-ID
?  7726030
INPUT RECORD TYPE TO BE MODIFIED
?  Customer
WOULD YOU LIKE TO ADD, DELETE OR CHANGE
?  add
INPUT CUSTOMER CODE
?  12345
```

INPUT CUSTOMER NAME

? P. Cheung

INPUT DEPARTMENT

? Applied Mathematics

SUCCESSFULLY UPDATED

WOULD YOU HAVE MORE UPDATES TO THIS RECORD TYPE

? No

INPUT RECORD TYPE TO BE UPDATED

? End

The program will not generate an updating report, other than a message indicating the success or failure of the update. In order to find out the status of the system, one can employ the Query Reporting programs.

2.4.3 Project Status

This part of the system is designed to generate various kinds of reports or query responses displayed on the terminal.

2.4.3.1 Weekly System Outputs

This is a batch job which is processed weekly. The weekly reports by Staff and by project are printed. These reports reflect the current updating and time reporting and they are used by the Staff as feedback from the system.

Other than these reports, the user has an option of

requesting either weekly, monthly or yearly end reports. These reports give indication of the progress of each project and Staff activities over a period of time.

This program is also capable of deleting old projects from the database. Any project, which has been completed for a time longer than that for which a history is kept, is deleted. A deletion report is generated for archive purposes whenever a deletion of any project has occurred.

2.4.3.2 Query Outputs

This program is run interactively. In general, the program prompts for the attributes, entities or their corresponding values. The user of the program either answers the questions or make a choice from the answer list. The report from each query is designed to be very concise and simple in content. The following is a list of query functions that are most useful.

(a) List the information of a project - Displaying of the title and narrative fields gives a description of the project. The Project Customer, Leader and Manager fields identify the persons who are responsible for the project. The key-dates field indicates the proposed, authorized, target and completion dates.

(b) List projects which fall in certain classification, such as projects with same key words or projects

with the same prefix of the service account or project number.

(c) List all Staff members who participate in a project.

(d) Given the Staff identification, list all projects that the Staff works on.

(e) List time commitment of Staff on projects.

(f) List the progress of a particular project.

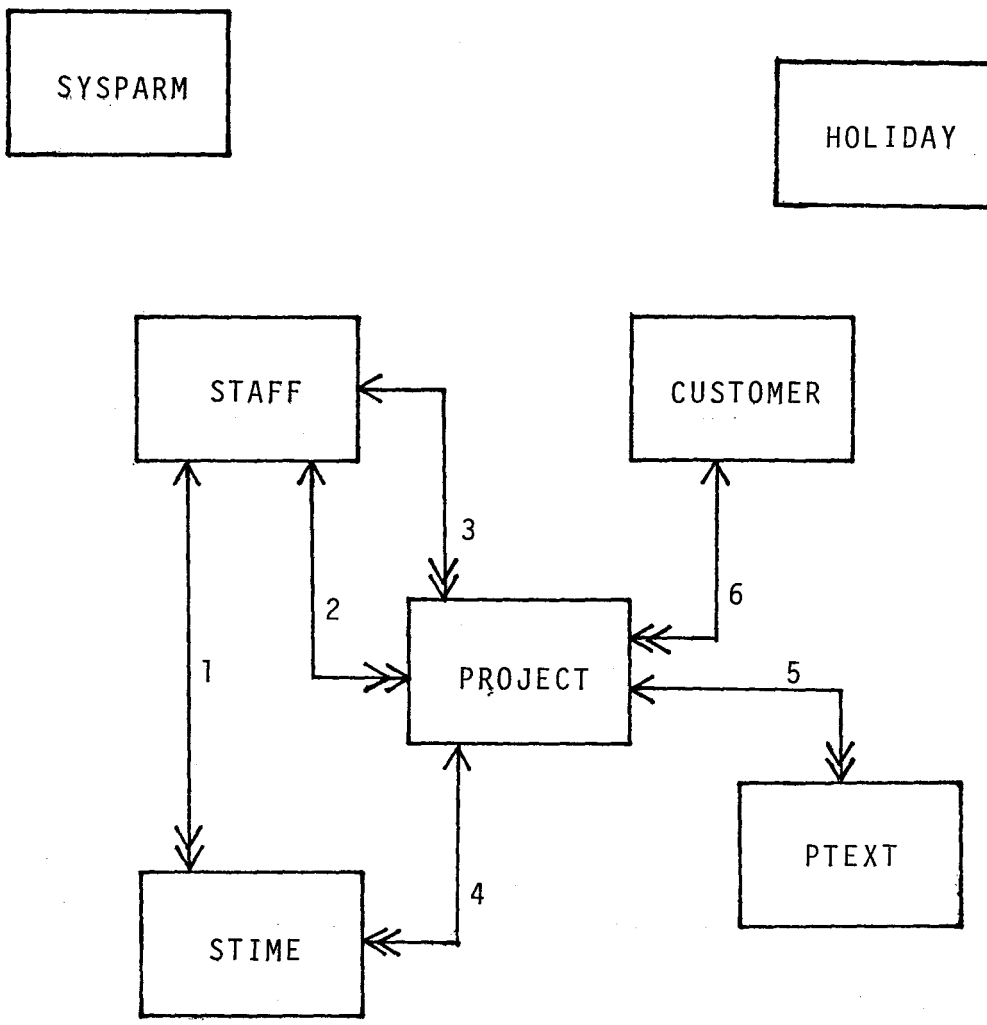
CHAPTER 3

IMPLEMENTATION

Due to the limited amount of main memory available, any COBOL program which requires database facilities is not able to execute in the interactive mode. Even batch programs are restricted to use not more than 127 K words of main memory. Hence the full implementation of the designed system is not possible. The Time Reporting via Terminal Program and Record Updating via Terminal program have been eliminated completely. The Query Reporting program is written in a way that it could be submitted to batch processing through the terminal. The output reports are kept on a file so that they could be viewed via the terminal after the completion of a Query Reporting run. In this section, a description of the implemented system is presented.

3.1 Schema of the System

The design of the schema is developed using normalization techniques with some minor modification. The schema is not fully non-redundant, since a normalized schema requires more independent files and it is impractical under the current circumstances. The following is the pictorial view of the schema.



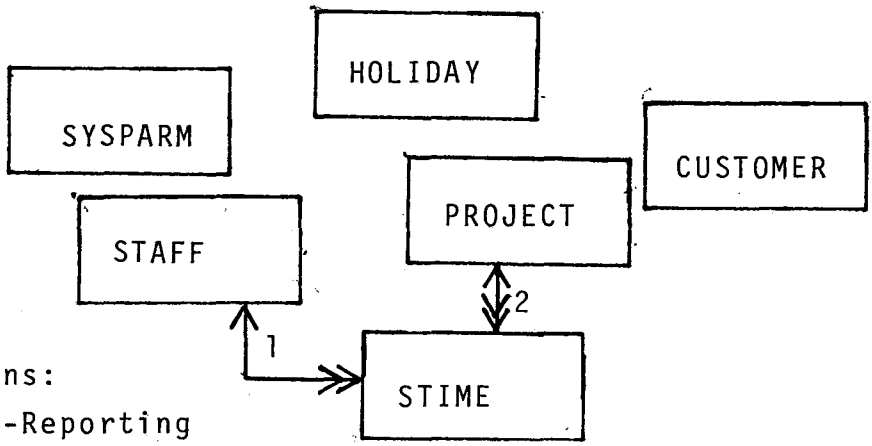
Relations:

1- Time-reporting
2- Authorize
3- Leading
4- Time-on-project
5- Description
6- Propose

3.2 Program Subschemas

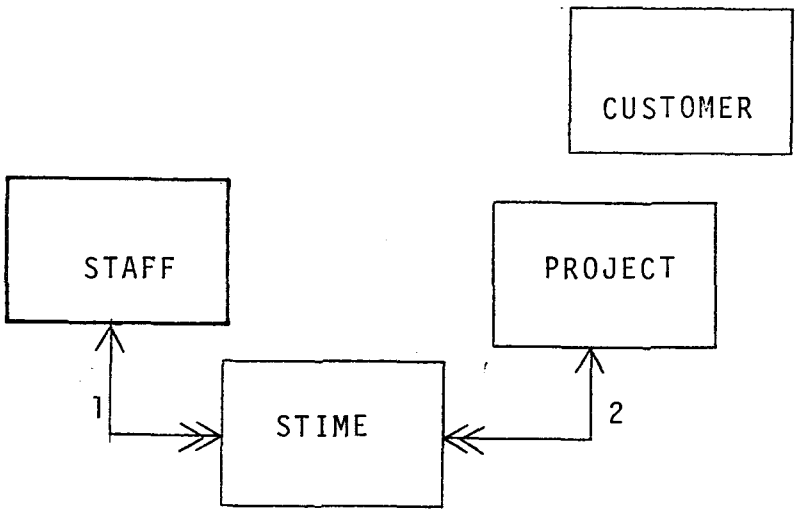
The design of the subschemas is totally dependent on the various application programs. Each may employ a different kind of subschema; for example, an updating program may require all fields in the file while a reporting program would only require access to the necessary information for the particular report. Six subschemas have been implemented for various applications.

Subschema ALLREC is accessed for initialization, and consists of all fields and files of the database. The updating programs make use of two subschemas, namely UPTONE and UPTTWO. The first one consists of all fields of SYSPARM, HOLIDAY, STAFF and CUSTOMER files, while Subschema UPTTWO contains all fields of PROEJCT, PTEXT and STIME files. TMSUB is another subschema which is used in the time reporting program. It consists of the descriptions SYSPARM and STIME files. Subschema RPTSUB is employed by the System Outputting program. Its schematic diagram is shown as the following.



Relations:
1- Time-Reporting
2- Time-on-project

The query reporting program makes use of another subschema,QURSUB; whose schematic diagram is shown as the following.



Relations:

1- Time-reporting

2- Time-on-project

Appendix D contains all the Schemas and Subschemas definition runs.

3.3 Program Narrative

The Project Information System that has been implemented consists of the following five basic sections and an initialization program, which is run first to allocate all files in the database. See Appendix D.

1 - Time Reporting via batch input

2 - Record Updating

3 - System Outputting

4 - Delete old project

5 - Query Reporting

3.3.1 Time Reporting via Batch Input

The weekly time reporting transactions are submitted to the system via this program. There will be one transaction per person reporting on each project. If the person worked on five projects for the past week, he has to submit five different transactions. If a month change occurs during the week, that week is split into two pseudo-weeks. This avoids the intermixing of the weekly subtotals when the monthly and yearly subtotals are calculated.

The program first cycles the weekly subtotals in the Staff-time record. If a month change has occurred during the week, a new subtotal field for the new month is allocated. If a year change has also occurred, a new year subtotal field is allocated and initialized.

Then the time reporting transaction is accepted and validated. The program will verify the dates as well as the correctness of the project number and Staff identification. All rejected transactions are reported on the error report with meaningful messages. The accepted transactions are then used to modify the subtotal fields in the Staff-time record. All the current year, month and week subtotals should be modified.

Input: Type 82C - Weekly time reporting transaction.

Output: PI910 - Time reporting error report

Subschema: TMSUB

3.3.2 Record Updating

This program accepts a number of different types of transactions for the modification of the records in the database. All transactions are first sorted into sequence by transaction type. Hence records are updated in the following sequence; System Parameter record,Holiday record, Customer record, Staff record, Project and Project Text records and finally the Staff-time record.

The System Parameter record is completely replaced by the transaction, hence all fields must be updated. Only one valid System Parameter transaction is accepted in each run. All fields are verified, particularly, the first date of the week field has to be consistent with the day specified.

The date on the Holiday record is checked but the

name of the Holiday is not verified. Duplicate records with the same date are not allowed.

The Customer record will not permit the same Customer Code for different records while Customer Name is not unique. Department name can contain alphanumeric characters. The Staff record will not permit the same Staff identification while Staff name may be the same. The Authorization field only permits an alphabet value of 'A' or Blank.

The Project record uses the Project Number as the primary key. All date fields are checked for validation. Project Leader, Manager and Customer must already exist in the database for the transaction to be valid. The cost estimate value must be numeric. The Project Delete Flag can be either '1' or '0'. When '1' is specified, it implies that the project has been completed.

The Project Text record has a concatenated key which consists of the Project number, Text Code and Line Number. A maximum of ninety-nine lines is possible for each kind of text. Text Code can be 'D' or 'N'. When 'D' is specified, the record is a description line; on the other hand, 'N' implies that this is a line from the project news.

The Staff-time record consists of all the time subtotals which the Staff Member has spent on each project. Hence the record is uniquely identified by the Staff-ID and the Project Number. The Staff-time Delete Flag is set to '1' if the Staff is removed from the project, otherwise it

is '0'. All fields in this record are not updated directly by the program except the week-subtotal field.

An updating report and an error report are produced after each run. Together, they will give a clear indication of the updating action.

Input: The following is a list of valid transactions which could be submitted to the program.

Transaction Type	Action	Description
10	A	Replacement of the System Parameter.
20	A	Addition of a Holiday record.
21	D	Deletion of a Holiday record.
22	C	Changing the name of the holiday.
30	A	Addition of a new Customer.
31	D	Deletion of a Customer record.
32	C	Changing of the Customer name.
33	C	Changing of the Department.
40	A	Addition of Staff record.
41	D	Deletion of Staff record.
42	C	Changing of the Staff Name field.
43	C	Changing of Authorization field.
50	A	Addition of Project record.
51	D	Deletion of Project record.
52	C	Changing Title fields.
53	C	Changing the Project Customer and Date-proposed.

Transaction Type	Action	Description
54	C	Changing the Project Manager and Date-authorized.
55	C	Changing the Target-date.
56	C	Changing the Project Leader.
57	C	Changing the Completion-date and Project Delete Flag.
58	C	Changing the Service Account.
59	C	Changing the Computer Account.
62	C	Changing the Estimated Costs.
63	C	Changing the Type of Application.
64	C	Changing the Area of Service.
65	C	Changing the keywords.
70	A	Addition of Project text record.
71	D	Deletion of Project text record.
72	C	Changing of one line of the Text.
80	A	Addition of Staff on project.
81	D	Deletion of Staff from project.
82	C	Changing of time spending.

Output: PI900 - Updating error report

PI800 - Updating information report

Sub-Schemas: UPTONE, UPTTWO

3.3.3 System Outputting

This program is executed whenever the hardcopy reports are desired. The program requires one single transaction; namely the period-end transaction which identifies the time period and report type requested.

Three basic reports are produced at each run. They are the Project Activity Report by Project Manager (PI100); the Project Activity Report by Project Leader (PI110) and the Staff Activity Report (PI200). PI100 is to be reviewed by the Project Manager. It shows the total in mandays spent on individual projects, as well as the Manpower and Workload indices.[1] PI110 is for the Project Leader to control the Staff activities on each project. PI200 is intended to be the feedback to the Staff who had reported time on the past week.

The period end reports are produced upon request from the user. Both PI300 and PI310 reports are intended to show the distribution of time spent on projects by Staff Member over a length of time. A maximum of ten subtotals are possible on either report.

---

[1] Manpower Index = $\frac{\text{Actual time spent on project}}{\text{\# of days between authorized date \& present}}$

Workload Index = $\frac{\text{Difference between actual \& estimated time}}{\text{\# of days between present \& target date}}$

Firstly, the transaction is accepted and validated. If the start and end date on the transaction is beyond the time period that history is retained, the upper and lower bounds are used instead of the specified dates. PI100, PI200 and PI300 are then produced. And depending on the report type, either no period-end report is generated or weekly, monthly or yearly report is produced.

Input: Type 90 - Period-end transaction.

Output: The following is a list of reports generated.

Report number	Titles
PI100	Project Activity Report by Project Manager.
PI110	Project Activity Report by Project Leader.
PI200	Staff Activity Report.
PI300	Period-end Report by Project.
PI310	Period-end Report by Staff.

Subschema: RPTSUB

3.3.4 Delete Old Project

If any project has been completed for longer than the time that history is kept, the information about this project is deleted by this program. The number of years that history is retained can be specified on the System Parameter Record. When the project is eliminated, a deletion report is generated.

Input: None

Output: PI400 Project deletion report

Subschema: ALLREC

3.3.5 Query Reporting

This program was originally intended to be interactive, accepting its inputs from terminals. However, due to insufficient memory, the program had to be split into three parts. The first program is run interactively to accept the query request. The inputs are edited into a transaction file, which is passed to the second program. The second program is submitted to the batch processing job queue via a terminal. This program, retrieves the file created by the first program and produces a simple and concise summary report. These report lines are written to a file which can be displayed by the third program on request.

The inputs to the first program consist of a list of Project Leaders and Staff. The Project Number to be listed can also be an input to the program. Customer Code and Service Account are other cirteria which can be used to select the projects to be listed. The user can specify 'ALL' to any of the selection criteria if all occurrences are to be retrieved. Either a brief or a detail form of the report may be requested.

The second program accesses the project file using the Project Number as the primary key. All selection criteria are verified before the Staff and Customer files are read; then the brief report is formatted and written to a file. The Staff-time information is required for

output only if the detail form of the report has been requested.

The last program retrieves the report file and displays the information at the terminal.

Input: Terminal conversation.

Output: Listing of the project information.

Subschema: QURSUB

3.4 Input and Output Specifications

This section describes the input and output specifications of the implemented system. The main input to the system is through transactions on punched cards, the query reporting program being the only exception. In the latter case the information is presented at a terminal. The standard output from the system is hardcopy from the printer. However, the query reporting program may display the output at a terminal. See Appendix C.

3.4.1 Input transaction

Input consists of the following transaction types: 10A, 20A, 21D, 22C, 30A, 31D, 32C, 33C, 40A, 41D, 42C, 43C, 50A, 51D, 52C, 53C, 54C, 55C, 56C, 57C, 58C, 59C, 62C, 63C, 64C, 65C, 70A, 71D, 72C, 80A, 81D, 82C, 90.

3.4.1.1 System Parameter Transaction

This transaction is used to update all fields in the

system parameter file (SYSPARM). Since this record controls the overall processing of the system, most of the fields should not be changed after the start of the system. Any time the record is required to be updated, every field must be defined. Input to program SORTREC

T-type	action	history retain			estimated cost unit		
		year	month	week	manpower	computer	
10	A						

man-day factor	first day of week	first date of week

field explanation:

a) T-type - transaction type always 10 N-2

b) Action - always A A-1

c) History Retain -

year - number of yearly subtotals to be retained N-2

month - number of monthly subtotals to be retained N-2

week - number of weekly subtotals to be retained N-2

d) Estimated cost unit -

manpower - manpower cost per manday N-3.2

computer - computer cost per hour N-3.2

e) Manday factor - manday to hour conversion factor N-3.2

f) First day of week[1] - a value ranging from 0 to 6 representing Sunday through Saturday N-1

---

[1] Record key of the file

g) First date of week - the corresponding start date of the week in YYYY-MM-DD format N-10

3.4.1.2 Holiday Transaction

The following transactions are for maintaining the Holiday file, which contains a list of user defined official holidays. Input to program SORTREC.

T-type	Action	Holiday Date			name of holiday
20	A	YYYY	MM	DD	

T-type	Action	Holiday Date		
21	D	YYYY	MM	DD

T-type	Action	Holiday Date			name of holiday
22	C	YYYY	MM	DD	

field explanation:

a) T-type - transaction type 20, 21 or 22 N-2

b) Action - A, D or C A-1

c) Holiday Date[1] - the date of the holiday N-8

d) Name of Holiday A-15

3.4.1.3 Customer Transaction

The following transactions are for maintaining the Customer file, which contains information about all the Project Customers. Input to program SORTREC.

---

[1] Record key of the file

T-type	Action	Customer code	Customer name	department
30	A			

T-type	Action	Customer code
31	D	

T-type	Action	Customer code	Customer name
32	C		

T-type	Action	Customer code	department
33	C		

field explanation:

a) T-type - transaction type 30, 31, 32 or 33 N-2

b) Action - A, D or C A-1

c) Customer code[1] - A unique code assigned by department AN-5

d) Customer name - name of the Customer maximum 25 characters AN-25

e) Department - name of the department which the customer works AN-20

3.4.1.4 Staff Transaction

The following transactions are for maintaining the Staff file, which contains all information about the Staff, Project Leader and Manager. Input to program SORTREC.

---

[1] Record key of the file

T-type	Action	Staff-ID	Staff name	Authorization
40	A			

T-type	Action	Staff-ID
41	D	

T-type	Action	Staff-ID	Staff name
42	C		

T-type	Action	Staff-ID	Authorization
43	C		

field explanation:

a) T-type - transaction type is 40, 41, 42 or 43 N-2

b) Action - A, D or C A-1

c) Staff-ID[1] - A unique identification of the Staff AN-10

d) Staff-name - name of the Staff AN-25

e) Authorization - 'A' or Blank which indicated the Staff's power to authorize new project A-1

3.4.1.5 Project Transaction

The following transactions are for maintaining the Project file. Since there are quite a number of fields in the Project record, more than ten transaction types are available. Each type updates either one or two fields in the project record except type 50 and 51. Transaction 50 is submitted in order to create a new project record, hence

[1] Record key of the file

all fields are initialized. Transaction 51 is used to set the delete flag to 'on'. Input to program SORTREC

T-type	Action	Project no
50	A	

T-type	Action	Project no
51	D	

T-type	Action	Project no	line no	project title
52	C			

T-type	Action	Project no	Proposed by	Date proposed		
53	C			YYYY	MM	DD

T-type	Action	Project no	Authorized by	Date authorized		
54	C			YYYY	MM	DD

T-type	Action	Project no	target date		
55	C		YYYY	MM	DD

T-type	Action	Project no	Project leader
56	C		

T-type	Action	Project no	completion-date			Delete flag
57	C		YYYY	MM	DD	

T-type	Action	Project no	Service account
58	C		

T-type	Action	Project no	Computer account
59	C		

T-type	Action	Project no	estimated costs		
62	C		mandays	computer hour	other

T-type	Action	Project no	type of application
63	C		

T-type	Action	Project no	area of service
64	C		

T-type	Action	Project no	K.W. no	Project key word
65	C			

field explanation:

a) T-type - transaction 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 62, 63, 64 or 65

b)	Action - A, D or C	A-1
c)	Project no[1] - a unique code which identifies individual projects	AN-10
d)	Line no. - either 1 or 2	N-2
e)	Project title - title of the project maximum 130 characters	AN-65
f)	Proposed by - contains the code of a customer who proposed the project	AN-5
g)	Date proposed - in YYYY-MM-DD format	N-8
h)	Authorized by - contains the Staff-ID of the Project Manager who gives permission to develop the project	AN-10
i)	Date authorized in YYYY-MM-DD	N-8
j)	Target date in YYYY-MM-DD format	N-8
k)	Project Leader - contains the Staff-ID of the Project Leader	AN-10
l)	Completion-date - in YYYY-MM-DD format	N-8
m)	Delete flag either '0' or '1', '1' indicates the project is completed	AN-1
n)	Service account	AN-10
o)	Computer account	AN-10
p)	Estimated costs	

---

[1] Record key of the file

Mandays - estimated number of working days required N8.2

Computer hour - estimated computer time required N8.2

Other - estimated other costs required N8.2

q) Type of application AN-20

r) Area of service AN-20

s) K.W. no. - keyword number N-1

t) Project key word AN-9

3.4.1.6 Project Text Transaction

These transactions are used to create the project description or the project news records in the Project Text file. Input to SORTREC.

T-type	Action	Project no	Text code	line no	text
70	A				

T-type	Action	Project no	Text code	line no
71	D			

T-type	Action	Project no	Text code	line no	text
72	C				

field explanation:

a) T-type - transaction type is 70, 71 or 72 N-2

b) Action - A, D or C A-1

c) project no[1] - Project number AN-10

d) Text code[1] - 'N' - News; 'D' - Description A-1

d) Line no[1] - line number 01 to 99 N-2

f) Text AN-64

3.4.1.7 Staff-time transaction

These records update the Staff-time file, which contains the time Staff are spending on individual projects. Whenever a Staff Member is assigned to a project, type '80' has to be submitted; which initiates all yearly, monthly and weekly time subtotals in the record. Type '81' is used to remove the Staff from an existing project. Type '82' changes the weekly time subtotals. Input to programs SORTREC and TMRPT.

T-type	Action	Staff-ID	Project-no
80	A		

T-type	Action	Staff-ID	Project-no
81	D		

T-type	Action	Staff-ID	Project-no	Date of week beginning		
				YYYY	MM	DD
82	C					

Date of week ending			time
YYYY	MM	DD	HH.HH

field explanation:

a) T-type - transaction type 80, 81 or 82 N-2

b) Action - A, D or C A-1

---

[1] Project-no, text code and line no form the concatenated key,

c) Staff-ID [1] - the identification code of the Staff on the project AN-10

d) Project-no [1] - the identification of the project which the Staff works on AN-10

e) Date of week beginning - the beginning date of the week which the time is to be reported on N-8

f) Date of week ending - the ending date of the week N-8

g) Time - total time in hours spent on the project for the week. The time contains two decimal places N2.2

3.4.1.8 Period-end Transaction

This transaction is input to SYSRPT for generating period end reports. Either yearly, monthly or weekly sub-total report may be requested.

T-type	Report type	Start date			end date		
90		YYYY	MM	DD	YYYY	MM	DD

field explanation:

a) T-type - transaction type is 90 N-2

b) Report type - 'Y', 'M', 'W' or 'N' A-1

---

[1] Staff-ID and Project-no form the concatenated key.

c) Start date - the first date of the period
When report type is 'Y', only year field is used
When report type is 'M', 'Year' and 'Month' fields are used
When report type is 'W', the whole date is used
When 'N' is specified, no period end report is generated N-8

d) End date - the last date of the period, same usage as the start date N-8

3.4.2 Terminal Input

The only use of a terminal for input is for program QURPT. In general, a question is asked by the program which then prompts the user for an answer. The information that is required is: a list of Project Leader, Staff, Customer, Service category and Project Number.

3.4.3 Output Report

The following is a list of output reports from the system.

PI100 - Project Activity Report by Project Manager, which is intended to be sent to the Project Manager. The report contains the list of all projects associated with the Project Manager, together with their period and current week time subtotals, Manpower and Workload indices.

PI110 - Project Activity Report by Project Leader, which is for the Project Leader. The report shows the individual Staff activity on the project. The period, current week and accumulated totals are summarized in this report.

PI200 - Staff Activity Report, which is intended to be a feedback to the Staff who has reported time spent on various projects.

PI300 - Period-end Report by Project. This report is intended to show the progress of a project over a period of time. A maximum of ten time subtotals, which are time spent by individual Staff, are printed and summarized.

PI310 - Period-end Report by Staff. The report is intended to show the Staff activity on various projects over a period of time. A maximum of ten time subtotals, which are time reported by the Staff on the project, are printed and summarized.

PI400 - Project Deletion Report. This report will be generated when a project has been completed for a time longer than history is retained in the database. It contains the project information and a summary of costs together with the key dates of the project.

PI800 - Updating Information Report. This report is

produced by the Record Updating Program which lists the successful updating, giving the transaction type, record type, record key and fields updated, and listed together with the previous and current value of the field.

PI900 - Updating Error Report. This report is produced by the Record Updating program which lists the unsuccessful updating transaction with the corresponding error message.

PI910 - Time Reporting Error Report. This report is generated by the time reporting program to indicate the rejected time reporting transaction.

3.4.4 Terminal output

The only terminal output is from the Query Reporting program. In the brief format the information given about the project is, its Customer, Project Leader and Manager. If detail form is requested, the Staff time spending information are also included.

CHAPTER 4

CONCLUDING REMARKS

In the previous chapters, I have already described the complete design of the Project Information System and the implemented portion in detail. Finally, I would like to evaluate the developed system and give some hints to improve the system in the future. I have also summarized a list of problems that have been encountered during the development of the software.

4.1 Evaluation of Results

The developed system can be evaluated in terms of the fulfilment of the stated objectives, the performance of the program software as well as their coding structure. As mentioned before, the system would maintain all information concerning all ongoing and completed projects, provided it is within the time that history is retained. New projects may be added and easily revised by executing the Updating Record program with the proper inputs. Staff can also be assigned to any project or removed from them. With all the generated reports, the management can control the various projects and allocate manpower resources effectively. Further more, the implemented system has been designed to facilitate future expansion.

The program software is coded in a uniform structure. The structure programming concepts have been used throughout the programs. 'Go To' statements are eliminated with exception of escaping from an enclosed block by jumping to the end of the block structure. Indentation of source coding, meaningful names and comment lines have been used in order to improve the readability of the programs.

The overhead costs of the system are represented by the run statistics which follow. Unfortunately, the cost per run statistics are unavailable at this time.

Run Statistics

Program	Compile Time (Sec)	Execution Time (Sec)
INIT	4	10
TIMERPT	21	17
SORTREC	2	2
UPTONE [1]	37	12
UPTTWO [1]	46	23
SYSRPT [1]	75	20
DELPRJT	10	15
QUCRT	7	1
QURPT	14	19
QULIST	2	4

See Appendix E for procedures to run the system.

---

[1] Overlay techniques have been employed.

4.2 Discussion of Problem

A major problem, which required considerable effort to overcome, was to make the system fit into the available memory. The Updating Record and System Outputting programs require more main core than the machine can provide. Hence they are split into different smaller programs and data are passed via temporary files. The segmentation feature of COBOL 5 has also been employed. During execution of the programs, only the mainline and controlling sections reside in main memory permanently, other sections are relocatable.

The database software provides the relation processing for retrieval but not deletion or creation of relational files. Hence the database is maintained by updating individual record types rather than relations. The 'Start' statement in COBOL 5 has been found to malfunction in positioning the root file of a relation, hence a random read has been used instead.

The database software does not provide a program controlled locking mechanism. Therefore the concurrent updating of the database by two or more programs is not possible.

Other problems that have been identified are summarized in the following lines.

- SELECT clause for database file can not contain other clauses such as ALTERNATE KEY, FILE ORGANIZATION,

ACCESS MODE, etc.

- Not able to create sequential database file.
- DIVIDE statement with REMAINDER option in COBOL 5 gives incorrect result when both the dividend and the result are the same field name.
- A numeric check can not validate an alphanumeric field which contains blanks.
- Misleading error messages from the software which delayed the development of the system. For example, the message, 'ISTAFF FILE NOT FOUND', was printed during the creation of the file. The real problem was found to be a new alternate key had been added in the schema while the subschema was not recompiled.

4.3 Future Enhancements

With limited time and resources, the system, as designed, is not fully implemented. When the memory problem is eliminated, then the terminal updating and reporting programs could be implemented. A further extension of the query reporting program could be made to imporve the system's interactive capability. Depending on future needs, additional special report programs could be written to query the database.

New integrated systems could be added to the database by expanding the existing files. For example, a Payroll System, which made use of the Staff record in

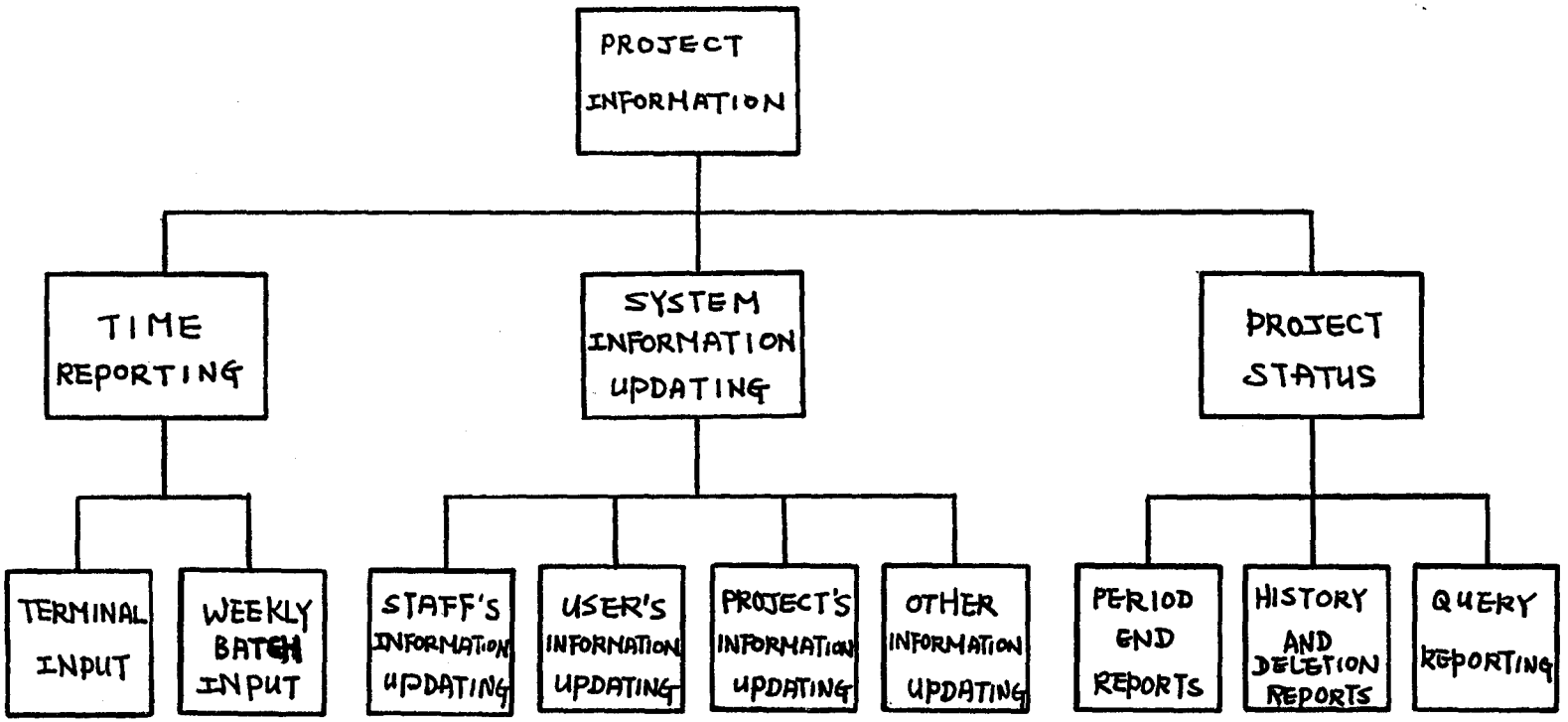
the database, could be developed. A Customer Billing System, could also be part of the database, which charges the Customer on the projects that are being developed or maintained. Of course, all of these require new fields to be added to the current file structures.

4.4 Dimensions of the Project

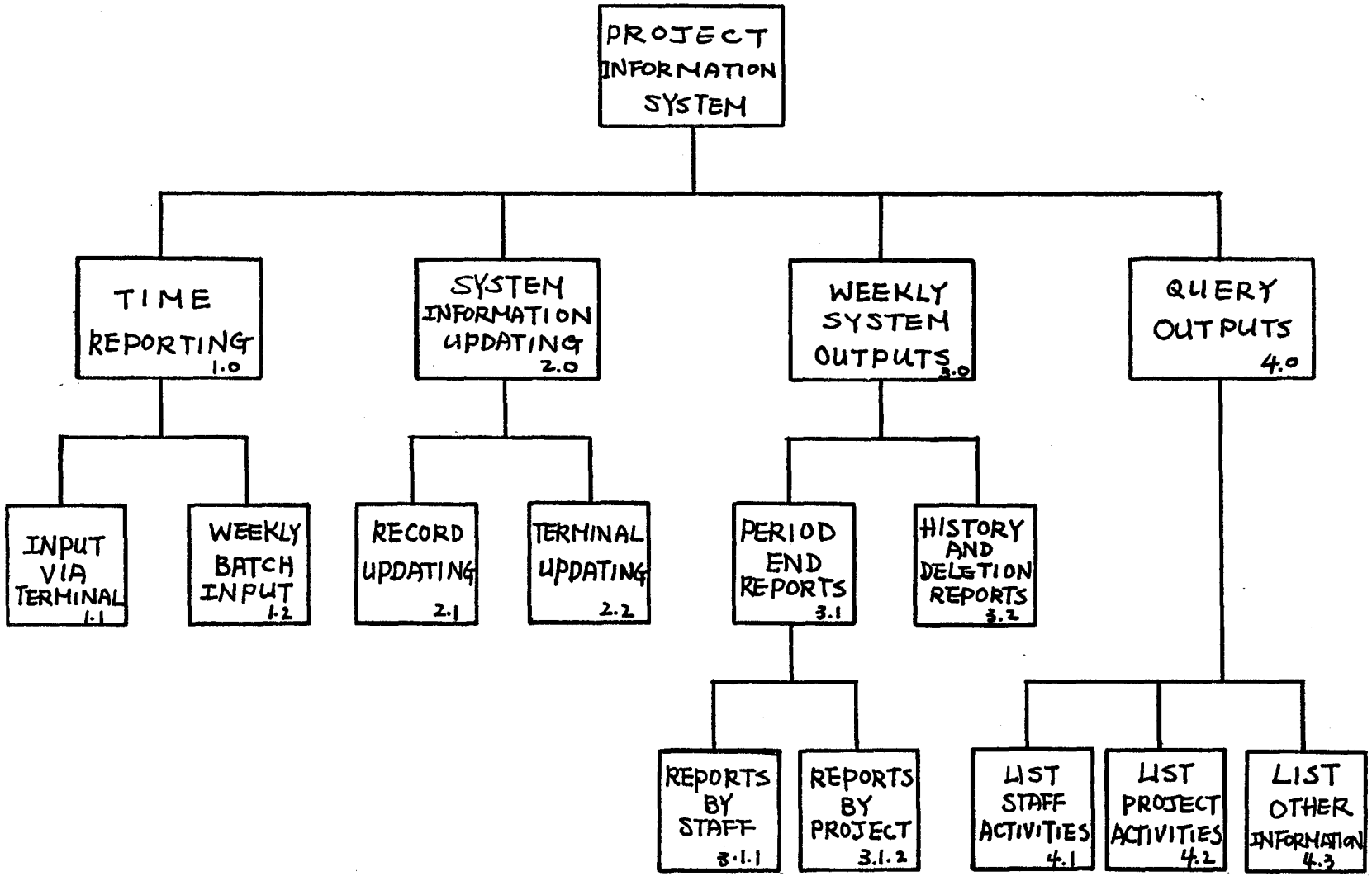
Finally, the dimensions of this project are defined by some statistics of the time breakdown of the effort required for the various stages. The project was completed in slightly less than four man-months, in which the familiarization, system analysis and design took eighteen mandays. The programming, system testing and implementation took thirty mandays, while the writing of the documentation accounted for the rest of the time. A total of sixty-five mandays has been spent in order to complete the project.

APPENDIX A

PROJECT INFORMATION SYSTEM DESIGN OVERVIEW

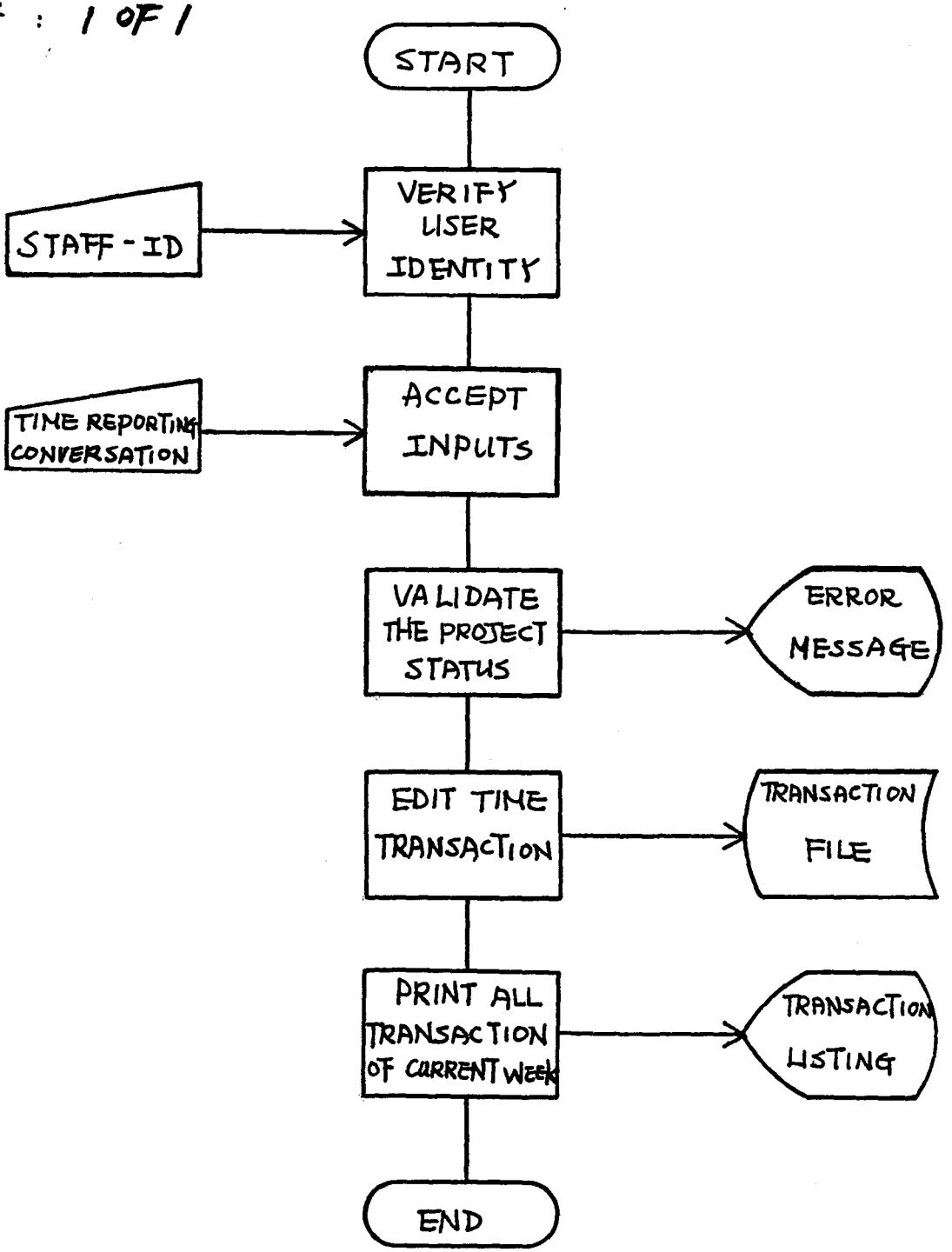


PROJECT INFORMATION SYSTEM - FUNCTIONAL OVERVIEW.

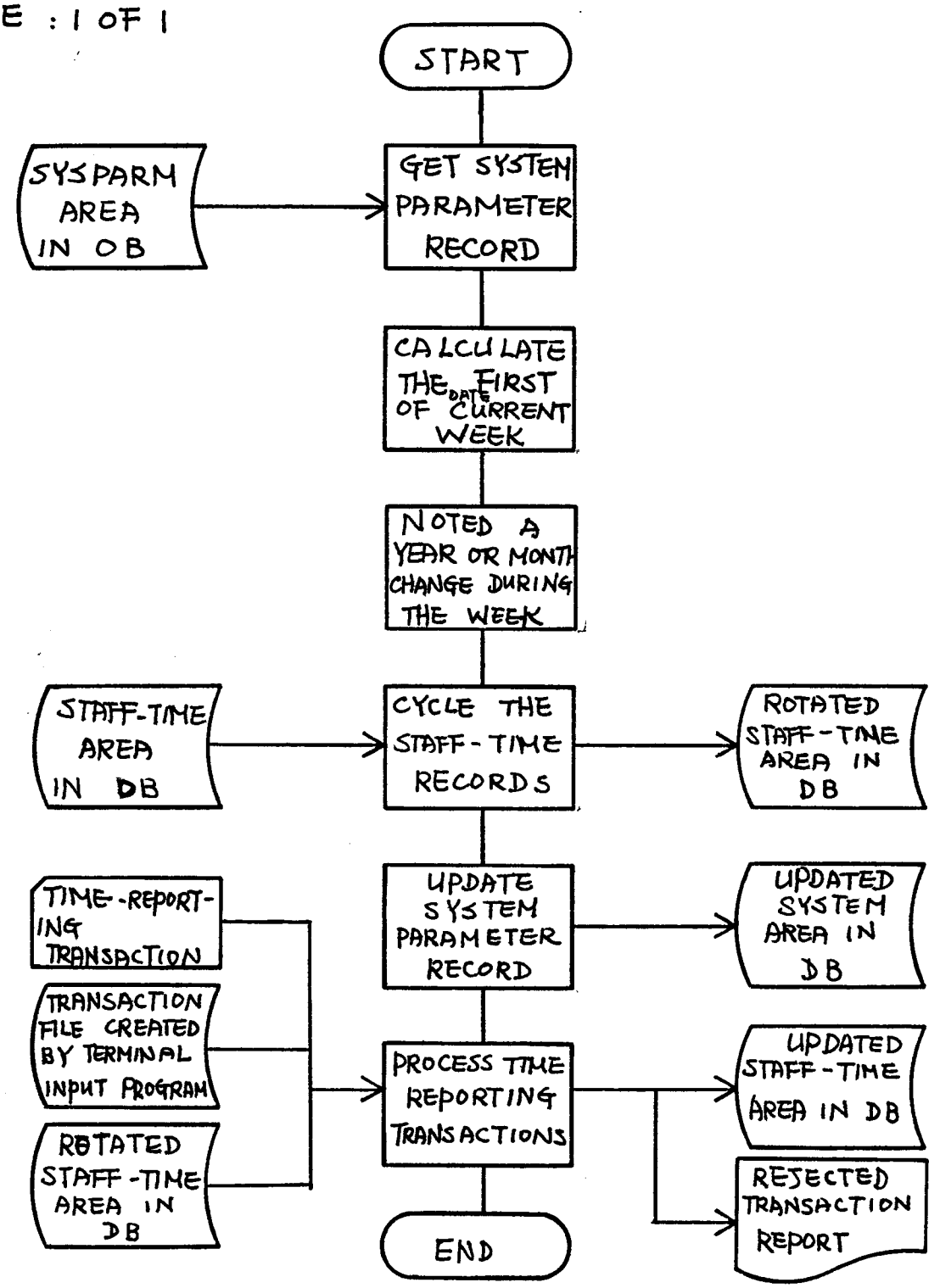


PROJECT INFORMATION SYSTEM - PROGRAMS OVERVIEW.

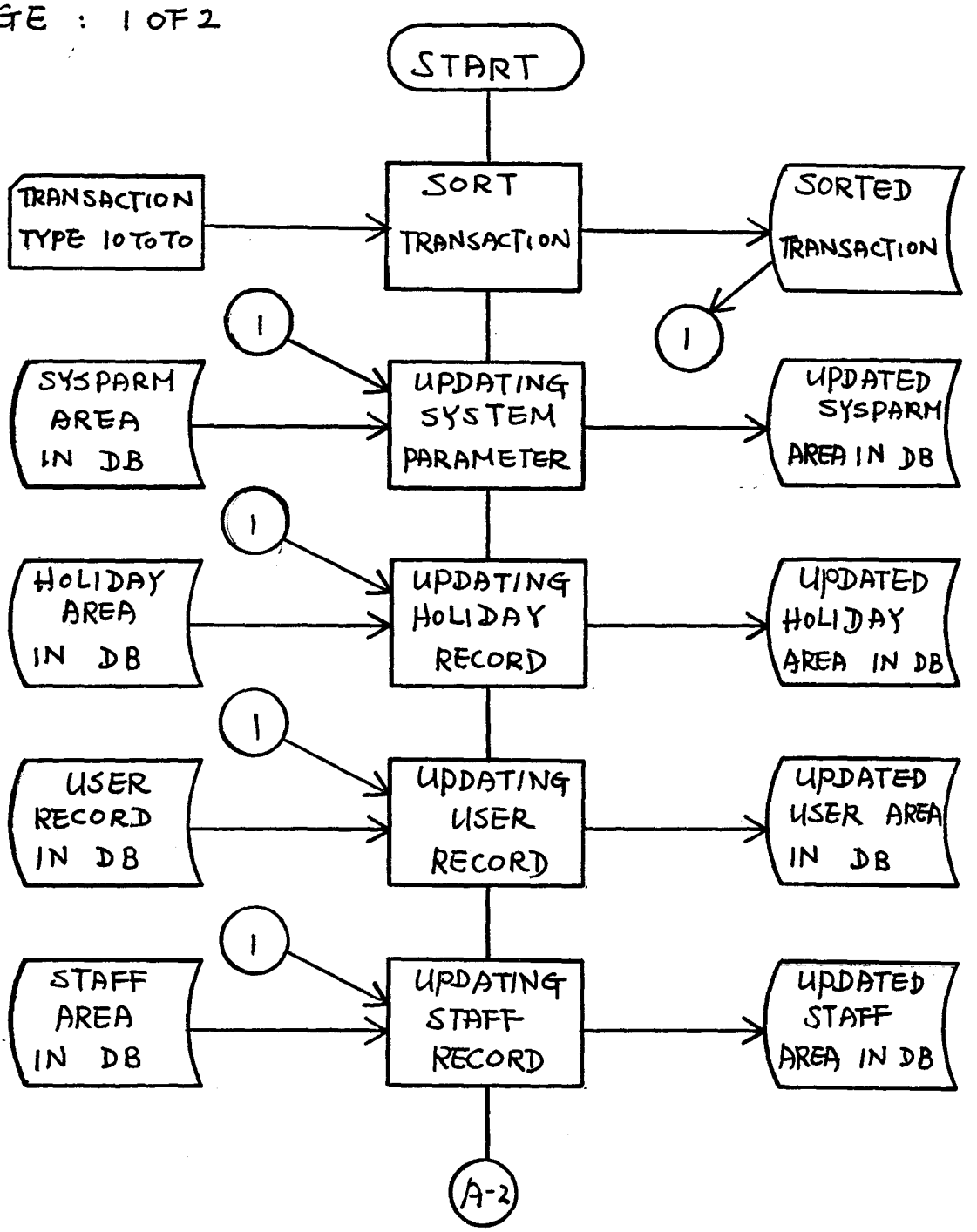
SYSTEM: PROJECT INFORMATION SYSTEM.
PROGRAM: TIME REPORTING VIA TERMINAL
DIAGRAM: 1.1
PAGE : 1 OF 1



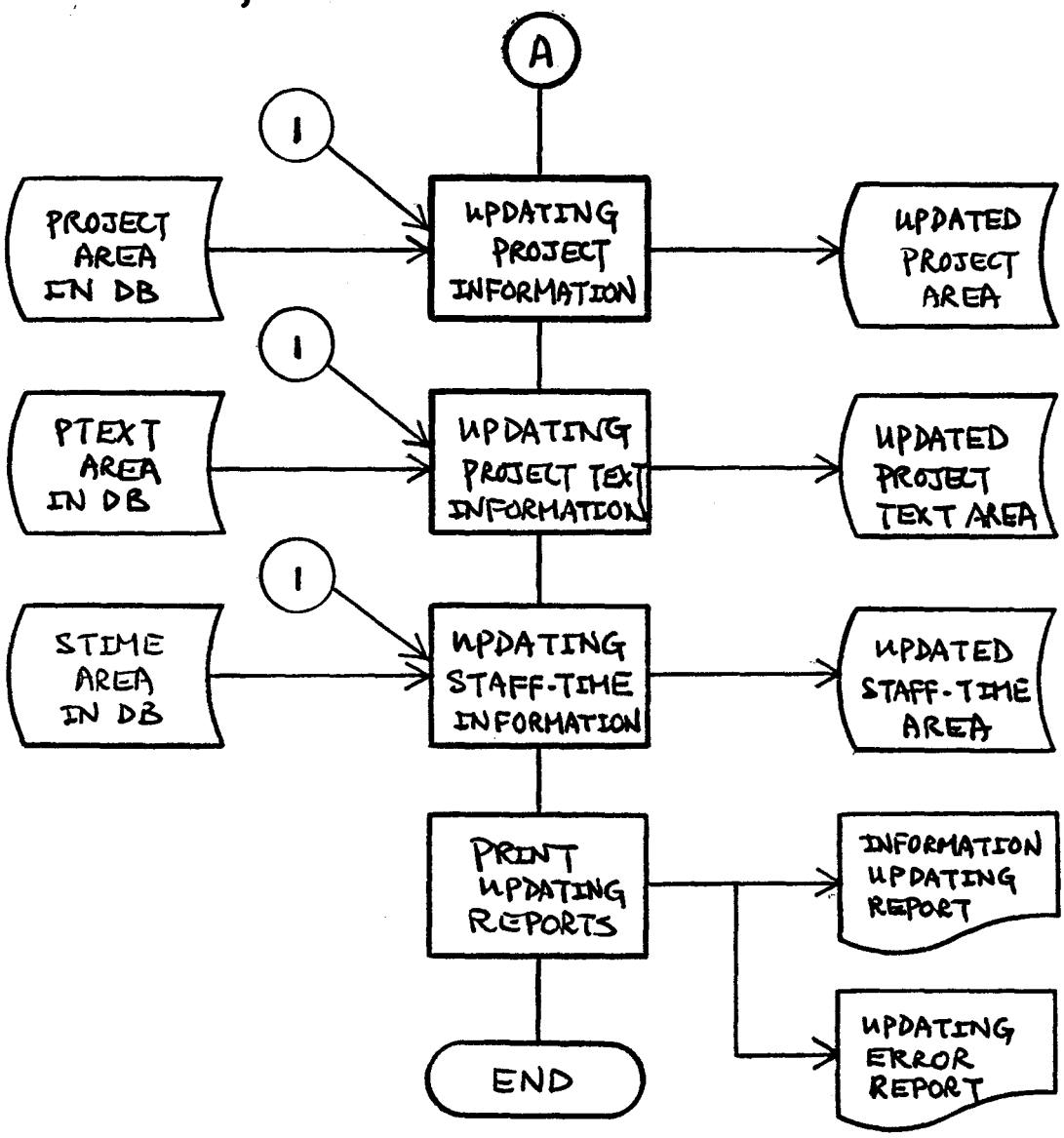
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: WEEKLY TIME REPORTING USING BATCH INPUT
DIAGRAM: 1.2
PAGE : 1 OF 1



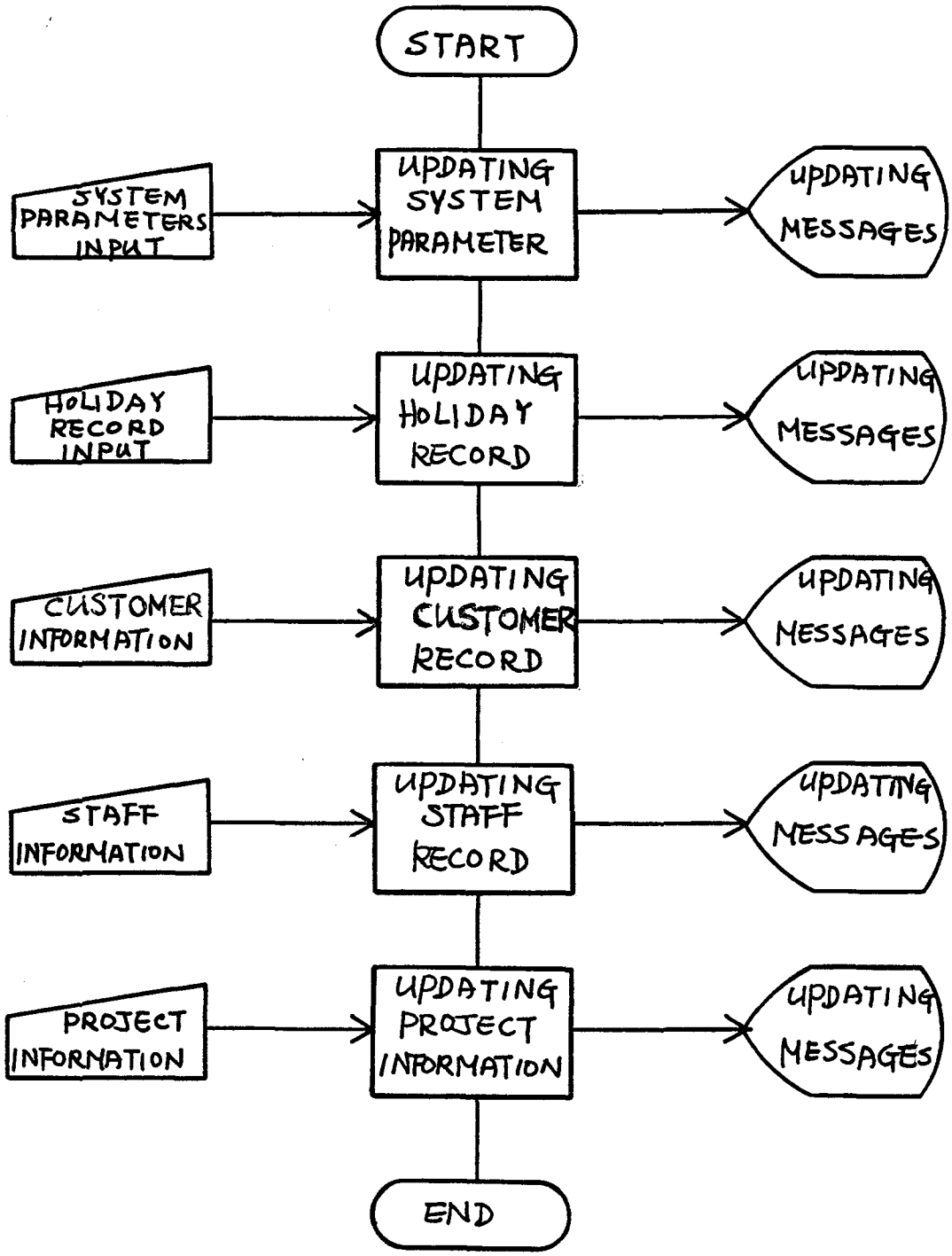
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : RECORD UPDATING
DIAGRAM : 2:1
PAGE : 1 OF 2



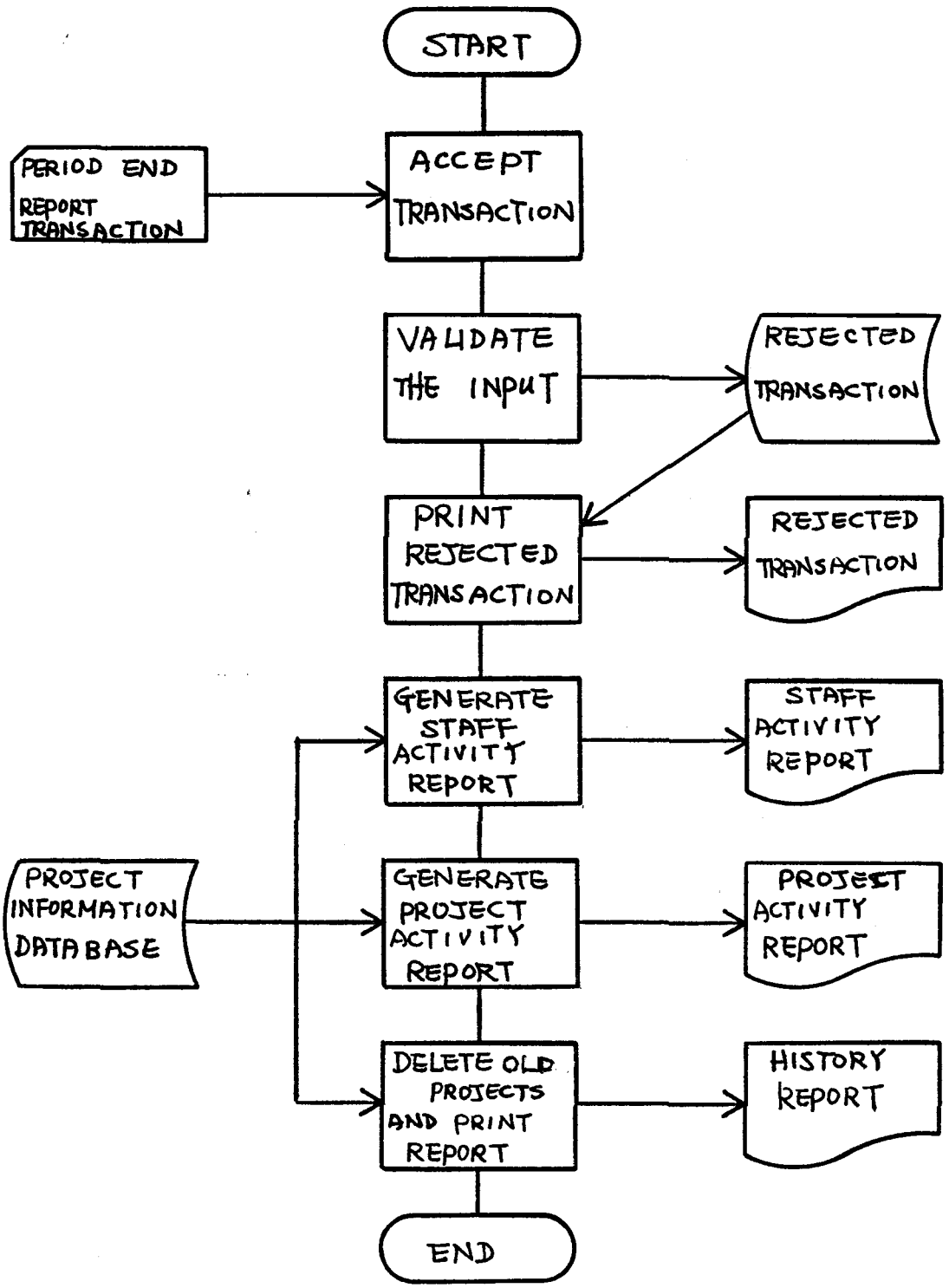
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : RECORD UPDATING
DIAGRAM : 2.1
PAGE : 2 of 2 .



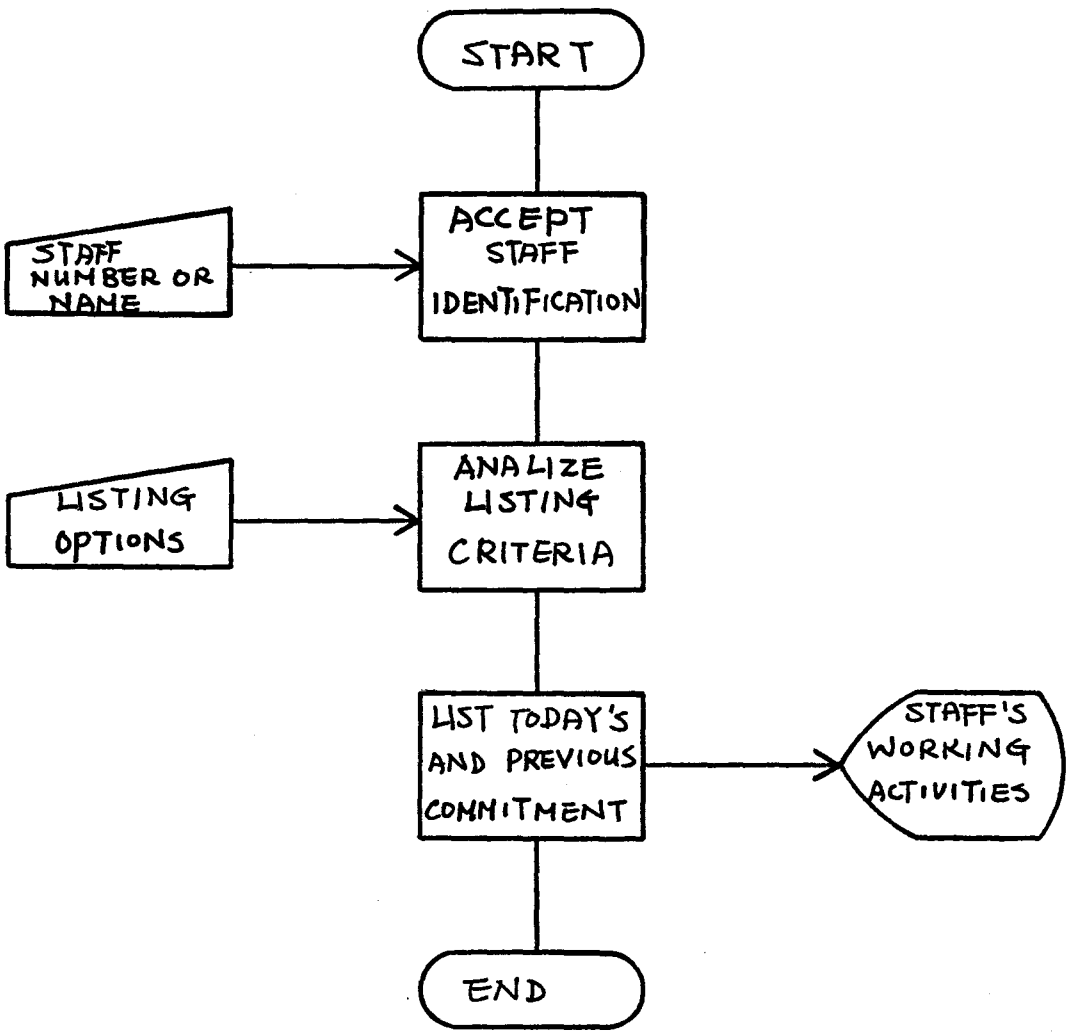
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : TERMINAL UPDATING
DIAGRAM : 2.2
PAGE : 1 OF 1



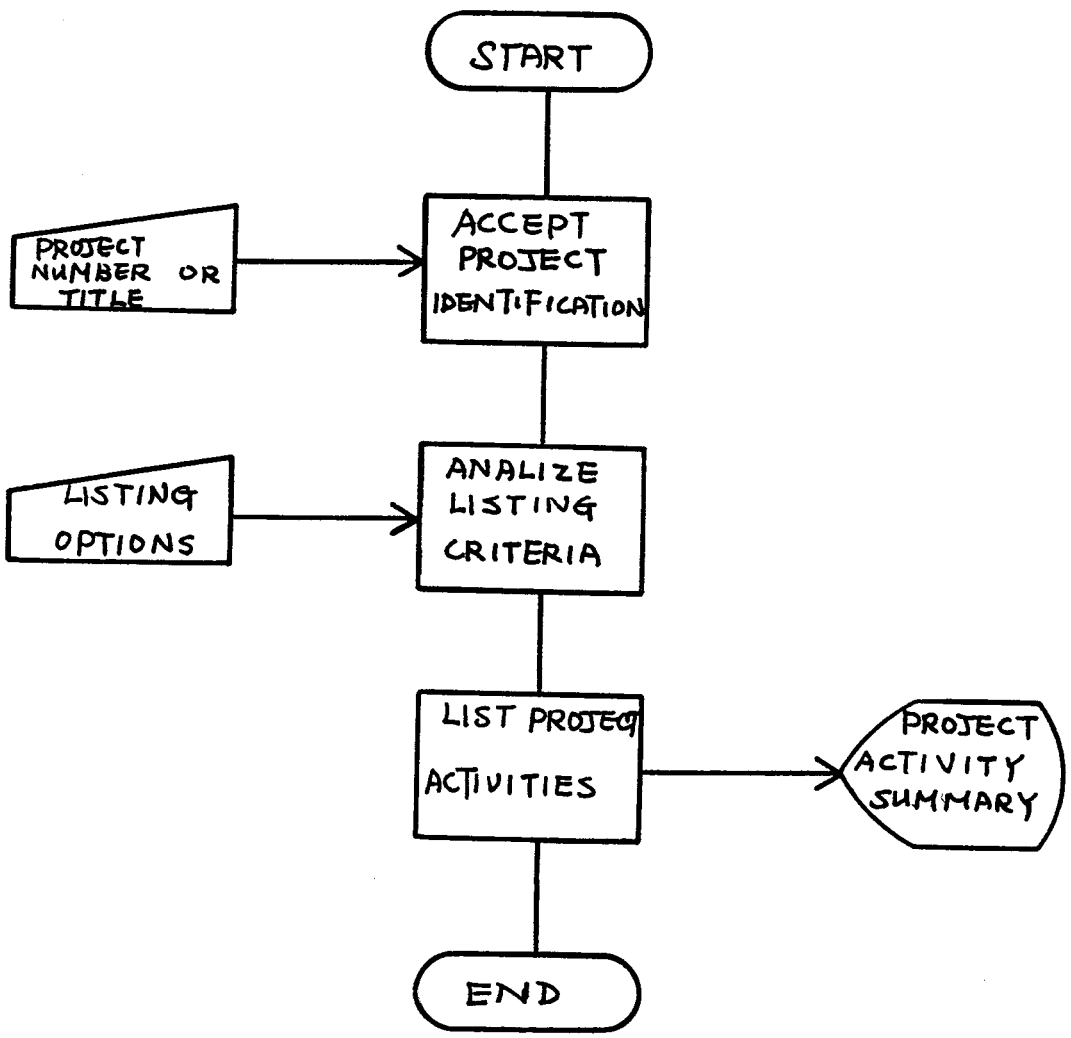
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: SYSTEM OUTPUTS
DIAGRAM: 3.0



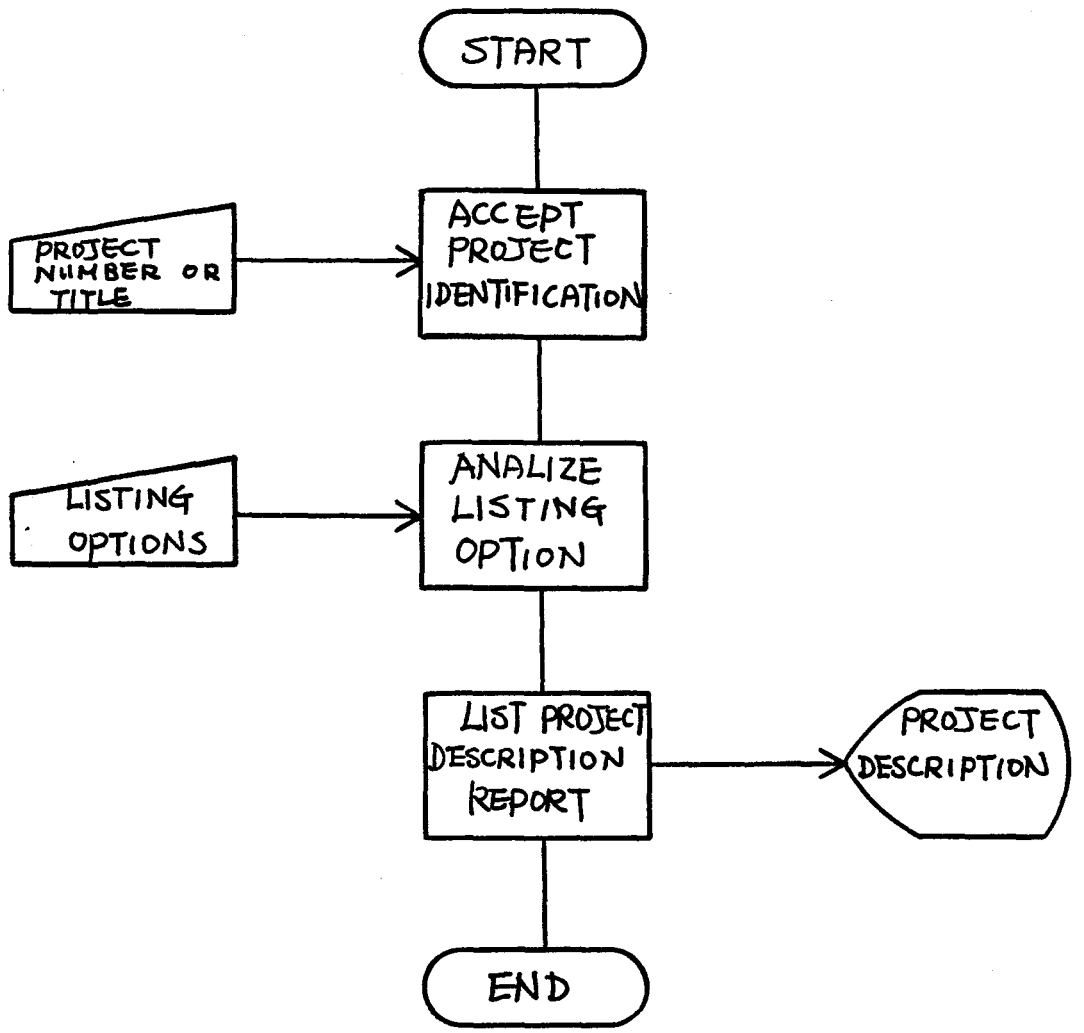
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM: LIST STAFF ACTIVITIES
DIAGRAM: 4.1
PAGE : 1 OF 1

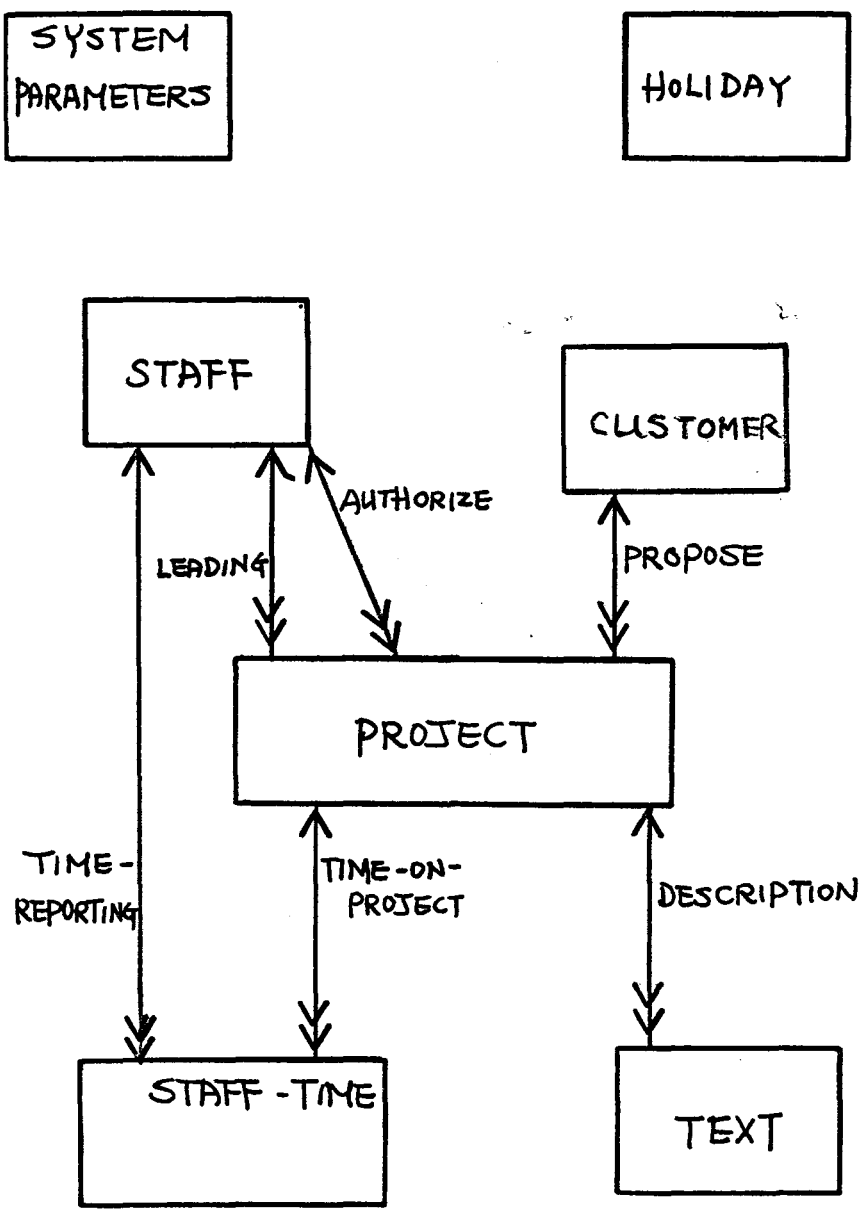


SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : LIST PROJECT ACTIVITIES
DIAGRAM : 4·2
PAGE : 1 OF 1



SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : LIST OTHER PROJECT INFORMATION
DIAGRAM : 4.3
PAGE : 1 OF 1





SCHEMA DIAGRAM

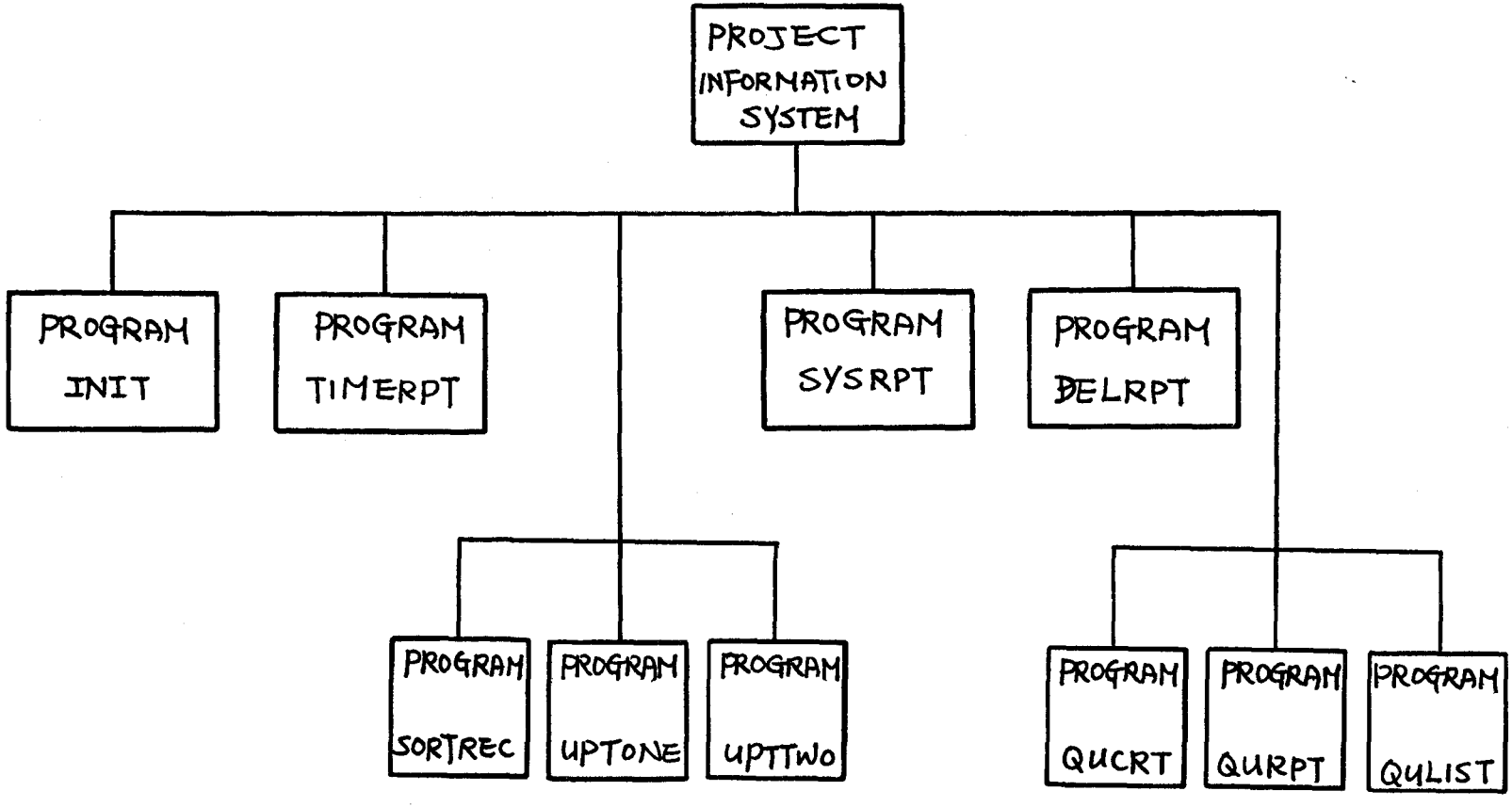
1. System Parameters contains the follwoing information.
    a. A field which indicates the number of year, month and week subtotals are maintained in the system.
    b. The cost of computer and manpower.
    c. Manday to hour conversion factor.
    d. The date chosen as the first day of the week and its corresponding date in year, month and day format.
2. Holiday record contains the following information.
    a. The date of the Holiday and it is the key of the record.
    b. The corresponding name of the Holiday.
3. Staff record contains the following information.
    a. Staff identification code which is the key of the record.
    b. Staff name.
    c. Authorization code.
4. Project record contains the following information.
    a. Project number which identifies the project.
    b. Project title.
    c. The date the project was proposed and the Customer who proposed it.
    d. The date on which the project was authorized and the Staff who authorized it.
    e. The target date of the project.
    f. Service and computer accounts.
    g. The estimated costs of manpower, computer and other miscellaneous costs.
    h. Completion date if the project has been completed.
    i. Delete flag if the project has been deleted.
    j. Some keywords which describes the project.
5. Text record contains the following information.
    a. The project number.
    b. Text code which identifies whether it is a news line or a project description.
    c. Line number.

d. Detail line of the text.

6. Customer record contains the following information.
   a. Customer code which identifies the record and the Customer.
   b. Customer name.
   c. Customer Department.
7. Staff-time record contains the following information.
   a. Staff-ID and Project-NO together form the concatenated key of the record.
   b. Delete flag.
   c. A field which indicates the latest year.
   d. Yearly subtotals.
   e. A field which indicates the latest month.
   f. Monthly subtotals.
   g. Weekly subtotals and the corresponding Begin-date of the week.

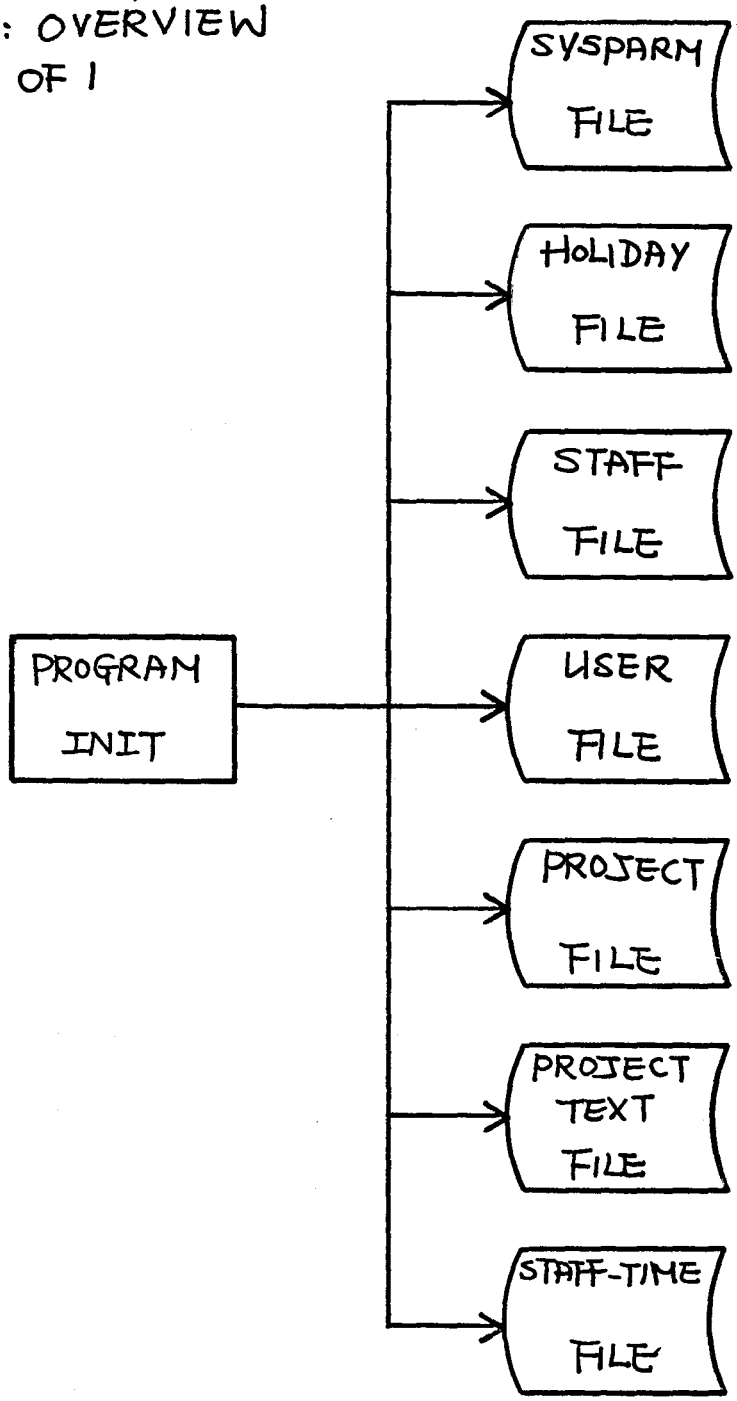
APPENDIX B

PROJECT INFORMATION SYSTEM PROGRAM FLOWCHARTS

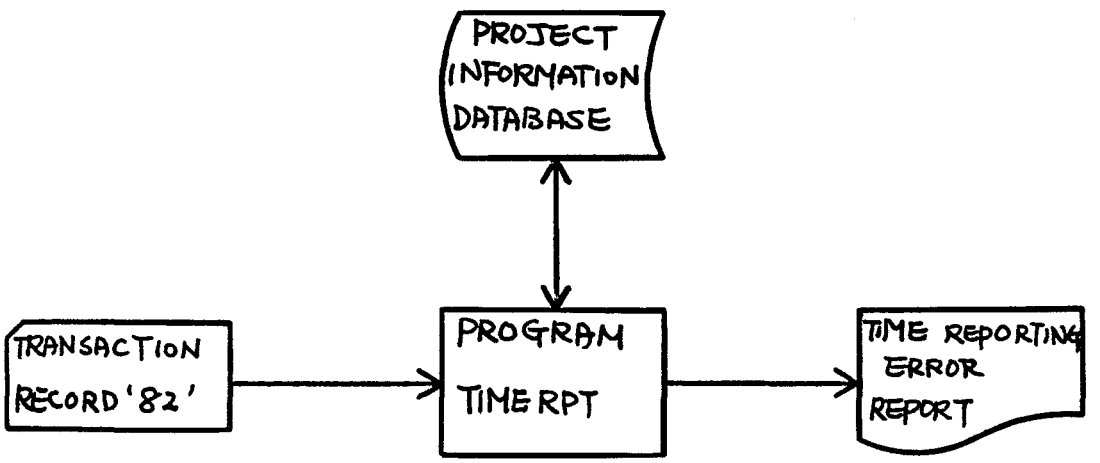


PROJECT INFORMATION SYSTEM - PROGRAM OVERVIEW

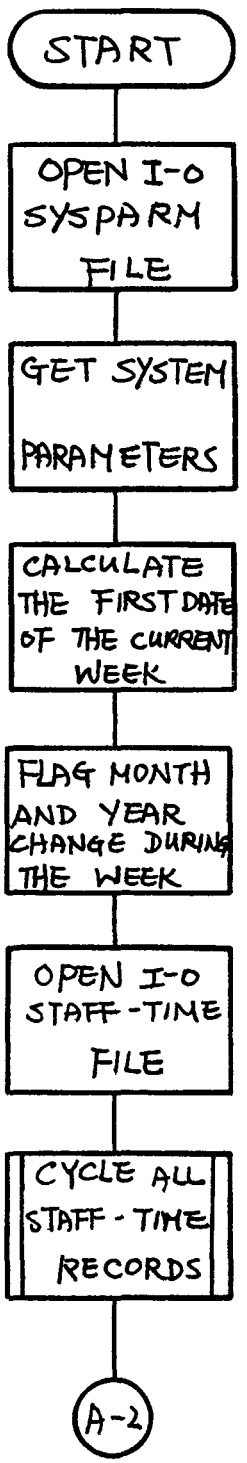
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : INIT
REMARK : OVERVIEW
PAGE : 1 OF 1



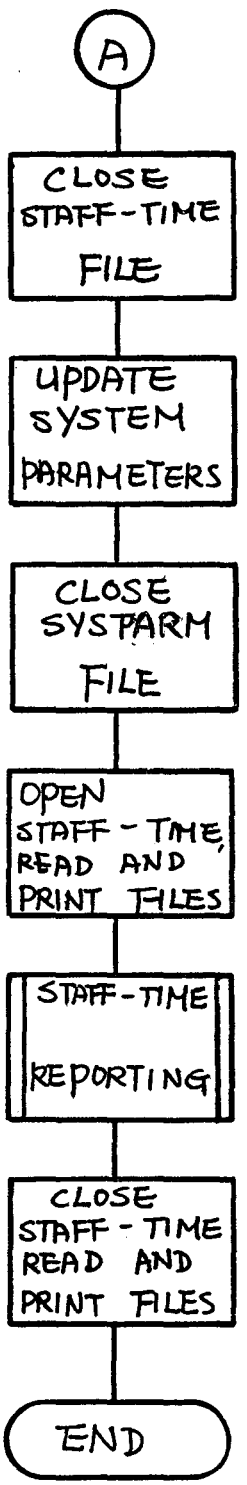
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : TIMERPT
REMARK : OVERVIEW
PAGE : 1 OF 1



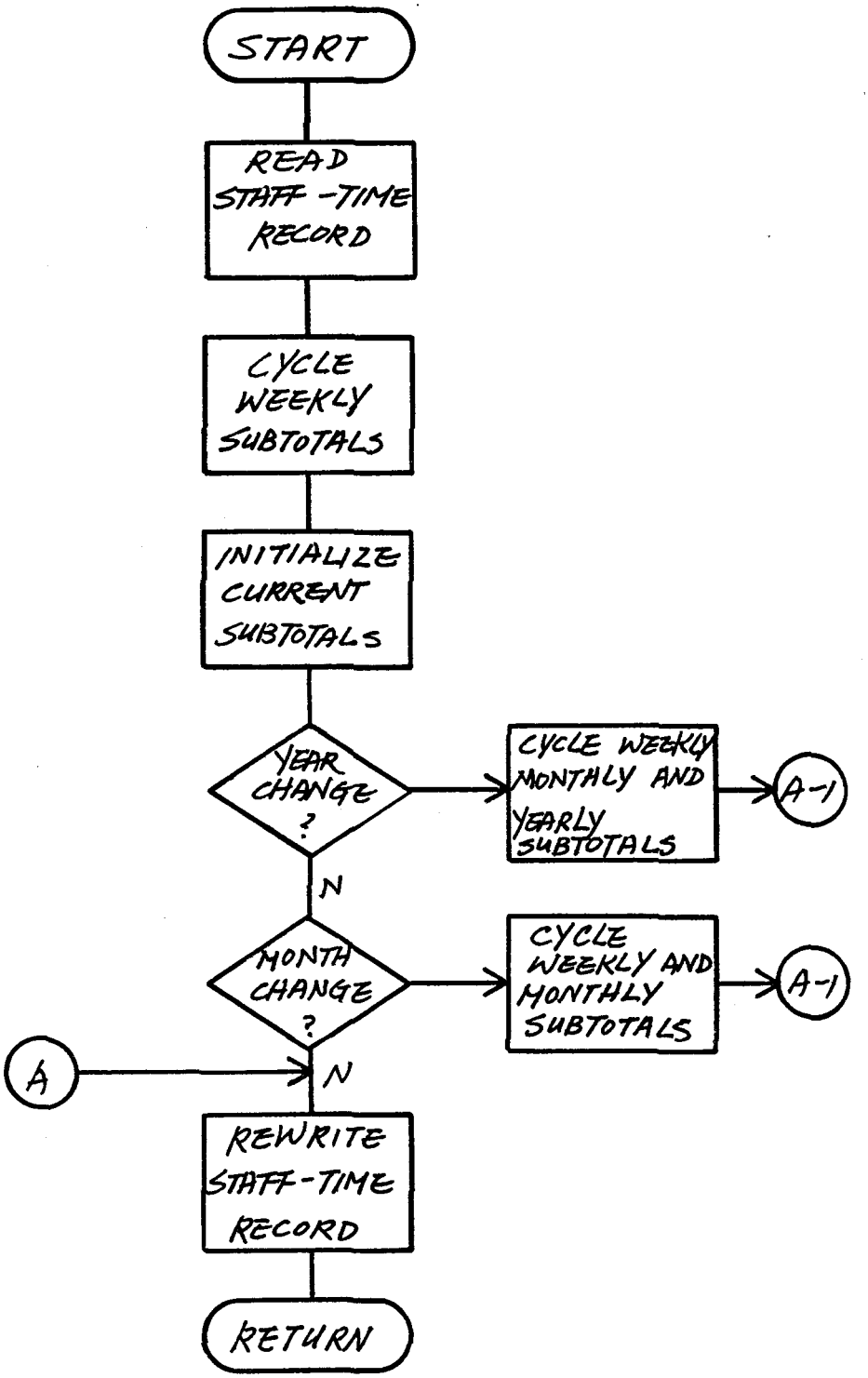
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : TIMERPT
REMARK : MAIN LINE
PAGE : 1 OF 2



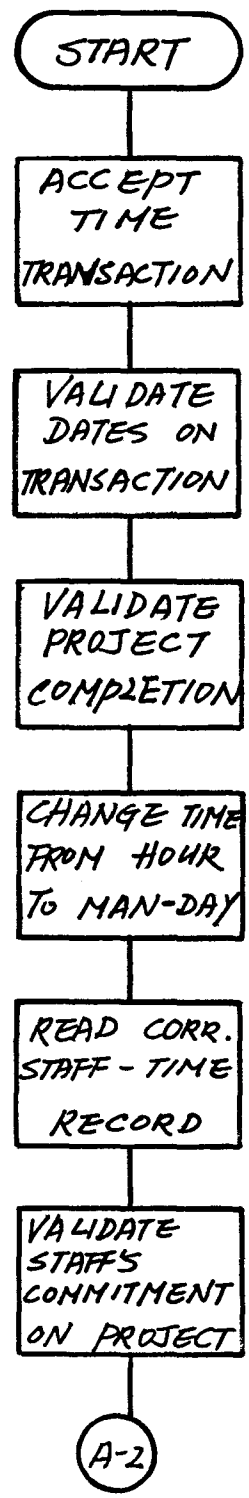
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : TIMERPT
REMARK : MAINLINE SECTION
PAGE : 2 OF 2



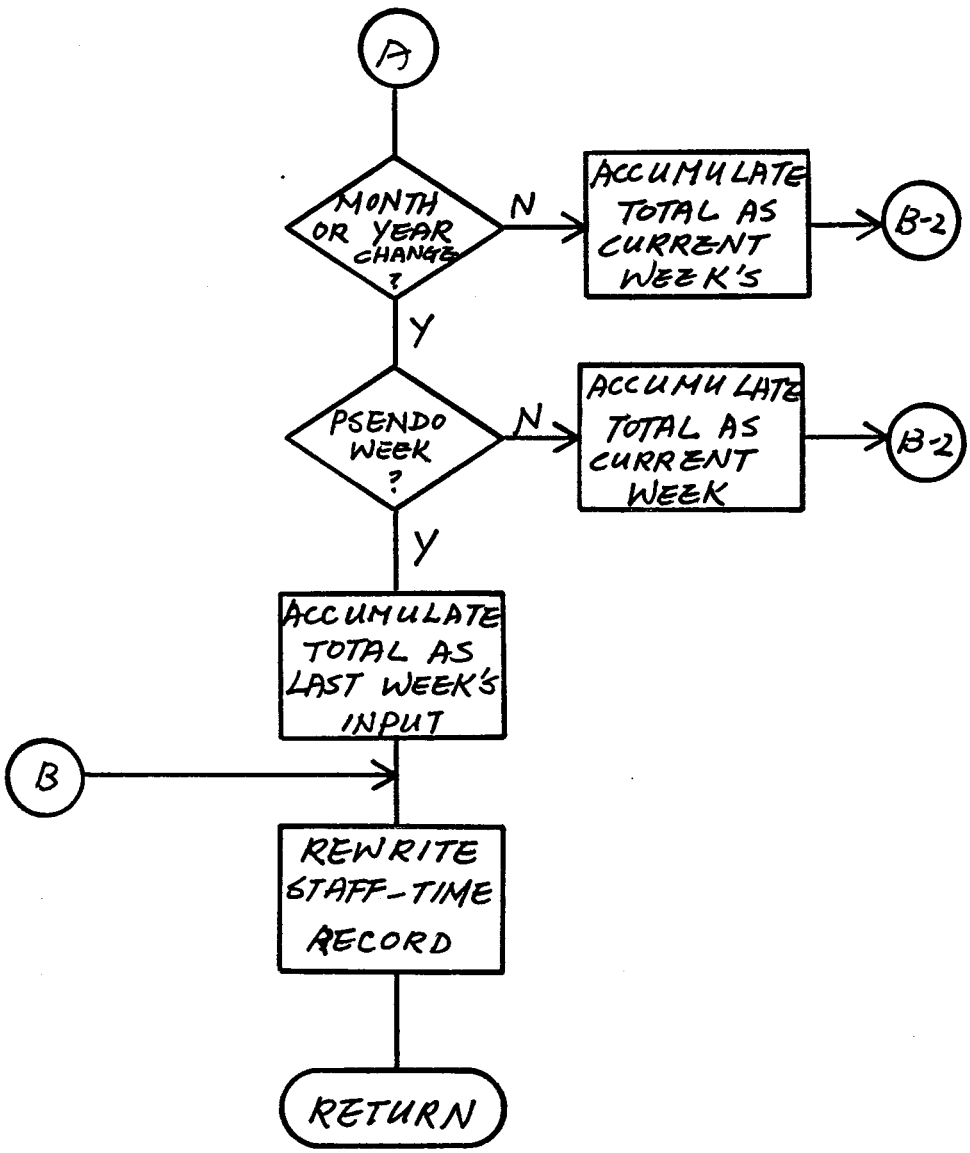
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: TIMERPT
REMARK: SECTION - "CYCLE ALL STAFF-TIME RECORDS"
PAGE: 1 OF 1



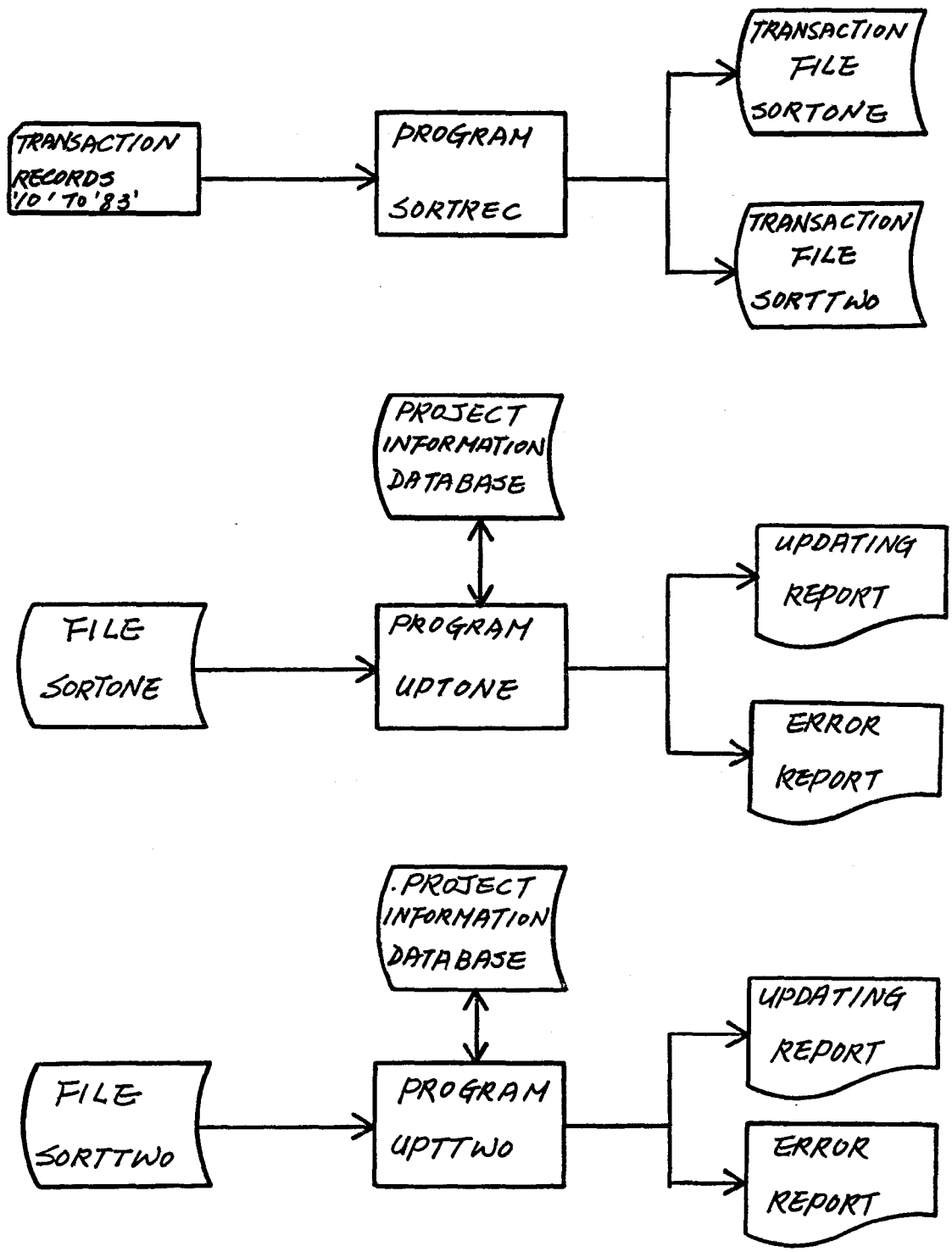
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : TIMERPT
REMARK : SECTION - "STAFF - TIME REPORTING"
PAGE : 1 OF 2



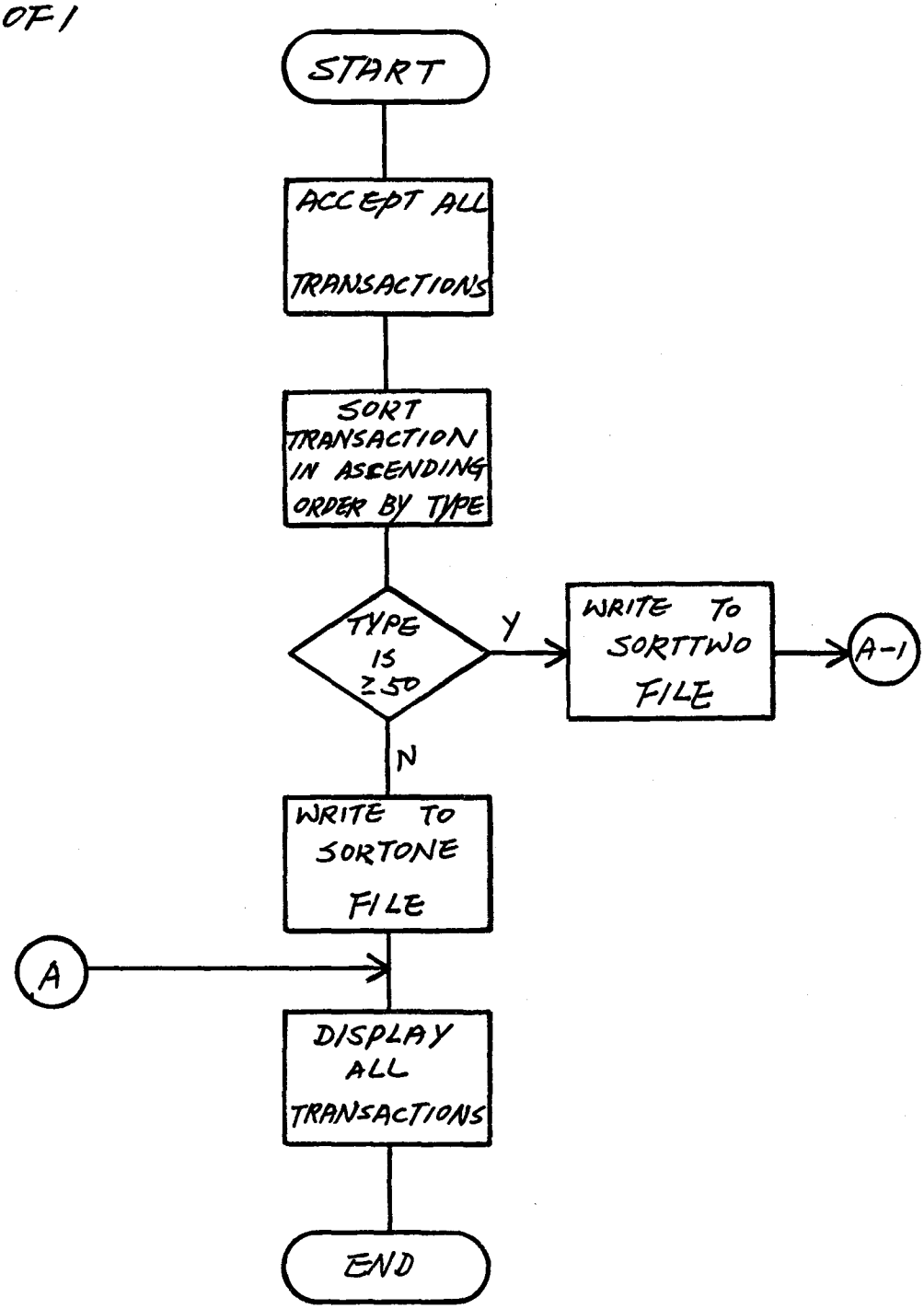
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM: TIMERPT
REMARK : SECTION - "STAFF-TIME REPORTING"
PAGE : 2 OF 2.



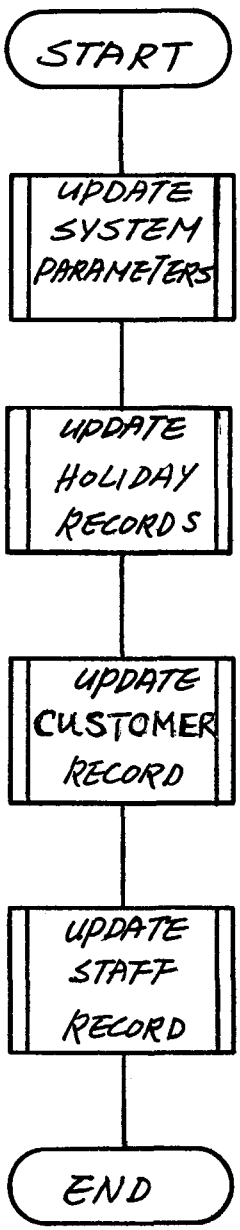
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : SORTREC , UPTONE AND UPTTWO
REMARKS : OVERVIEW
PAGE : 1 OF 1



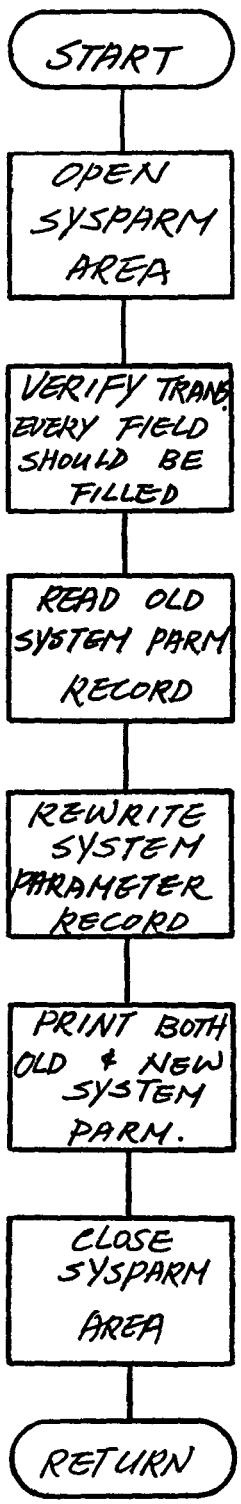
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : SORTREC
REMARK : MAINLINE SECTION
PAGE : 1 OF 1



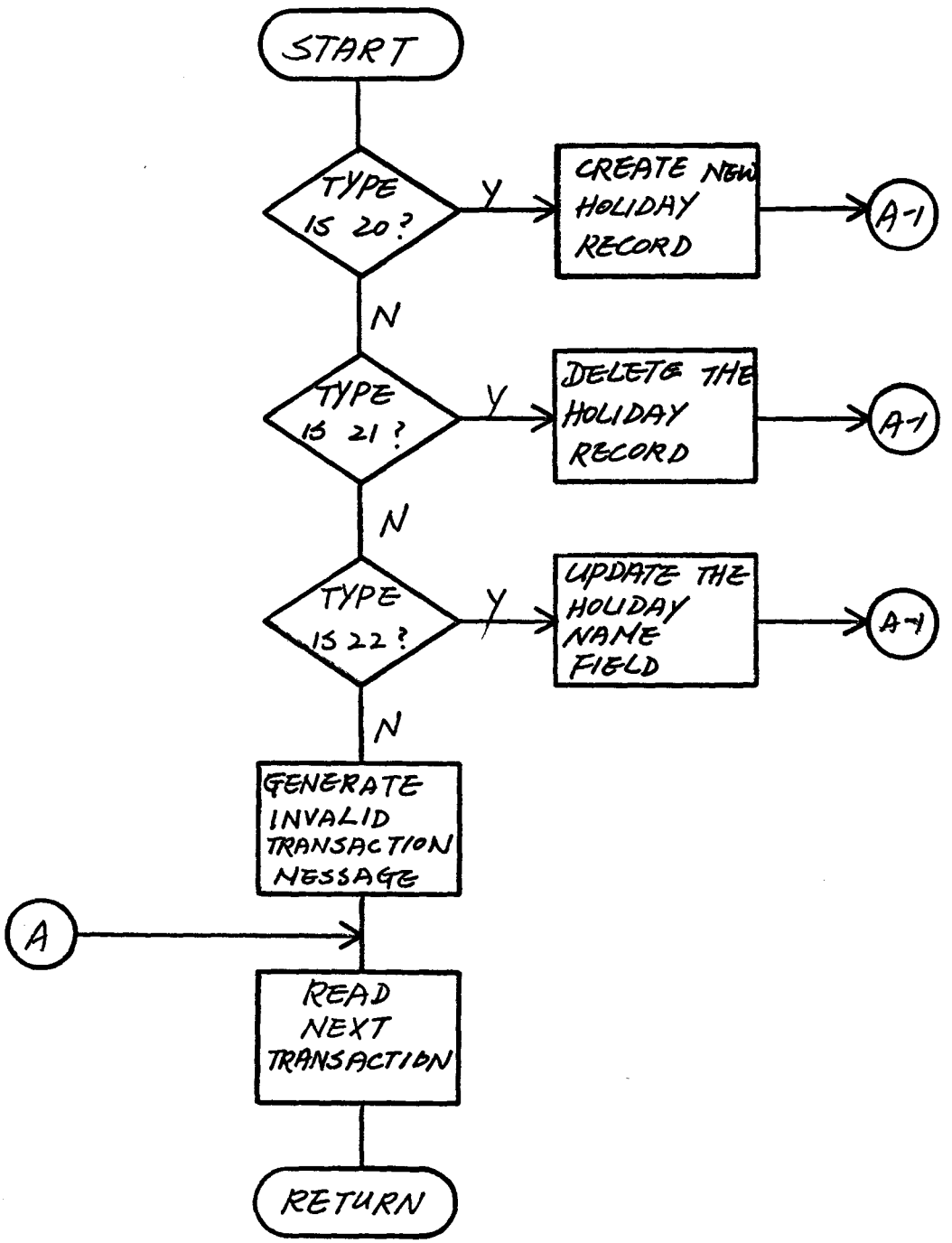
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : UPTONE
REMARK : MAINLINE SECTION
PAGE : 1 OF 1



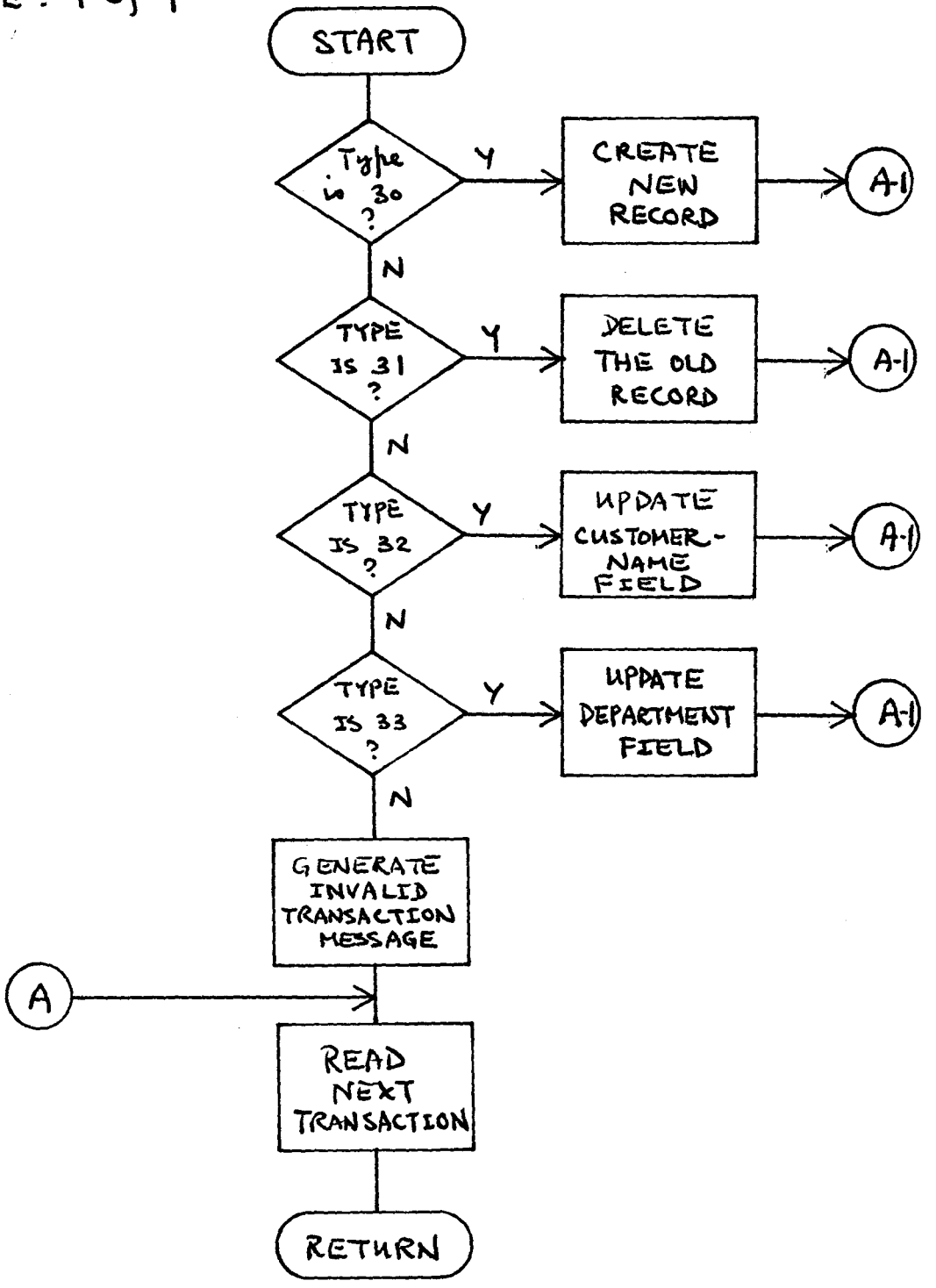
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : UPTREC
REMARK : SECTION - 'UPDATE - SYSPARM-REC'
PAGE : 1 OF 1



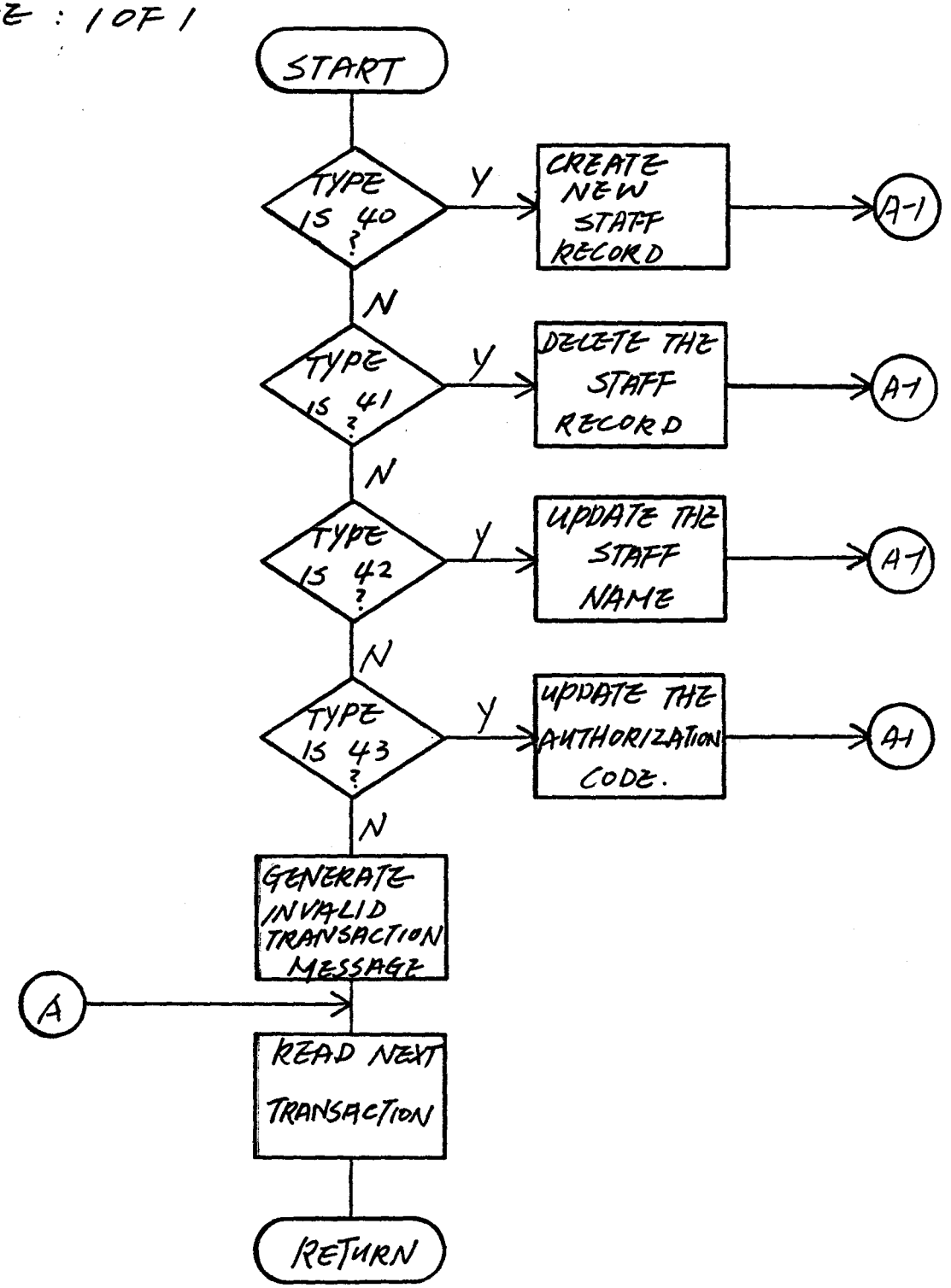
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : UPTONE
REMARK : UPDATE HOLIDAY RECORD SECTION
PAGE : 1 OF 1



SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM: UPTONE
REMARK : UPDATE CUSTOMER RECORD SECTION .
PAGE : 1 of 1

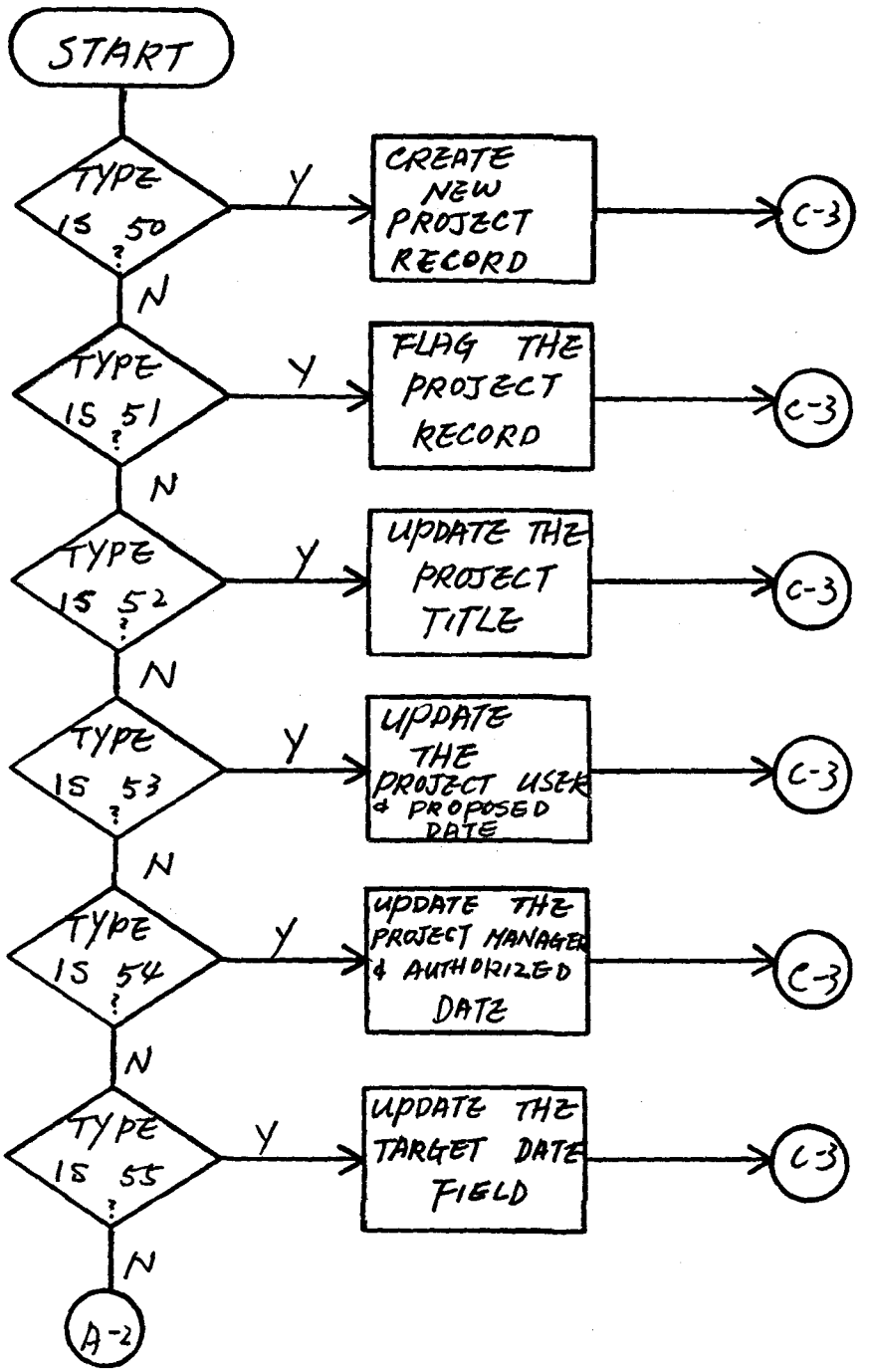


SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: UPTONE
REMARK: UPDATE STAFF RECORD SECTION
PAGE : 1 OF 1

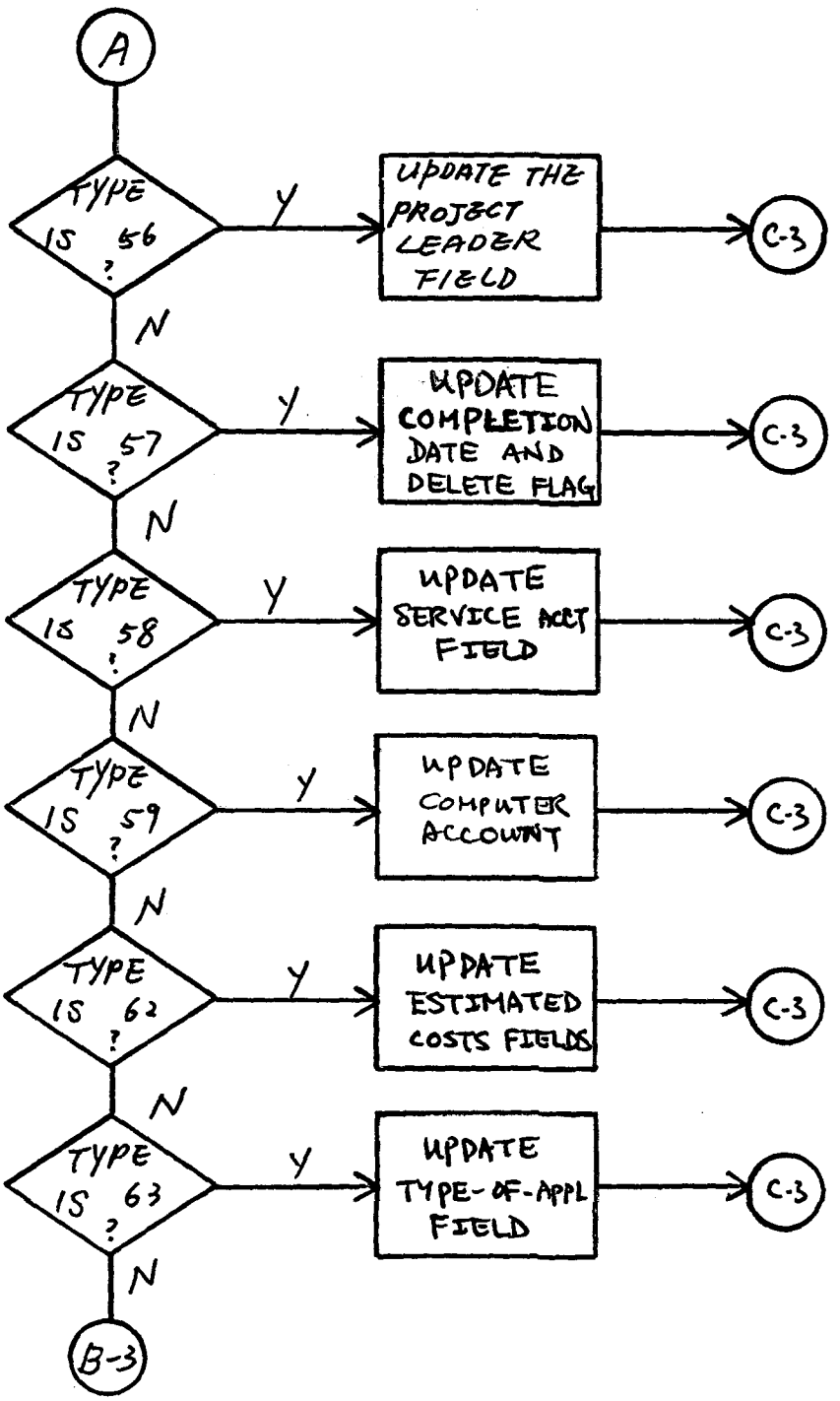


SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : UPTTWO
REMARK : MAINLINE SECTION
PAGE : 1 OF 1

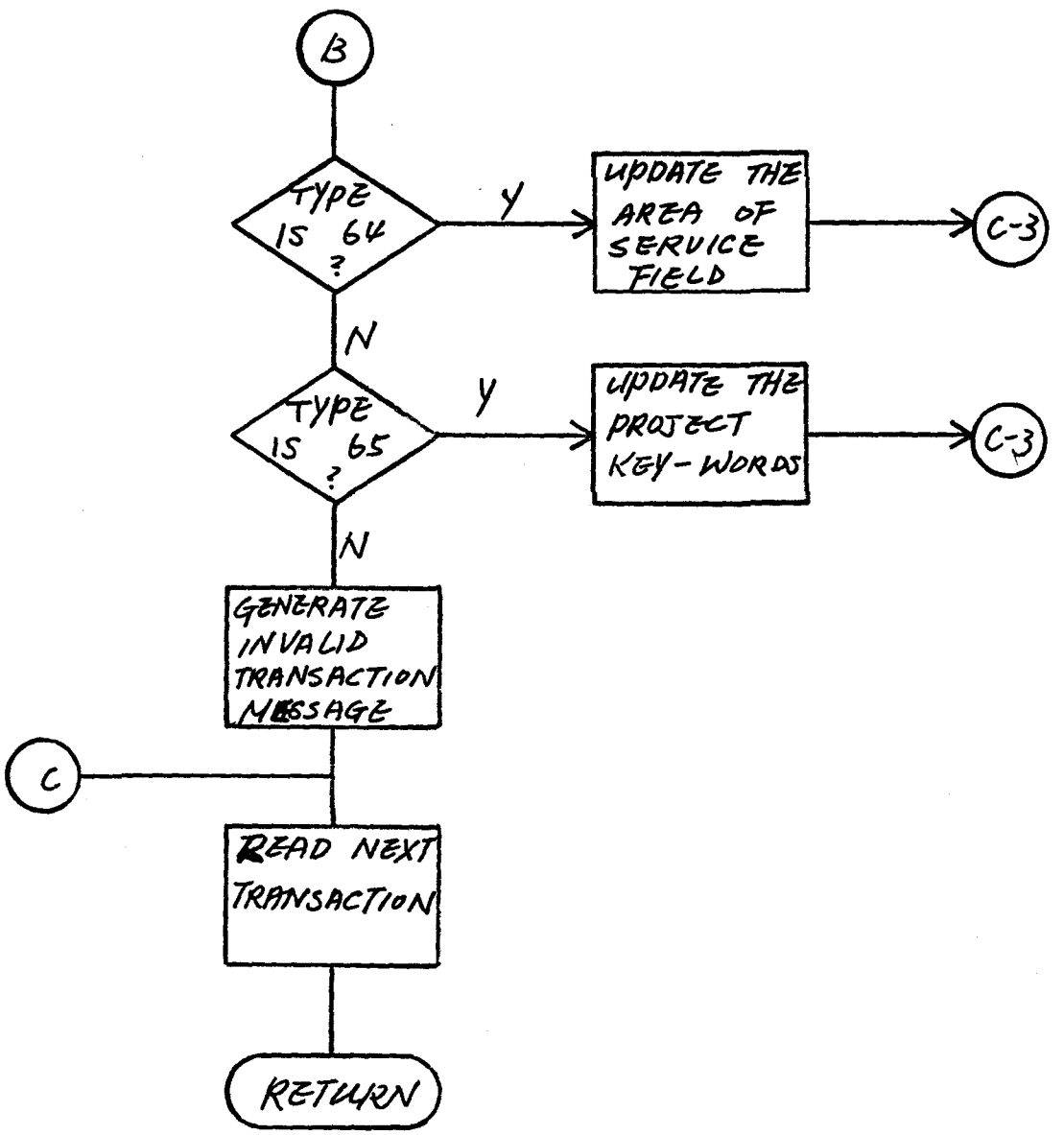
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM: UPTTWO
REMARK : UPDATE PROJECT RECORD SECTION
PAGE : 1 OF 3



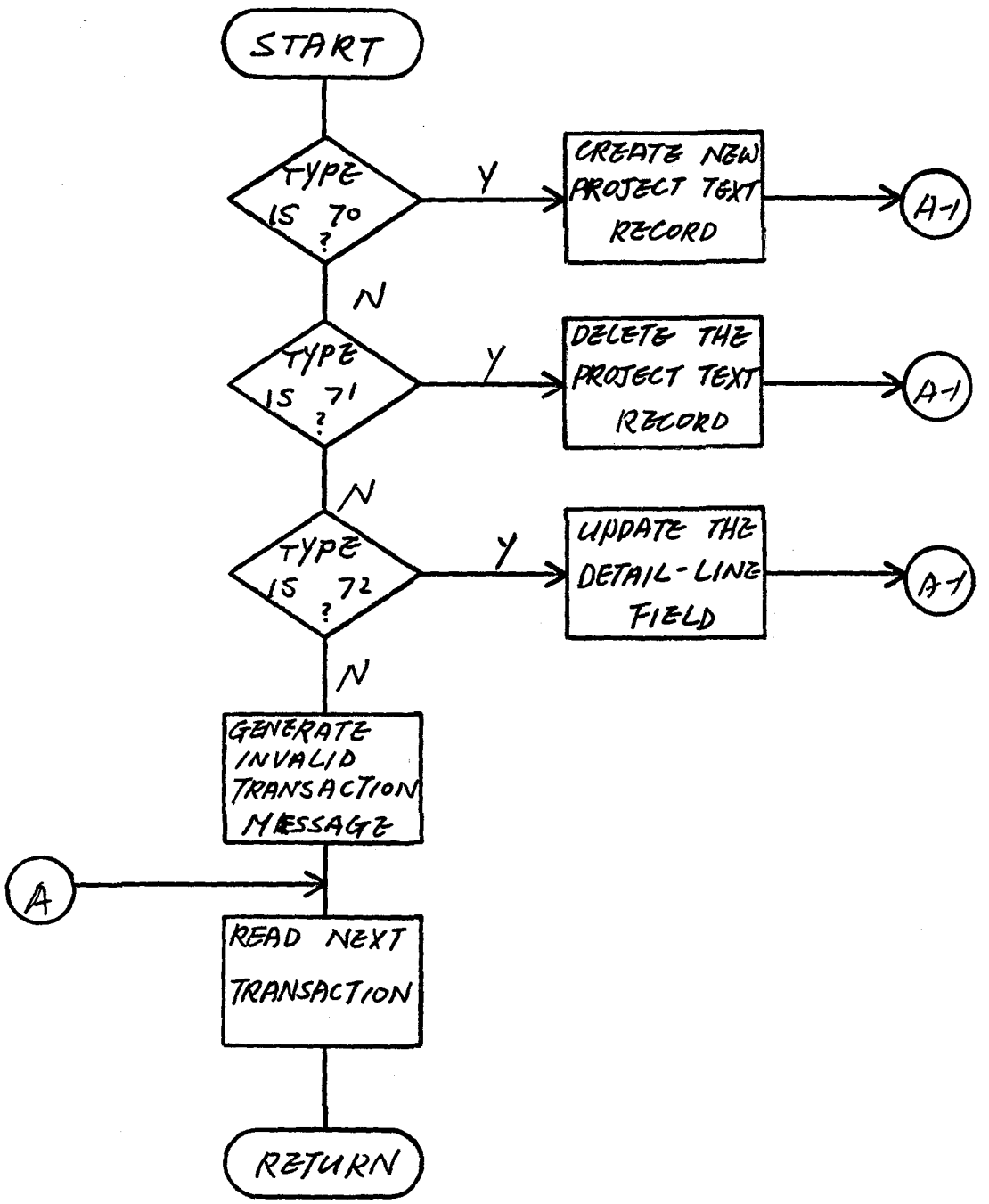
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM: UPTTWO
REMARK : UPDATE PROJECT RECORD SECTION
PAGE : 2 OF 3



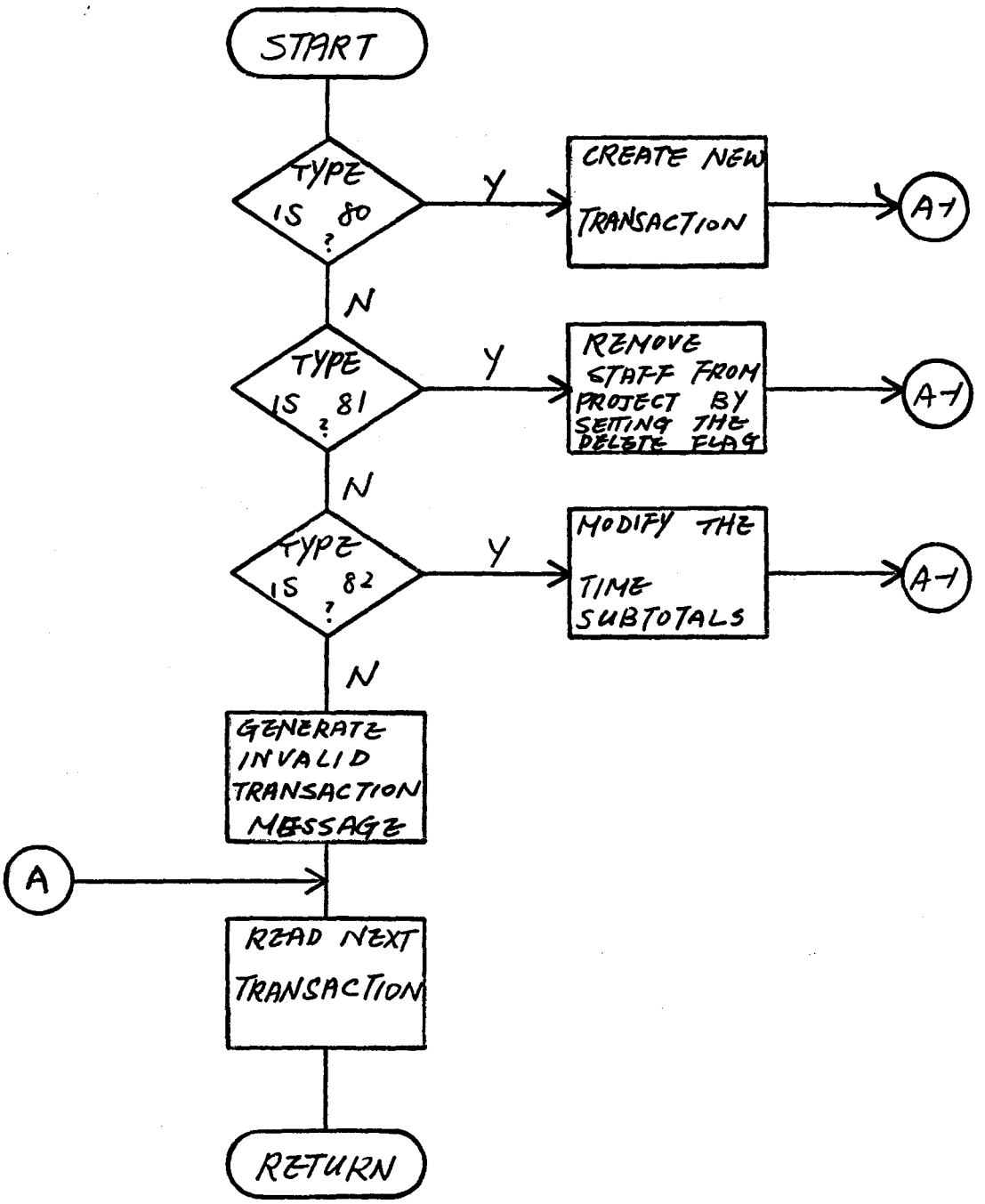
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : UPTTWO
REMARK : UPDATE PROJECT RECORD SECTION
PAGE : 3 OF 3.



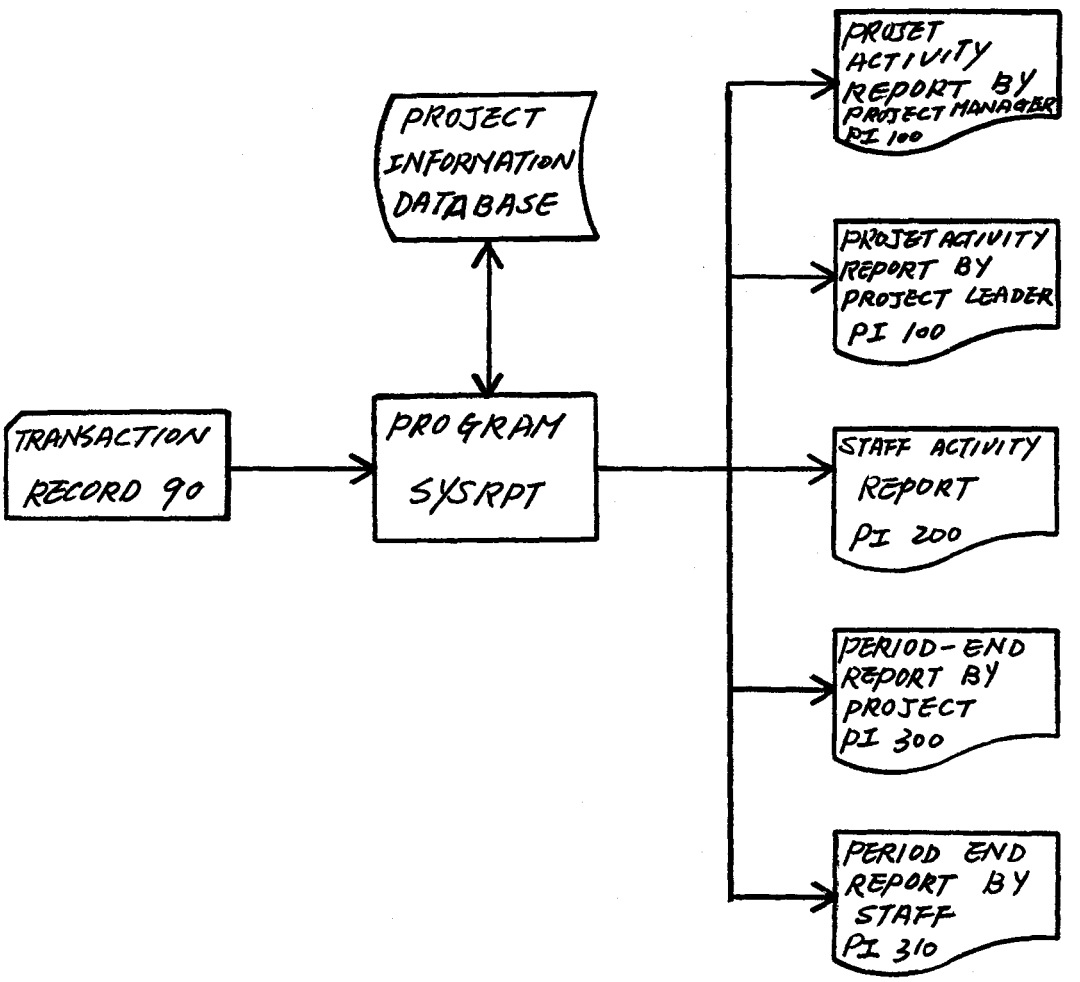
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : UPTTWO
REMARK : UPDATE PROJECT TEXT SECTION
PAGE : 1 OF 1



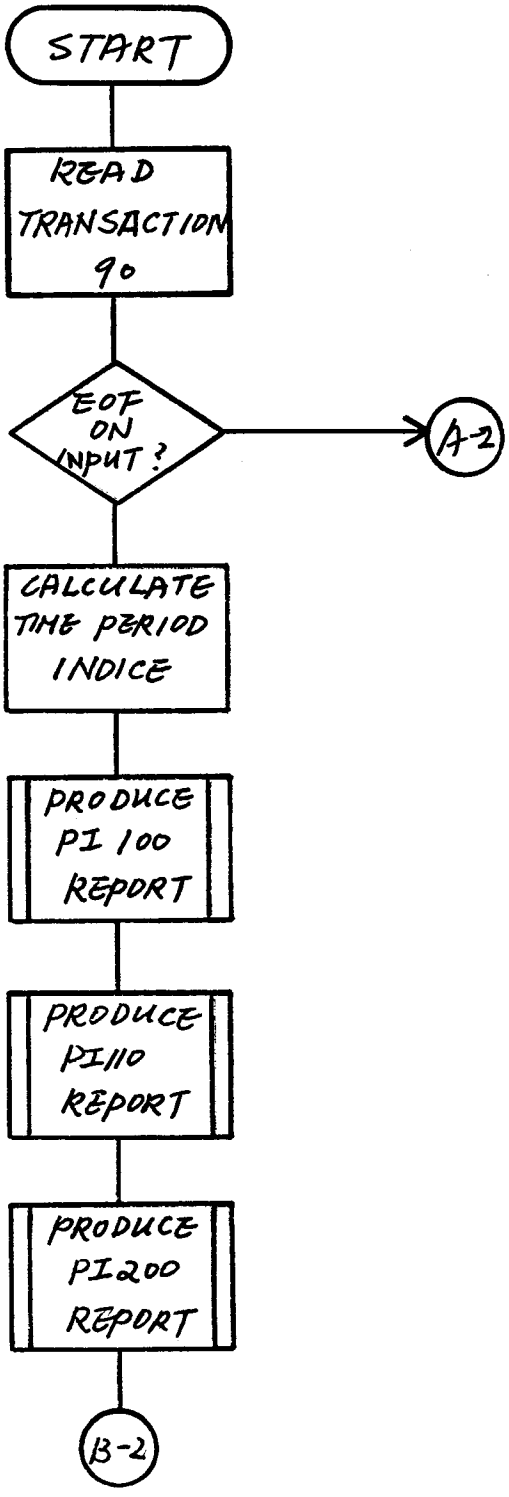
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : UPTTWO
REMARK : UPDATE STAFF-TIME SECTION
PAGE : 1 OF 1



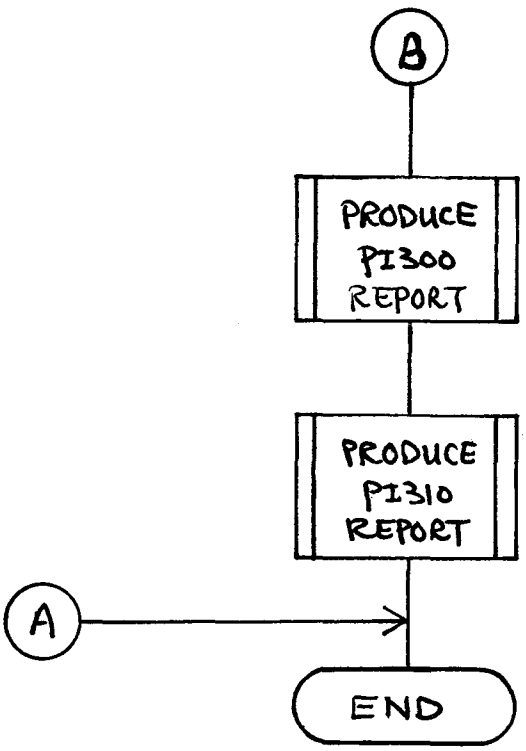
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : SYSRPT
REMARK : OVERVIEW
PAGE : 1 OF 1



SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : SYSRPT
REMARKS : MAINLINE SECTION
PAGE : 1 OF 2



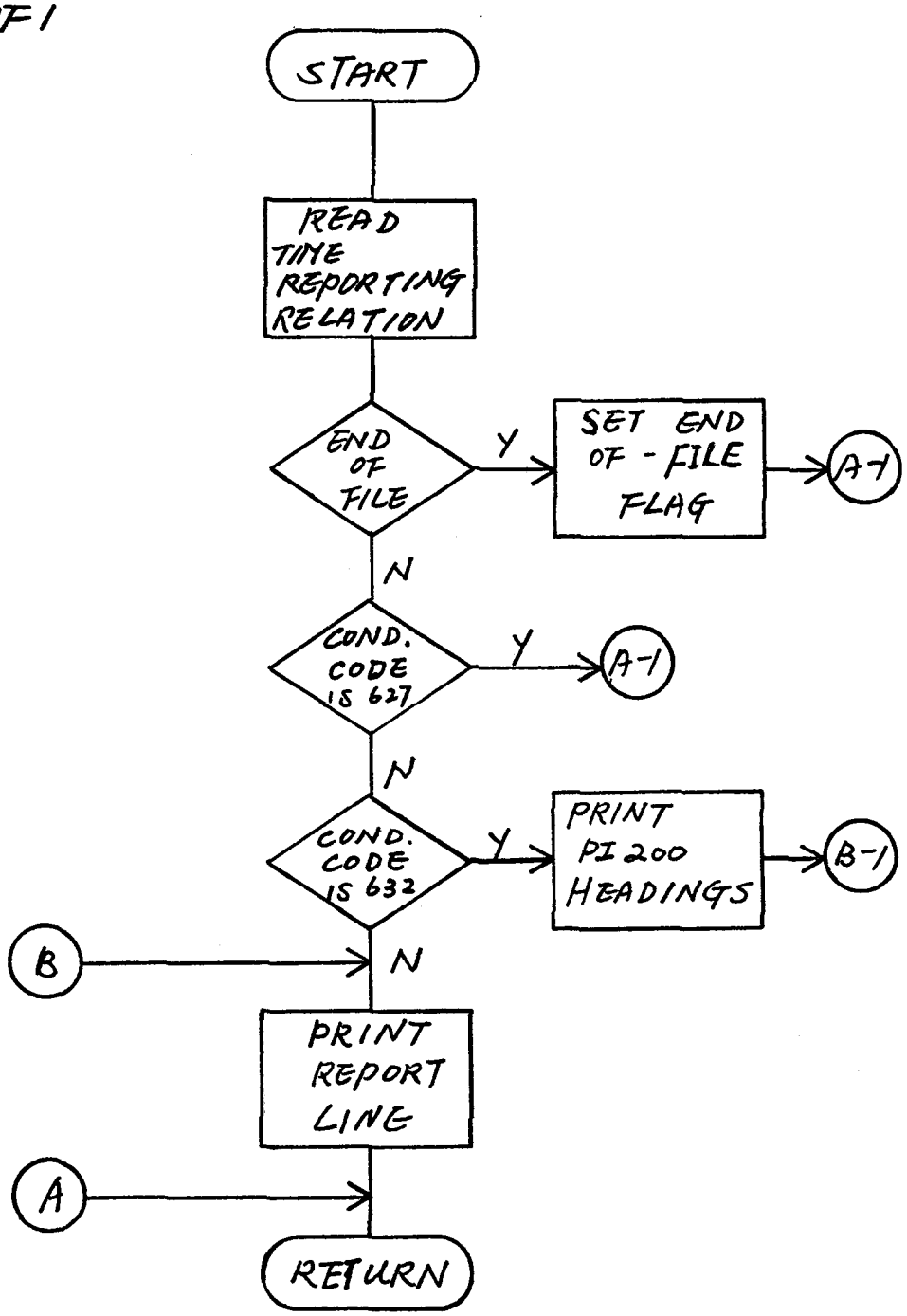
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: SYSRPT
REMARK: MAINLINE SECTION.
PAGE: 2 of 2



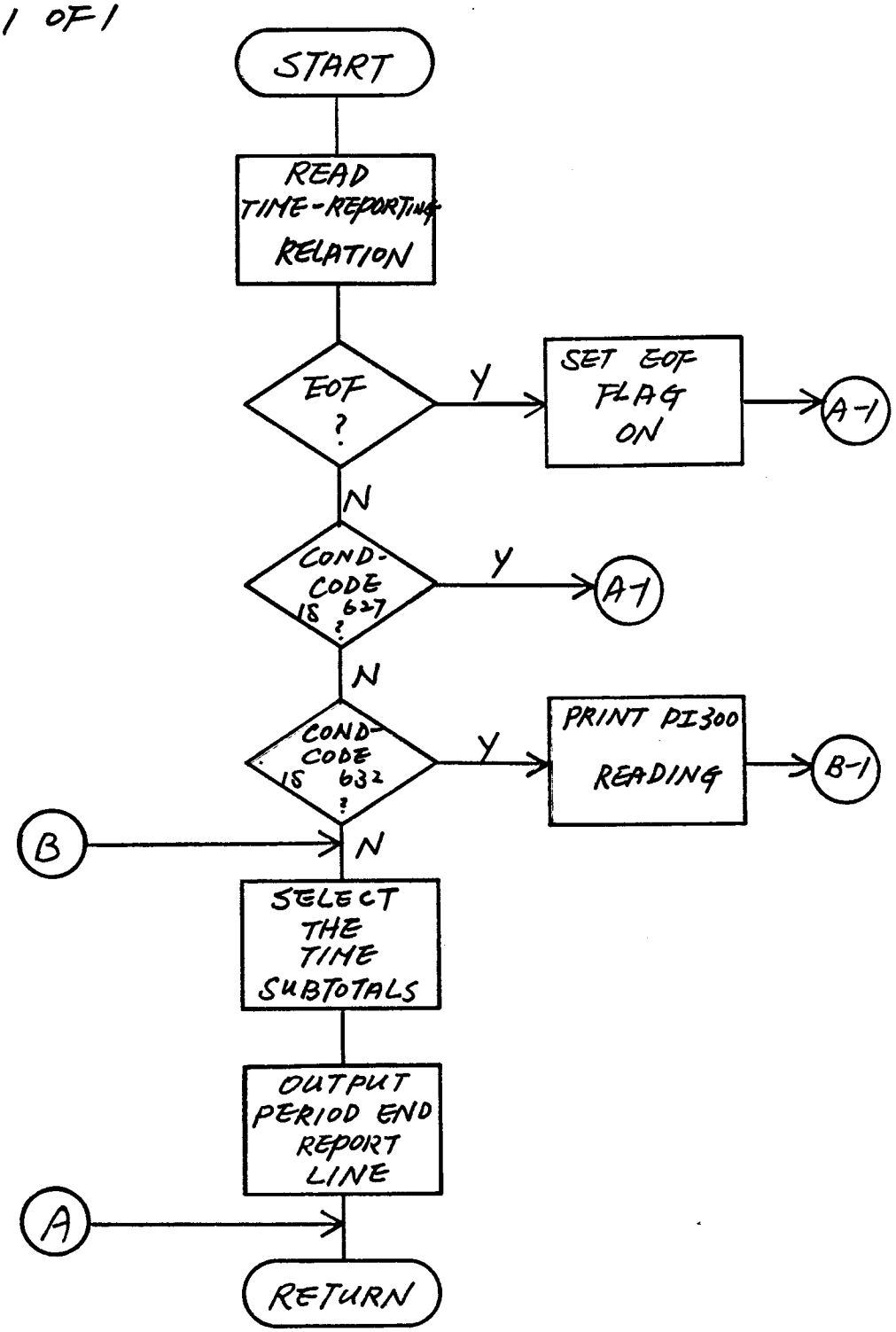
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : SYSRPT
REMARK : PRODUCE PI/00 REPORT SECTION
PAGE : 1 OF 1

SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : SYSRPT
REMARK : PRODUCE PI 110 REPORT SECTION
PAGE : 1 OF 1

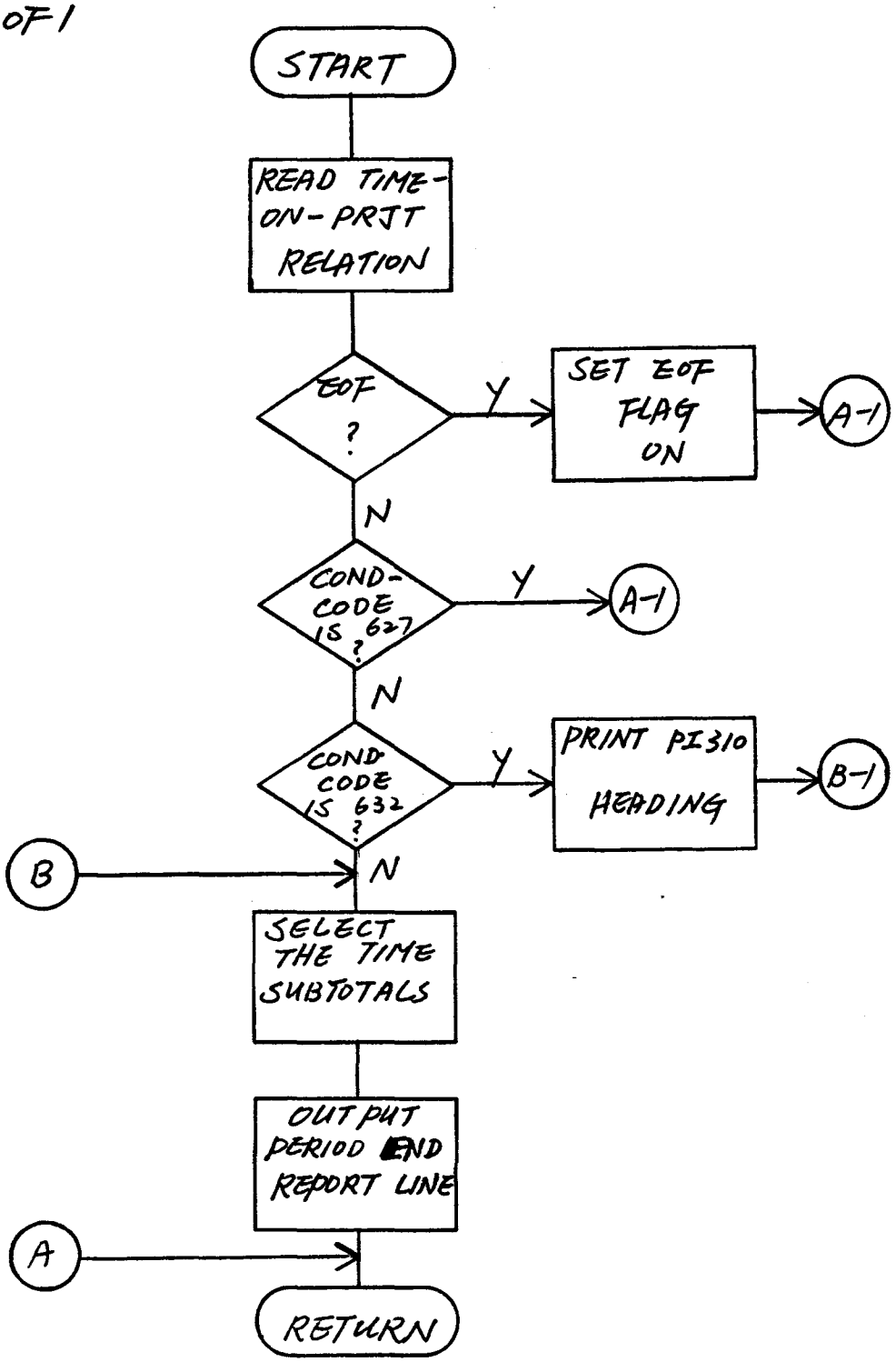
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: SYSRPT
REMARK: PRODUCE PI200 REPORT SECTION
PAGE: 1 OF 1



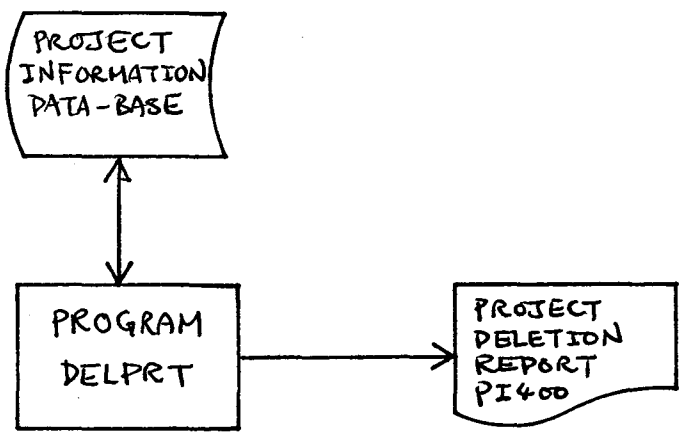
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : SYSRPT
REMARK : PRODUCE PI300 REPORT
PAGE : 1 OF 1



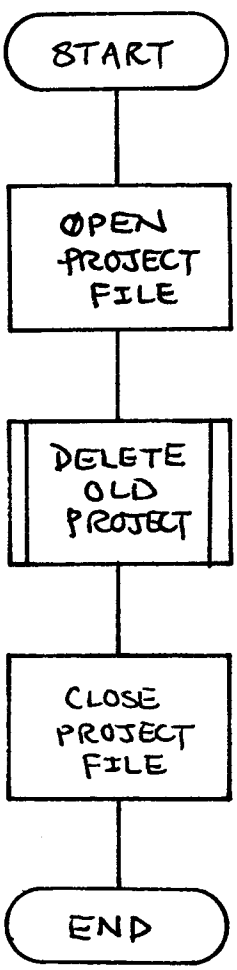
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : SYSRPT
REMARK : PRODUCE PI 310 REPORT
PAGE : 1OF1



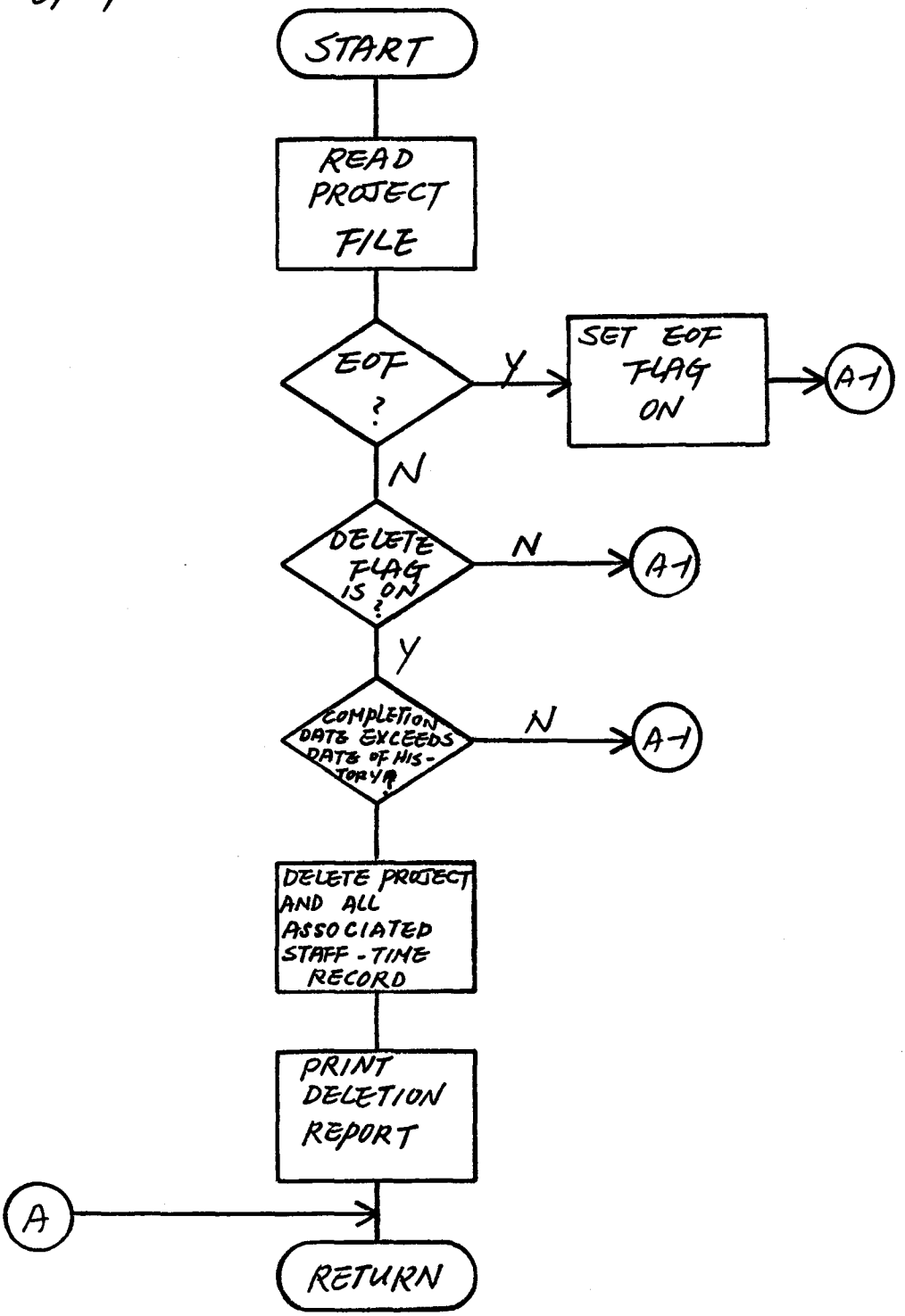
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM: DELPRJT
REMARK: OVERVIEW
PAGE : 1 of 1.



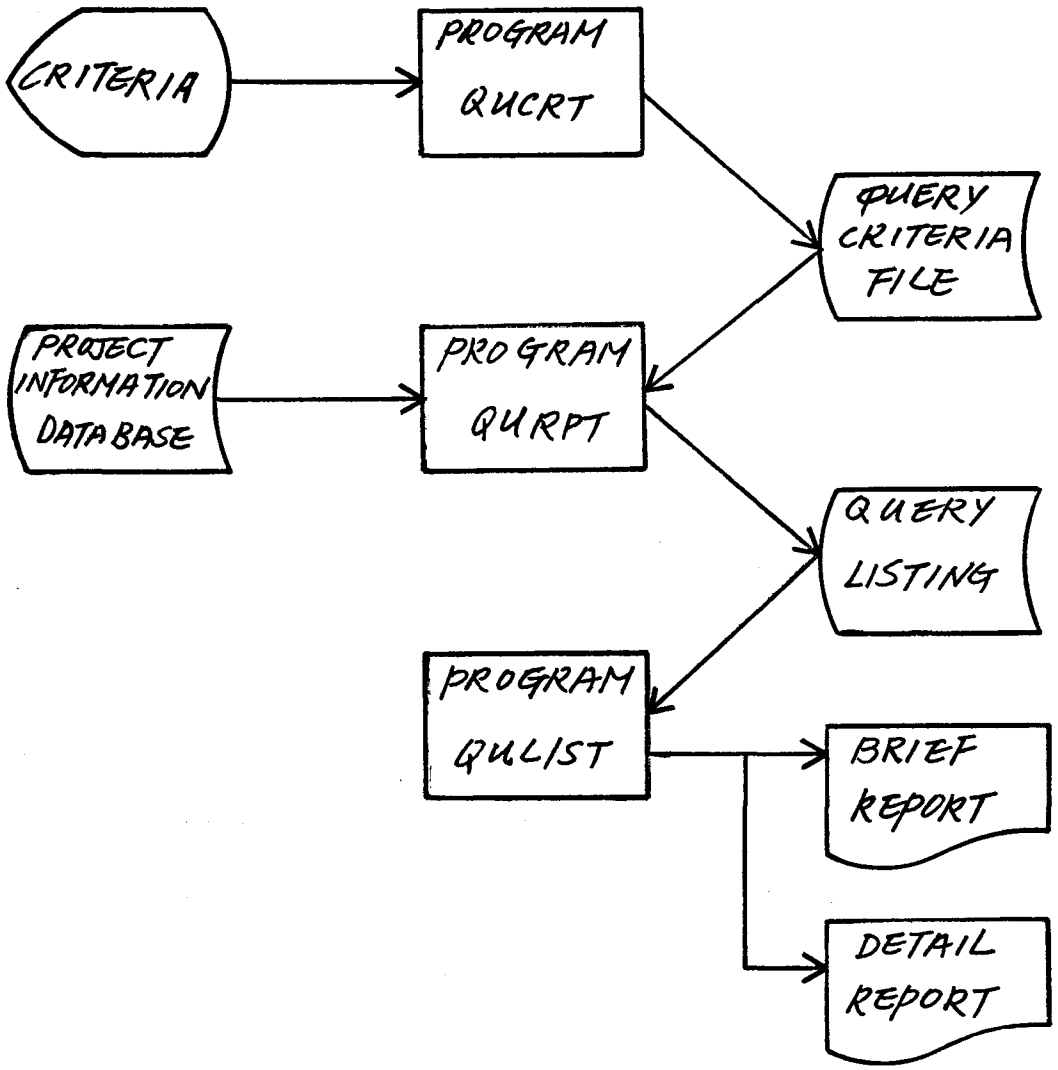
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : DELPRJT
REMARK : MAINLINE SECTION
PAGE : 1 OF 1



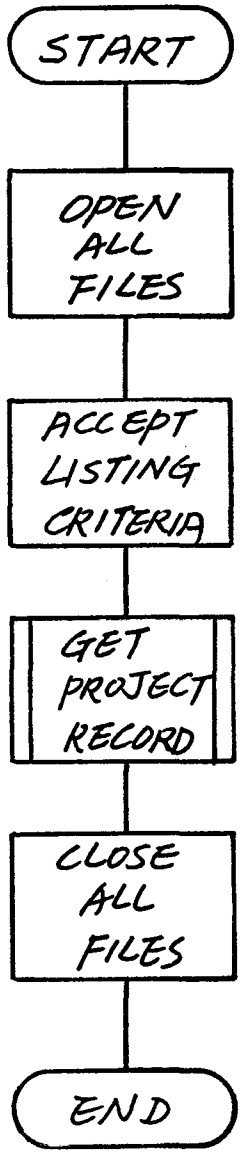
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : DELPRJT
REMARK : DELETE OLD PROJECTS SECTION
PAGE : 1 OF 1



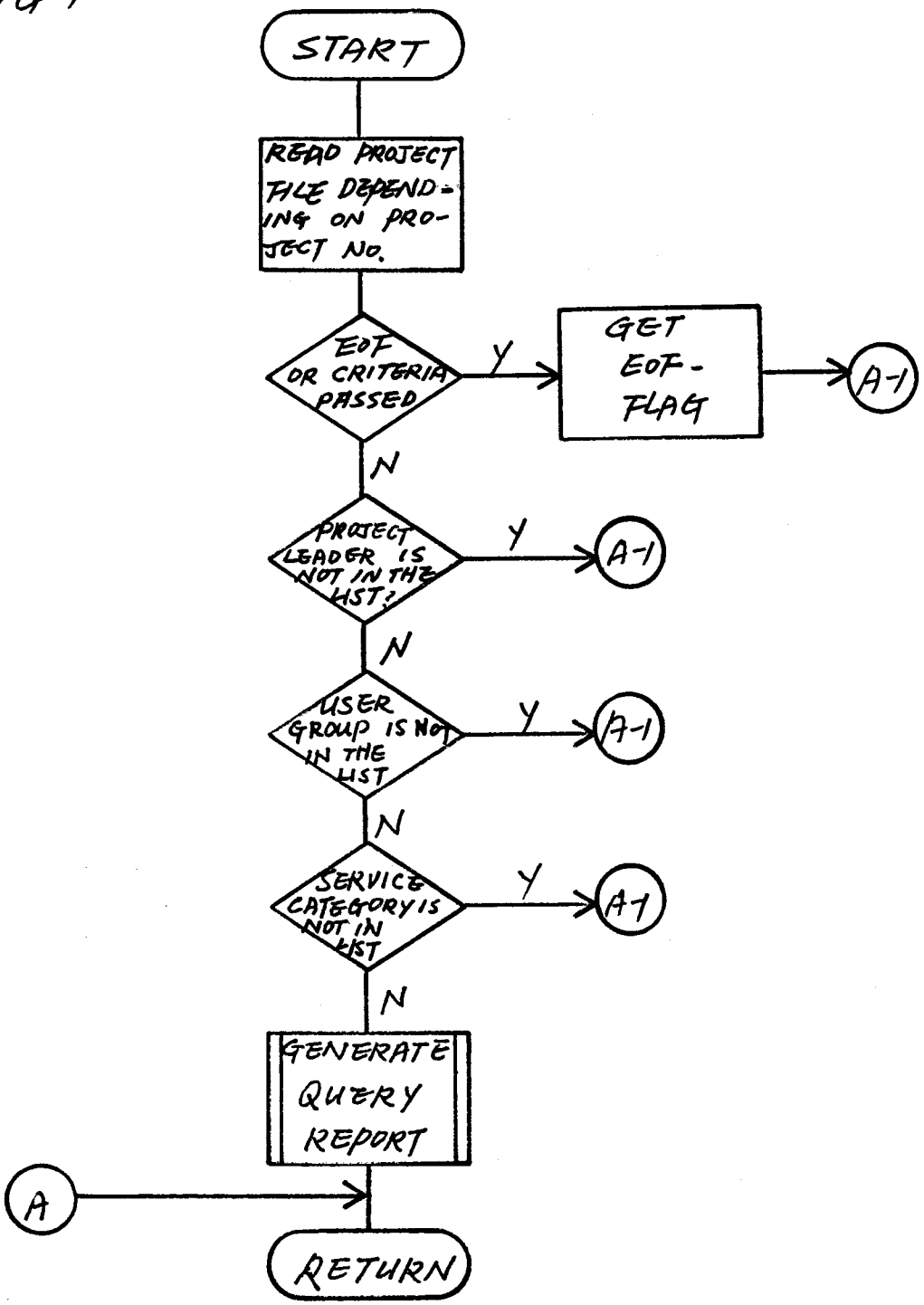
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : QUCRT , QURPT AND QULIST
REMARK : OVERVIEW.
PAGE : 1 of 1



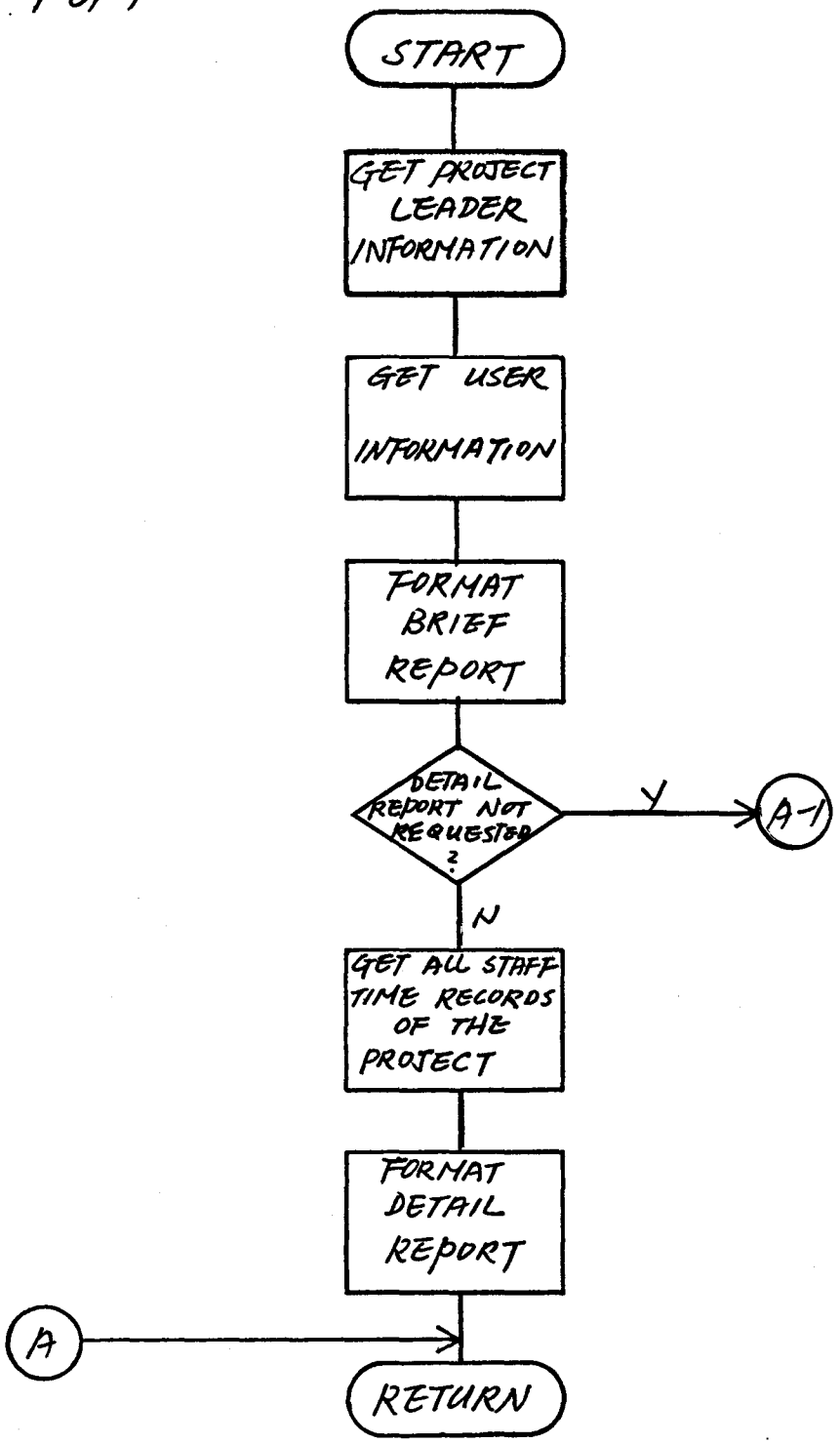
SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : QURPT
REMARK : MAINLINE SECTION
PAGE : 1 OF 1



SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : QURPT
REMARK : GET-PROJECT-RECORD SECTION
PAGE : 1 OF 1



SYSTEM : PROJECT INFORMATION SYSTEM
PROGRAM : QURPT
REMARK : GENERATE QUERY REPORT SECTION
PAGE : 1 OF 1



APPENDIX C

INPUT AND OUTPUT SAMPLES LISTING

PUNCHED CARD DATA FORM

DATA DESCRIPTION: SYSTEM PARAMETER & PERIOD END TRANSACTION

PREPARED BY

DATE

PAGE 1

TYPE	ACTION	HISTORY YEAR	HISTORY MON	HISTORY WK	COST/UNIT MANPOWER	COST/UNIT COMPUTER	MANDAY FACTOR	DAY	FIRST DATE YYYY	FIRST DATE MM	FIRST DATE DD
10	A	05	12	26	150000	050000	00700	0	1978	09	11

TYPE	RPT	START DATE YYYYMMDD	END DATE YYYYMMDD
90	W	19780101	19721231

0 = ZERO 1 = ONE 2 = TWO

ϕ = ALPHA O I = ALPHA I Z = ALPHA Z

80 COLUMN DATA SHEET

TITLE HOLIDAY TRANSACTIONS

DATE

BY

TYPE	ACTION	HOLIDAY DATE YYYY	MM	DD	NAME OF HOLIDAY
20	A	1978	01	01	NEW YEAR
20	A	1978	09	04	LABOUR DAY
20	A	1978	04	01	APRIL FOOL

TYPE	ACTION	HOLIDAY DATE YYYY	MM	DD
21	D	1978	04	01

TYPE	ACTION	HOLIDAY DATE YYYY	MM	DD	NAME OF HOLIDAY
22	C	1978	09	04	LABOR DAY

PUNCHED CARD DATA FORM

DATA DESCRIPTION: CUSTOMER TRANSACTION

PREPARED BY

DATE

PAGE 1

TYPE	ACTION	CUSTOMER CODE	CUSTOMER NAME	DEPARTMENT
30	A	00001	PROF. REDISH	APPL. MATHS.
30	A	00002	DR. KEECH	COMP. CENTER
30	A	00003	PROF. MASTERSON	COMP. CENTER

TYPE	ACTION	CUSTOMER CODE
31	D	00001

TYPE	ACTION	CUSTOMER CODE	CUSTOMER NAME
32	C	00002	DR KEECH

TYPE	ACTION	CUSTOMER CODE	DEPARTMENT
33	C	00002	COMPUTER CENTER
33	C	00002	COMPUTER CENTER

0 = ZERO 1 = ONE 2 = TWO

Ø = ALPHA O I = ALPHA I Z = ALPHA Z

80 COLUMN DATA SHEET

TITLE STAFF TRANSACTION

DATE

BY

TYPE	ACTION	STAFF-ID	STAFF NAME	CODE
40	A	00010	PAUL CHEUNG	A
40	A	00020	DORA CHEUNG	A
40	?	00030	DONALD CHEUNG	

TYPE	ACTION	STAFF-ID
41	D	00030

TYPE	ACTION	STAFF-ID	STAFF NAME
42	C	00010	PAUL N. K. CHEUNG

TYPE	ACTION	STAFF-ID	CODE
43	C	00020	

	PUNCHED CARD DATA FORM	DATA DESCRIPTION: PROJECT DEFINITION	PREPARED BY: DATE: PAGE 1 OF 3

TYPE	ACTION	PROJECT NUMBER
50	A	K1234

TYPE	ACTION	PROJECT NUMBER
51	D	

TYPE	ACTION	PROJECT NUMBER	LINE NUM	PROJECT TITLE
52	C	K1234	01	TRAFFIC FORECASTING SYSTEM
52	C	K1234	02	------------------------------

TYPE	ACTION	PROJECT NUMBER	PROPOSED BY	DATE PROPOSED YYYYMMDD
53	C	K1234	00002	19780807

TYPE	ACTION	PROJECT NUMBER	AUTHORIZED BY	DATE AUTHORIZED YYYYMMDD
54	C	K1234	00010	19780209

TYPE	ACTION	PROJECT NUMBER	TARGET DATE YYYYMMDD
55	C	K1234	19780915

0 = ZERO 1 = ONE 2 = TWO

ϕ = ALPHA O I = ALPHA I Ƶ = ALPHA Z

681 (REV. 12/74)

PUNCHED CARD DATA FORM

DATA DESCRIPTION: PROJECT DEFINITION

PREPARED BY:

DATE:

PAGE: 2

TYPE	ACTION	PROJECT NUMBER	PROJECT LEADER
56	C	K1234	00020

TYPE	ACTION	PROJECT NUMBER	COMPLETION DATE (YYYYMMDD)	FLAG
57	C	K1234	19780831	1

TYPE	ACTION	PROJECT NUMBER	SERVICE ACCOUNT
58	C	K1234	ACCT20

TYPE	ACTION	PROJECT NUMBER	COMPUTER ACCOUNT
59	C	K1234	JSGRAD

TYPE	ACTION	PROJECT NUMBER	ESTIMATED COSTS: MANDAYS	ESTIMATED COSTS: COMPUTER HOUR	ESTIMATED COSTS: OTHER
62	C	K1234	0000030000	0000007500	0000009000

TYPE	ACTION	PROJECT NUMBER	TYPE OF APPLICATION
63	C	K1234	TRAFFIC

011

0 = ZERO   1 = ONE   2 = TWO

Ø = ALPHA O   I = ALPHA I   Z = ALPHA Z

PUNCHED CARD DATA FORM

DATA DESCRIPTION: PROJECT DEFINITION

PREPARED BY

DATE

PAGE 3

TYPE	ACTION	PROJECT NUMBER	AREA OF SERVICE
64	C	1234	BUDGET

TYPE	ACTION	PROJECT NUMBER	NO.	PROJECT KEYWORD
65	C	1234	1	CRITICAL

0 = ZERO 1 = ONE 2 = TWO

ϕ = ALPHA O I = ALPHA I Z = ALPHA Z

	PUNCHED CARD DATA FORM	DATA DESCRIPTION: PROJECT TEXT TRANSACTION	PREPARED BY
			DATE
			PAGE 1 OF 1

PROJECT DEFINITION

	TYPE	ACTION	PROJECT NUMBER	CODE	LINE	PROJECT DESCRIPTION OR PROJECT NEWS
5	7	0	A M 1 2 3 4	D	0 1	THIS PROJECT CONTAINS TOP SECRET.
6	7	0	A M 1 2 3 4	D	0 2	NO PART SHOULD BE VIEWED WITHOUT WRITTEN PERMISSION.
7	7	0	A M 4 5 2 1	N	0 1	THERE IS A MEETING ON FRIDAY 2.00 P.M. ROOM 30M 6SB

	TYPE	ACTION	PROJECT NUMBER	CODE	LINE
18	7	1	D M 1 2 3 4	D	0 1
19	7	1	D M 1 2 3 4	D	0 2

	TYPE	ACTION	PROJECT NUMBER	CODE	LINE	PROJECT DESCRIPTION OR PROJECT NEWS
23	7	2	C M 4 5 2 1	N	0 1	THERE IS A MEETING ON FRIDAY 2.00 P.M. ROOM 30M 6SB

0 = ZERO 1 = ONE 2 = TWO

ϕ = ALPHA O I = ALPHA I Z = ALPHA Z

80 COLUMN DATA SHEET

TITLE STAFF-TIME TRANSACTION

DATE

BY

TYPE	ACTION	STAFF-ID	PROJECT-NO
80	A	00010	K1234
80	A	00020	K1234
80	A	00020	K4321

TYPE	ACTION	STAFF-ID	PROJECT-NO
81	D	00020	K4321

TYPE	ACTION	STAFF-ID	PROJECT-NO	BEGIN DATE			END DATE			TIME
				YYYY	MM	DD	YYYY	MM	DD	HHH
82	C									

80 COLUMN DATA SHEET

TITLE TIME REPORTING TRANSACTION

DATE

BY

TYPE	ACTION	STAFF-ID	PROJECT-NO	BEGIN DATE	END DATE	TIME
				YYYYMMDD	YYYYMMDD	HHHH
82	C	00010	K1234	19780911	19780918	0100
82	C	00020	K1234	19780911	19780918	0250

TIME PERIOD

FROM 1978-08-01

TO 0000-00-00

PROJECT INFORMATION SYSTEM - PROJECT ACTIVITY REPORT

BY PROJECT MANAGER

DATE 1978-09-06

REPORT-NO PI100

MANAGER - PAUL CHEUNG

MANAGER ID - 00010

PROJ-NO	P R O J E C T T I T L E	PERIOD-TOTL IN MAN-DAYS	MANPOWER INDEX	WORK LOAD INDEX
K1234	TRAFFIC FORECASTING SYSTEM	16.44	0.01	249.69
K4321	DATA ADMINISTRATION SYSTEM FOR IBM 370 COMPUTER USERS	14.04	0.01	5.53

TIME PERIOD
FROM 1978-08-01 PROJECT INFORMATION SYSTEM - PROJECT ACTIVITY REPORT DATE 1978-09-06
TO 0000-00-00 BY PROJECT LEADER REPORT-NO PI110

LEADER - L.M. LONG
PROJECT NO - P4444
TITLE - SIM 360 A S/360 SIMULATOR

STAFF-ID	S T A F F N A M E	PERIOD-TOTL IN MAN-DAYS	CURRENT WEEK TOTL	ACCM TOTALS
00050	P. Y. WONG	20.40	1.00	1.00
00060	L.M. LONG	7.85	0.00	0.00
	TOTAL IN MAN-DAYS	144.59	6.49	13.63
	ESTIMATED MANPOWER INDEX	0.27		
	ESTIMATED WORK LOAD INDEX	-15.39		

TIME PERIOD

FROM 1978-08-01 PROJECT INFORMATION SYSTEM - STAFF ACTIVITY REPORT

TO 0000-00-00

PAGE 4

DATE 1978-09-06

REPORT-NO PI200

STAFF NAME - P. Y. WONG

STAFF ID - 00050

PROJ-NO	P R O J E C T T I T L E	PERIOD-TOTL IN MAN-DAYS	CURRENT WEEK TOTL	ACCM TOTALS
P4444	SIM 360 A S/360 SIMULATOR	20.40	1.00	1.00
P6666	COMPUTER GRAPHIC SOFTWARE	7.14	0.00	0.00

TIME PERIOD
FROM 1978-08-01
TO 0000-00-00

PROJECT INFORMATION SYSTEM - PERIOD END REPORT
BY PROJECT

PROJECT NO - P3333
TITLE - DATA ANALYSIS SYSTEM

WEEKLY SUBTOTALS

STAFF NAME	- 1 -	- 2 -	- 3 -	- 4 -	- 5 -	- 6 -	- 7 -	- 8 -	- 9 -	- 10 -	TOTAL
PAUL CHEUNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.85	7.85
DORA CHEUNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.28	9.28
DONALD CHEUNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.14	0.00	10.71	17.85
TOTAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.14	0.00	27.84	34.98

TIME PERIOD

FROM 1978-09-01 PROJECT INFORMATION SYSTEM - PERIOD END REPORT PAGE 4

TO 0000-00-00 BY STAFF DATE 1978-09-06

REPORT-NO PI310

STAFF NAME - P. Y. WONG

STAFF ID - 00050

WEEKLY SUBTOTALS

PROJECT	- 1 -	- 2 -	- 3 -	- 4 -	- 5 -	- 6 -	- 7 -	- 8 -	- 9 -	- 10 -	TOTALS
P4444	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.14	0.00	12.14	19.28
P6666	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.14	0.00	0.00	7.14
TOTAL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.28	0.00	12.14	26.42

PROJECT INFORMATION SYSTEM - UPDATING INFORMATION REPORT

TYPE	RECORD	RECORD KEY	FIELD UPDATED	** PREVIOUS VALUE ***	***** CURRENT VALUE ***
53 C	PROJECT	P3333	PRJT-USER		00003
			DATE PROPOSED	0000-00-00	1978-07-30
53 C	PROJECT	P4444	PRJT-USER		00003
			DATE PROPOSED	0000-00-00	1978-06-30
53 C	PROJECT	P6666	PRJT-USER		00004
			DATE PROPOSED	0000-00-00	1978-05-20
54 C	PROJECT	K4321	PRJT MANAGER		00010
			DATE AUTHORIZE	0000-00-00	1978-08-09
54 C	PROJECT	K1234	PRJT MANAGER		00010
			DATE AUTHORIZE	0000-00-00	1978-08-09
54 C	PROJECT	P3333	PRJT MANAGER		00040
			DATE AUTHORIZE	0000-00-00	1978-07-31
54 C	PROJECT	P4444	PRJT MANAGER		00070
			DATE AUTHORIZE	0000-00-00	1978-06-30
54 C	PROJECT	P6666	PRJT MANAGER		00070
			DATE AUTHORIZE	0000-00-00	1978-05-27
55 C	PROJECT	K1234	TARGET DATE	0000-00-00	1978-09-15
55 C	PROJECT	K4321	TARGET DATE	0000-00-00	1978-09-01
55 C	PROJECT	P3333	TARGET DATE	0000-00-00	1978-10-01
55 C	PROJECT	P6666	TARGET DATE	0000-00-00	1978-10-10
55 C	PROJECT	P4444	TARGET DATE	0000-00-00	1978-11-11
56 C	PROJECT	K1234	PRJT LEADER		00020
56 C	PROJECT	K4321	PRJT LEADER		00030
56 C	PROJECT	P3333	PRJT LEADER		00050
56 C	PROJECT	P4444	PRJT LEADER		00060

PAGE 1

PROJECT INFORMATION SYSTEM - UPDATING ERROR REPORT

DATE 1978-08-23

REPORT-NO PI900

TRANSACTION RECORD	ERROR MESSAGE
1234567890123456789012345678901234567890123456789012345678901234567890	

NUMBER OF ERROR ENCOUNTERED 0

APPENDIX D

A LISTING OF THE PROGRAMS

The Schema and Subschemas runs have been enclosed. A complete listing of the programs can be obtained through the Department of Applied Mathematics.

```
00001                SCHEMA NAME IS PRJTINF-DB.
00002
00003                AREA NAME IS SYSPARM.
00004                AREA NAME IS HOLIDAY.
00005                AREA NAME IS STAFF.
00006                AREA NAME IS CUSTOMR.
00007                AREA NAME IS PROJECT.
00008                AREA NAME IS PTEXT.
00009                AREA NAME IS STIME.
00010
00011
00012          /*
00013                *****************************************************************
00014                *                                                               *
00015                *     FILE NAME   SYSPARM                                       *
00016                *     FILE ORGANIZATION  INDEXED SEQUENTIAL                     *
00017                *     RECORD FORMAT  FIXED                                      *
00018                *     RECORD SIZE  30 CHARACTERS                                *
00019                *                                                               *
00020                *****************************************************************
00021          */
00022                RECORD NAME IS SYSPARM-REC WITHIN SYSPARM.
00023
00024                 01  NUM-YEAR                    PIC ≠9(02)≠
00025                                                 CHECK VALUE  0 THRU 10.
00026                 01  NUM-MONTH                   PIC ≠9(02)≠
00027                                                 CHECK VALUE  0 THRU 24.
00028                 01  NUM-WEEK                    PIC ≠9(02)≠
00029                                                 CHECK VALUE  0 THRU 52.
00030                 01  MANPOWER-PER-MANDAY         PIC ≠9(03)V99≠.
00031                 01  COMPUTER-PER-HOUR           PIC ≠9(03)V99≠.
00032                 01  MANDAY-FACTOR               PIC ≠9(03)V99≠
00033                                                 CHECK VALUE 1.00 THRU 24.00.
00034                 01  FIRST-DAY-OF-WEEK           PIC ≠9(01)≠
00035                                                 CHECK VALUE  0 THRU 6.
00036                 01  FIRST-YYYY                  PIC ≠9(04)≠
00037                                                 CHECK VALUE 0000 THRU 2050.
00038                 01  FIRST-MM                    PIC ≠9(02)≠
00039                                                 CHECK VALUE 0 THRU 12.
00040                 01  FIRST-DD                    PIC ≠9(02)≠
00041                                                 CHECK VALUE 0 THRU 31.
00042
00043
00044          /*
00045                *****************************************************************
00046                *                                                               *
00047                *     FILE NAME   HOLIDAY                                       *
00048                *     FILE ORGANIZATION  INDEXED SEQUENTIAL                     *
00049                *     RECORD FORMAT  FIXED                                      *
00050                *     RECORD SIZE  23 CHARACTERS                                *
00051                *                                                               *
00052                *****************************************************************
00053          */
00054                RECORD NAME IS HOLIDAY-REC WITHIN HOLIDAY.
00055
00056                 01  HOLIDAY-YYYY                PIC ≠9(04)≠
00057                                                 CHECK VALUE 0000 THRU 2050.
```

```
00058                01  HOLIDAY-MM                  PIC ≠9(02)≠
00059                                                 CHECK VALUE  0 THRU 12.
00060                01  HOLIDAY-DD                  PIC ≠9(02)≠
00061                                                 CHECK VALUE  0 THRU 31.
00062                01  HOLIDAY-NAME                PIC ≠X(15)≠.
00063
00064
00065           /*
00066           *****************************************************************
00067           *                                                               *
00068           *    FILE NAME   STAFF                                          *
00069           *    FILE ORGANIZATION  INDEXED SEQUENTIAL                      *
00070           *    RECORD FORMAT  FIXED                                       *
00071           *    RECORD SIZE  36 CHARACTERS                                 *
00072           *                                                               *
00073           *****************************************************************
00074           */
00075            RECORD NAME IS STAFF-REC WITHIN STAFF.
00076
00077            01  STAFF-ID                    PIC ≠X(10)≠.
00078            01  STAFF-NAME                  PIC ≠X(25)≠.
00079            01  AUTHORIZATION               PIC ≠X(01)≠
00080                                            CHECK VALUE ≠ ≠  ≠A≠.
00081
00082
00083           /*
00084           *****************************************************************
00085           *                                                               *
00086           *    FILE NAME   CUSTOMR                                        *
00087           *    FILE ORGANIZATION  INDEXED SEQUENTIAL                      *
00088           *    RECORD FORMAT  FIXED                                       *
00089           *    RECORD SIZE  50 CHARACTERS                                 *
00090           *                                                               *
00091           *****************************************************************
00092           */
00093            RECORD NAME IS CUSTOMER-REC WITHIN CUSTOMR.
00094
00095            01  CUSTOMER-CODE               PIC ≠X(05)≠.
00096            01  CUSTOMER-NAME               PIC ≠X(25)≠.
00097            01  DEPT                        PIC ≠X(20)≠.
00098
00099
00100           /*
00101           *****************************************************************
00102           *                                                               *
00103           *    FILE NAME   PROJECT                                        *
00104           *    FILE ORGANIZATION  INDEXED SEQUENTIAL                      *
00105           *    RECORD FORMAT  FIXED                                       *
00106           *    RECORD SIZE 315 CHARACTERS                                 *
00107           *                                                               *
00108           *****************************************************************
00109           */
00110            RECORD NAME IS PROJECT-REC WITHIN PROJECT.
00111
00112            01  PRJT-NO                     PIC ≠X(10)≠.
00113            01  TITLE-FIRST                 PIC ≠X(65)≠.
00114            01  TITLE-SECOND                PIC ≠X(65)≠.
00115            01  PROPOSED-YYYY               PIC ≠9(04)≠.
```

```
00116                                          CHECK VALUE 0000 THRU 2050.
00117           01  PROPOSED-MM               PIC ≠9(02)≠
00118                                          CHECK VALUE  0 THRU 12.
00119           01  PROPOSED-DD               PIC ≠9(02)≠
00120                                          CHECK VALUE  0 THRU 31.
00121           01  AUTHORIZED-YYYY           PIC ≠9(04)≠
00122                                          CHECK VALUE 0000 THRU 2050.
00123           01  AUTHORIZED-MM             PIC ≠9(02)≠
00124                                          CHECK VALUE  0 THRU 12.
00125           01  AUTHORIZED-DD             PIC ≠9(02)≠
00126                                          CHECK VALUE  0 THRU 31.
00127           01  TARGET-YYYY               PIC ≠9(04)≠
00128                                          CHECK VALUE 0000 THRU 2050.
00129           01  TARGET-MM                 PIC ≠9(02)≠
00130                                          CHECK VALUE  0 THRU 12.
00131           01  TARGET-DD                 PIC ≠9(02)≠
00132                                          CHECK VALUE  0 THRU 31.
00133           01  COMPLETION-YYYY           PIC ≠9(04)≠
00134                                          CHECK VALUE 0000 THRU 2050.
00135           01  COMPLETION-MM             PIC ≠9(02)≠
00136                                          CHECK VALUE  0 THRU 12.
00137           01  COMPLETION-DD             PIC ≠9(02)≠
00138                                          CHECK VALUE  0 THRU 31.
00139           01  PRJT-LEADER               PIC ≠X(10)≠.
00140           01  PRJT-MANAGER              PIC ≠X(10)≠.
00141           01  PRJT-USER                 PIC ≠X(05)≠.
00142           01  SERVICE-ACCT              PIC ≠X(10)≠.
00143           01  COMPUTER-ACCT             PIC ≠X(10)≠.
00144           01  E-MANDAY                  PIC ≠9(08)V99≠.
00145           01  E-COMP-HR                 PIC ≠9(08)V99≠.
00146           01  E-OTHER                   PIC ≠9(08)V99≠.
00147           01  TYPE-OF-APPL              PIC ≠X(20)≠.
00148           01  AREA-OF-SVC               PIC ≠X(20)≠.
00149           01  KW-1                      PIC ≠X(09)≠.
00150           01  KW-2                      PIC ≠X(09)≠.
00151           01  KW-3                      PIC ≠X(09)≠.
00152           01  PRJT-D-FLAG               PIC ≠X(01)≠
00153                                          CHECK VALUE ≠0≠ ≠1≠.
00154
00155
00156       /*
00157         ***************************************************************
00158         *                                                             *
00159         *    FILE NAME   PTEXT                                        *
00160         *    FILE ORGANIZATION  INDEXED SEQUENTIAL                    *
00161         *    RECORD FORMAT  FIXED                                     *
00162         *    RECORD SIZE  77 CHARACTERS                               *
00163         *                                                             *
00164         ***************************************************************
00165       */
00166        RECORD NAME IS PTEXT-REC WITHIN PTEXT.
00167
00168           01  PROJECT-NO                PIC ≠X(10)≠.
00169           01  TEXT-CODE                 PIC ≠X(01)≠
00170                                          CHECK VALUE ≠D≠  ≠N≠.
00171           01  LINE-NO                   PIC ≠9(02)≠
00172                                          CHECK VALUE  1 THRU 99.
00173           01  DETAIL-LINE               PIC ≠X(64)≠.
```

```
00174
00175
00176          /*
00177                *****************************************************************
00178                *                                                               *
00179                *     FILE NAME    STIME                                        *
00180                *     FILE ORGANIZATION  INDEXED SEQUENTIAL                     *
00181                *     RECORD FORMAT  VARIABLE                                   *
00182                *     RECORD SIZE 135 TO 759 CHARACTERS                         *
00183                *                                                               *
00184                *****************************************************************
00185          */
00186           RECORD NAME IS STIME-REC WITHIN STIME.
00187
00188            01  S-STAFF-ID                  PIC ≠X(10)≠.
00189            01  S-PRJT-NO                   PIC ≠X(10)≠.
00190            01  STIME-D-FLAG                PIC ≠X(01)≠
00191                                            CHECK VALUE ≠0≠ ≠1≠.
00192            01  LATEST-YR                   PIC ≠9(04)≠
00193                                            CHECK VALUE 0000 THRU 2050.
00194            01  YR-SUB OCCURS 10 TIMES      PIC ≠9(04)V99≠.
00195            01  LATEST-MON                  PIC ≠9(02)≠
00196                                            CHECK VALUE  0 THRU 12.
00197            01  MON-SUB OCCURS 24 TIMES     PIC ≠9(04)V99≠.
00198            01  LATEST-WK-PTR               PIC ≠9(02)≠
00199                                            CHECK VALUE 0 THRU 52.
00200            01  NUM-WK                      PIC ≠9(02)≠
00201                                            CHECK VALUE 0 THRU 52.
00202            01  WK-SUB OCCURS NUM-WK TIMES.
00203                05  WEEK-YYYY               PIC ≠9(04)≠
00204                                            CHECK VALUE 0000 THRU 2050.
00205                05  WEEK-MM                 PIC ≠9(02)≠
00206                                            CHECK VALUE  0 THRU 12.
00207                05  WEEK-DD                 PIC ≠9(02)≠
00208                                            CHECK VALUE  0 THRU 31.
00209                05  WEEK-SUB                PIC ≠9(02)V99≠.
00210
00211
00212           DATA CONTROL.
00213
00214           AREA NAME IS SYSPARM
00215               KEY IS FIRST-DAY-OF-WEEK
00216                   DUPLICATES ARE NOT ALLOWED.
00217           AREA NAME IS HOLIDAY
00218               KEY IDENTIFIER IS HDAY-KEY < HOLIDAY-YYYY
00219                                            HOLIDAY-MM  HOLIDAY-DD >
00220                   DUPLICATES ARE NOT ALLOWED.
00221
00222           AREA NAME IS STAFF
00223               KEY IS STAFF-ID
00224                   DUPLICATES ARE NOT ALLOWED
00225               KEY IS ALTERNATE AUTHORIZATION
00226                   DUPLICATES ARE INDEXED.
00227
00228           AREA NAME IS CUSTOMR
00229               KEY IS CUSTOMER-CODE
00230                   DUPLICATES ARE NOT ALLOWED
00231               KEY IS ALTERNATE DEPT
```

```
00232                       DUPLICATES ARE INDEXED.
00233
00234                   AREA NAME IS PROJECT
00235                       KEY IS PRJT-NO
00236                           DUPLICATES ARE NOT ALLOWED
00237                       KEY IS ALTERNATE PRJT-LEADER
00238                           DUPLICATES ARE INDEXED
00239                       KEY IS ALTERNATE PRJT-MANAGER
00240                           DUPLICATES ARE INDEXED
00241                       KEY IS ALTERNATE PRJT-USER
00242                           DUPLICATES ARE INDEXED
00243                       KEY IS ALTERNATE SERVICE-ACCT
00244                           DUPLICATES ARE INDEXED
00245                       KEY IS ALTERNATE TYPE-OF-APPL
00246                           DUPLICATES ARE INDEXED
00247                       KEY IS ALTERNATE AREA-OF-SVC
00248                           DUPLICATES ARE INDEXED
00249                       KEY IS ALTERNATE KW-1
00250                           DUPLICATES ARE INDEXED
00251                       KEY IS ALTERNATE KW-2
00252                           DUPLICATES ARE INDEXED
00253                       KEY IS ALTERNATE KW-3
00254                           DUPLICATES ARE INDEXED.
00255
00256                   AREA NAME IS PTEXT
00257                       KEY IDENTIFIER IS TEXT-KEY < PROJECT-NO  TEXT-CODE  LINE-NO >
00258                           DUPLICATES ARE NOT ALLOWED.
00259
00260                   AREA NAME IS STIME
00261                       KEY IDENTIFIER IS TIME-KEY < S-STAFF-ID  S-PRJT-NO >
00262                           DUPLICATES ARE NOT ALLOWED.
00263
00264
00265                   RELATION NAME IS AUTHORIZED-BY
00266                       JOIN WHERE STAFF-ID EQ PRJT-MANAGER.
00267
00268                   RELATION NAME IS LEADING
00269                       JOIN WHERE STAFF-ID EQ PRJT-LEADER.
00270
00271                   RELATION NAME IS PROPOSE
00272                       JOIN WHERE CUSTOMER-CODE EQ PRJT-USER.
00273
00274                   RELATION NAME IS DESCRIPTION
00275                       JOIN WHERE PRJT-NO EQ PROJECT-NO.
00276
00277                   RELATION NAME IS TIME-REPORTING
00278                       JOIN WHERE STAFF-ID EQ S-STAFF-ID.
00279
00280                   RELATION NAME IS TIME-ON-PRJT
00281                       JOIN WHERE PRJT-NO EQ S-PRJT-NO.
DDL COMPLETE.     045300B CM USED.              0     DIAGNOSTICS.
    CP TIME USED=     2.480  SECONDS
```

```
00001                TITLE DIVISION.
00002                    SS  ALLREC WITHIN PRJTINF-DB.
00003
00004
00005                ALIAS DIVISION.
00006                    AD  REALM SYSPARM BECOMES PARM-FILE.
00007                    AD  REALM HOLIDAY BECOMES HDAY-FILE.
00008                    AD  REALM STAFF   BECOMES STAF-FILE.
00009                    AD  REALM CUSTOMR BECOMES CUST-FILE.
00010                    AD  REALM PROJECT BECOMES PRJT-FILE.
00011                    AD  REALM PTEXT   BECOMES PTXT-FILE.
00012                    AD  REALM STIME   BECOMES STME-FILE.
00013
00014
00015                REALM DIVISION.
00016                    RD  PARM-FILE, HDAY-FILE, STAF-FILE, CUST-FILE, PRJT-FILE,
00017                        PTXT-FILE, STME-FILE.
00018
00019
00020                RECORD DIVISION.
00021
00022                01  SYSPARM-REC.                                          ** WITHIN PARM-FI
00023                    05  HISTORY-RETAIN.                                   ** ORDINAL     1
00024                        10  NUM-YEAR              PIC 9(02).              ** ORDINAL     2
00025                        10  NUM-MONTH             PIC 9(02).              ** ORDINAL     3
00026                        10  NUM-WEEK              PIC 9(02).              ** ORDINAL     4
00027                    05  COST-PER-UNIT.                                    ** ORDINAL     5
00028                        10  MANPOWER-PER-MANDAY PIC 9(03)V99.             ** ORDINAL     6
00029                        10  COMPUTER-PER-HOUR   PIC 9(03)V99.             ** ORDINAL     7
00030                    05  MANDAY-FACTOR         PIC 9(03)V99.              ** ORDINAL     8
00031                    05  FIRST-DAY-OF-WEEK     PIC X(01).                 ** ORDINAL     9
00032                    05  FIRST-DATE-OF-WEEK.                               ** ORDINAL    10
00033                        10  FIRST-YYYY        PIC 9(04).                 ** ORDINAL    11
00034                        10  FIRST-MM          PIC 9(02).                 ** ORDINAL    12
00035                        10  FIRST-DD          PIC 9(02).                 ** ORDINAL    13
00036
00037                01  HOLIDAY-REC.                                          ** WITHIN HDAY-FI
00038                    05  HDAY-KEY.                                         ** ORDINAL     1
00039                        10  HOLIDAY-YYYY      PIC 9(04).                 ** ORDINAL     2
00040                        10  HOLIDAY-MM        PIC 9(02).                 ** ORDINAL     3
00041                        10  HOLIDAY-DD        PIC 9(02).                 ** ORDINAL     4
00042                    05  HOLIDAY-NAME          PIC X(15).                 ** ORDINAL     5
00043
00044                01  STAFF-REC.                                            ** WITHIN STAF-FI
00045                    05  STAFF-ID              PIC X(10).                 ** ORDINAL     1
00046                    05  STAFF-NAME            PIC X(25).                 ** ORDINAL     2
00047
00048                    05  AUTHORIZATION         PIC X(01).                 ** ORDINAL     3
00049                01  CUSTOMER-REC.                                         ** WITHIN CUST-FI
00050                    05  CUSTOMER-CODE         PIC X(05).                 ** ORDINAL     1
00051                    05  CUSTOMER-NAME         PIC X(25).                 ** ORDINAL     2
00052                    05  DEPT                  PIC X(20).                 ** ORDINAL     3
00053
00054                01  PROJECT-REC.                                          ** WITHIN PRJT-FI
00055                    05  PRJT-NO               PIC X(10).                 ** ORDINAL     1
00056                    05  PRJT-TITLE.                                       ** ORDINAL     2
00057                        10  TITLE-FIRST       PIC X(65).                 ** ORDINAL     3
```

```
                10  TITLE-SECOND         PIC X(65).                        ** ORDINAL     4
            05  PRJT-KEY-DATES.                                            ** ORDINAL     5
                10  DATE-PROPOSED.                                         ** ORDINAL     6
                    15  PROPOSED-YYYY    PIC 9(04).                        ** ORDINAL     7
                    15  PROPOSED-MM      PIC 9(02).                        ** ORDINAL     8
                    15  PROPOSED-DD      PIC 9(02).                        ** ORDINAL     9
                10  DATE-AUTHORIZED.                                       ** ORDINAL    10
                    15  AUTHORIZED-YYYY  PIC 9(04).                        ** ORDINAL    11
                    15  AUTHORIZED-MM    PIC 9(02).                        ** ORDINAL    12
                    15  AUTHORIZED-DD    PIC 9(02).                        ** ORDINAL    13
                10  TARGET-DATE.                                           ** ORDINAL    14
                    15  TARGET-YYYY      PIC 9(04).                        ** ORDINAL    15
                    15  TARGET-MM        PIC 9(02).                        ** ORDINAL    16
                    15  TARGET-DD        PIC 9(02).                        ** ORDINAL    17
                10  COMPLETION-DATE.                                       ** ORDINAL    18
                    15  COMPLETION-YYYY  PIC 9(04).                        ** ORDINAL    19
                    15  COMPLETION-MM    PIC 9(02).                        ** ORDINAL    20
                    15  COMPLETION-DD    PIC 9(02).                        ** ORDINAL    21
            05  PERSONS.                                                   ** ORDINAL    22
                10  PRJT-LEADER          PIC X(10).                        ** ORDINAL    23
                10  PRJT-MANAGER         PIC X(10).                        ** ORDINAL    24
                10  PRJT-USER            PIC X(05).                        ** ORDINAL    25
            05  ACCOUNT.                                                   ** ORDINAL    26
                10  SERVICE-ACCT         PIC X(10).                        ** ORDINAL    27
                10  COMPUTER-ACCT        PIC X(10).                        ** ORDINAL    28
            05  ESTIMATED-COST.                                            ** ORDINAL    29
                10  E-MANDAY             PIC 9(08)V99.                     ** ORDINAL    30
                10  E-COMP-HR            PIC 9(08)V99.                     ** ORDINAL    31
                10  E-OTHER              PIC 9(08)V99.                     ** ORDINAL    32
            05  PRJT-KEYWORDS.                                             ** ORDINAL    33
                10  TYPE-OF-APPL         PIC X(20).                        ** ORDINAL    34
                10  AREA-OF-SVC          PIC X(20).                        ** ORDINAL    35
                10  KW-1                 PIC X(09).                        ** ORDINAL    36
                10  KW-2                 PIC X(09).                        ** ORDINAL    37
                10  KW-3                 PIC X(09).                        ** ORDINAL    38
            05  PRJT-D-FLAG              PIC X(01).                        ** ORDINAL    39

        01  PTEXT-REC.                                                     ** WITHIN PTXT-FI
            05  TEXT-KEY.                                                  ** ORDINAL     1
                10  PROJECT-NO           PIC X(10).                        ** ORDINAL     2
                10  TEXT-CODE            PIC X(01).                        ** ORDINAL     3
                10  LINE-NO              PIC 9(02).                        ** ORDINAL     4
            05  DETAIL-LINE              PIC X(64).                        ** ORDINAL     5

        01  STIME-REC.                                                     ** WITHIN STME-FI
            05  TIME-KEY.                                                  ** ORDINAL     1
                10  S-STAFF-ID           PIC X(10).                        ** ORDINAL     2
                10  S-PRJT-NO            PIC X(10).                        ** ORDINAL     3
            05  STIME-D-FLAG             PIC X(01).                        ** ORDINAL     4
            05  YEAR-SUBTOTALS.                                            ** ORDINAL     5
                10  LATEST-YR            PIC 9(04).                        ** ORDINAL     6
                10  YR-SUB OCCURS 10 TIMES   PIC 9(04)V99.                 ** ORDINAL     7
            05  MONTH-SUBTOTALS.                                           ** ORDINAL     8
                10  LATEST-MON           PIC 9(02).                        ** ORDINAL     9
                10  MON-SUB OCCURS 24 TIMES   PIC 9(04)V99.                ** ORDINAL    10
            05  WEEK-SUBTOTALS.                                            ** ORDINAL    11
                10  LATEST-WK-PTR        PIC 9(02).                        ** ORDINAL    12
                10  NUM-WK               PIC 9(02).                        ** ORDINAL    13
```

```
                00116                          10  WK-SUB OCCURS 1 TO 52 TIMES DEPENDING ON NUM-WK.                    ** ORDINAL   14
                00117                              15  WEEK-BEGIN-DATE.                                                ** ORDINAL   15
                00118                                  20  WEEK-YYYY    PIC 9(04).                                     ** ORDINAL   16
                00119                                  20  WEEK-MM      PIC 9(02).                                     ** ORDINAL   17
                00120                                  20  WEEK-DD      PIC 9(02).                                     ** ORDINAL   18
                00121                              15  WEEK-SUB        PIC 9(02)V99.                                  ** ORDINAL   19
                00122
                00123
PRIMARY KEY     00031          FIRST-DAY-OF-WEEK FOR AREA PARM-FILE
PRIMARY KEY     00038          HDAY-KEY FOR AREA HDAY-FILE
PRIMARY KEY     00045          STAFF-ID FOR AREA STAF-FILE
ALTERNATE KEY   00048          AUTHORIZATION FOR AREA STAF-FILE
PRIMARY KEY     00050          CUSTOMER-CODE FOR AREA CUST-FILE
ALTERNATE KEY   00052          DEPT FOR AREA CUST-FILE
PRIMARY KEY     00055          PRJT-NO FOR AREA PRJT-FILE
ALTERNATE KEY   00077          PRJT-LEADER FOR AREA PRJT-FILE
ALTERNATE KEY   00078          PRJT-MANAGER FOR AREA PRJT-FILE
ALTERNATE KEY   00079          PRJT-USER FOR AREA PRJT-FILE
ALTERNATE KEY   00081          SERVICE-ACCT FOR AREA PRJT-FILE
ALTERNATE KEY   00088          TYPE-OF-APPL FOR AREA PRJT-FILE
ALTERNATE KEY   00089          AREA-OF-SVC FOR AREA PRJT-FILE
ALTERNATE KEY   00090          KW-1 FOR AREA PRJT-FILE
ALTERNATE KEY   00091          KW-2 FOR AREA PRJT-FILE
ALTERNATE KEY   00092          KW-3 FOR AREA PRJT-FILE
PRIMARY KEY     00095          TEXT-KEY FOR AREA PTXT-FILE
PRIMARY KEY     00103          TIME-KEY FOR AREA STME-FILE
                *****          RECORD MAPPING IS NEEDED FOR REALM -   PARM-FILE
                *****          RECORD MAPPING IS NEEDED FOR REALM -   HDAY-FILE
                *****          RECORD MAPPING IS NEEDED FOR REALM -   STAF-FILE
                *****          RECORD MAPPING IS NOT NEEDED FOR REALM -   CUST-FILE
                *****          RECORD MAPPING IS NEEDED FOR REALM -   PRJT-FILE
                *****          RECORD MAPPING IS NEEDED FOR REALM -   PTXT-FILE
                *****          RECORD MAPPING IS NEEDED FOR REALM -   STME-FILE
                00124                  RELATION DIVISION.
                00125                      RN IS TIME-REPORTING.
                00126                      RN IS TIME-ON-PRJT.
                *****          END-OF-SUB-SCHEMA SOURCE INPUT

                *****                  RELATION   STATISTICS                    *****
RELATION 001                   TIME-REPORTING TRAVERSES AREA - STAF-FILE
                                                        AREA - STME-FILE
RELATION 002                   TIME-ON-PRJT TRAVERSES AREA - PRJT-FILE
                                                     AREA - STME-FILE

                -----          BEGIN SUB-SCHEMA FILE MAINTENANCE                -----

                -----          END OF FILE MAINTENANCE                          -----
   DDL COMPLETE.     054000B CM USED.              0     DIAGNOSTICS.
       CP TIME USED=     1.592  SECONDS
```

```
00001                TITLE DIVISION.
00002                    SS  TIMESUB WITHIN PRJTINF-DB.
00003
00004
00005                ALIAS DIVISION.
00006                    AD  REALM SYSPARM BECOMES PARM-FILE.
00007                    AD  REALM PROJECT BECOMES PRJT-FILE.
00008                    AD  REALM STIME   BECOMES STME-FILE.
00009
00010
00011                REALM DIVISION.
00012                    RD  PARM-FILE, STME-FILE, PRJT-FILE.
00013
00014
00015                RECORD DIVISION.
00016
00017                01  SYSPARM-REC.                                          ** WITHIN PARM-FI
00018                    05  HISTORY-RETAIN.                                   ** ORDINAL     1
00019                        10  NUM-YEAR              PIC 9(02).              ** ORDINAL     2
00020                        10  NUM-MONTH             PIC 9(02).              ** ORDINAL     3
00021                        10  NUM-WEEK              PIC 9(02).              ** ORDINAL     4
00022                    05  COST-PER-UNIT.                                    ** ORDINAL     5
00023                        10  MANPOWER-PER-MANDAY PIC 9(03)V99.             ** ORDINAL     6
00024                        10  COMPUTER-PER-HOUR   PIC 9(03)V99.             ** ORDINAL     7
00025                    05  MANDAY-FACTOR         PIC 9(03)V99.              ** ORDINAL     8
00026                    05  FIRST-DAY-OF-WEEK     PIC X(01).                 ** ORDINAL     9
00027                    05  FIRST-DATE-OF-WEEK.                               ** ORDINAL    10
00028                        10  FIRST-YYYY            PIC 9(04).              ** ORDINAL    11
00029                        10  FIRST-MM              PIC 9(02).              ** ORDINAL    12
00030                        10  FIRST-DD              PIC 9(02).              ** ORDINAL    13
00031
00032                01  PROJECT-REC.                                          ** WITHIN PRJT-FI
00033                    05  PRJT-NO               PIC X(10).                 ** ORDINAL     1
00034                    05  PRJT-D-FLAG           PIC X(01).                 ** ORDINAL     2
00035
00036                01  STIME-REC.                                            ** WITHIN STME-FI
00037                    05  TIME-KEY.                                         ** ORDINAL     1
00038                        10  S-STAFF-ID            PIC X(10).              ** ORDINAL     2
00039                        10  S-PRJT-NO             PIC X(10).              ** ORDINAL     3
00040                    05  STIME-D-FLAG          PIC X(01).                 ** ORDINAL     4
00041                    05  YEAR-SUBTOTALS.                                   ** ORDINAL     5
00042                        10  LATEST-YR             PIC 9(04).              ** ORDINAL     6
00043                        10  YR-SUB OCCURS 10 TIMES  PIC 9(04)V99.         ** ORDINAL     7
00044                    05  MONTH-SUBTOTALS.                                  ** ORDINAL     8
00045                        10  LATEST-MON            PIC 9(02).              ** ORDINAL     9
00046                        10  MON-SUB OCCURS 24 TIMES  PIC 9(04)V99.        ** ORDINAL    10
00047                    05  WEEK-SUBTOTALS.                                   ** ORDINAL    11
00048                        10  LATEST-WK-PTR         PIC 9(02).              ** ORDINAL    12
00049                        10  NUM-WK                PIC 9(02).              ** ORDINAL    13
00050                        10  WK-SUB OCCURS 1 TO 52 TIMES DEPENDING ON NUM-WK.  ** ORDINAL    14
00051                            15  WEEK-BEGIN-DATE.                          ** ORDINAL    15
00052                                20  WEEK-YYYY     PIC 9(04).              ** ORDINAL    16
00053                                20  WEEK-MM       PIC 9(02).              ** ORDINAL    17
00054                                20  WEEK-DD       PIC 9(02).              ** ORDINAL    18
00055                            15  WEEK-SUB          PIC 9(02)V99.           ** ORDINAL    19
*****        END OF SUB-SCHEMA SOURCE INPUT
```

```
PRIMARY KEY    00026        FIRST-DAY-OF-WEEK FOR AREA PARM-FILE
PRIMARY KEY    00037        TIME-KEY FOR AREA STME-FILE
PRIMARY KEY    00033        PRJT-NO FOR AREA PRJT-FILE
               *****        RECORD MAPPING IS NEEDED FOR REALM -    PARM-FILE
               *****        RECORD MAPPING IS NEEDED FOR REALM -    STME-FILE
               *****        RECORD MAPPING IS NEEDED FOR REALM -    PRJT-FILE

               -----        BEGIN SUB-SCHEMA FILE MAINTENANCE              -----


               -----        END OF FILE MAINTENANCE                        -----
   DDL COMPLETE.     0540008 CM USED.                0     DIAGNOSTICS.

      CP TIME USED=     0.754  SECONDS
```

```
00001                 TITLE DIVISION.
00002                     SS  UPTONE WITHIN PRJTINF-DB.
00003
00004
00005                 ALIAS DIVISION.
00006                     AD  REALM SYSPARM BECOMES PARM-FILE.
00007                     AD  REALM HOLIDAY BECOMES HDAY-FILE.
00008                     AD  REALM STAFF   BECOMES STAF-FILE.
00009                     AD  REALM CUSTOMR BECOMES CUST-FILE.
00010
00011
00012                 REALM DIVISION.
00013                     RD  PARM-FILE, HDAY-FILE, STAF-FILE, CUST-FILE.
00014
00015
00016                 RECORD DIVISION.
00017
00018                 01  SYSPARM-REC.                                          ** WITHIN PARM-FI
00019                     05  HISTORY-RETAIN.                                   ** ORDINAL     1
00020                         10  NUM-YEAR              PIC 9(02).              ** ORDINAL     2
00021                         10  NUM-MONTH             PIC 9(02).              ** ORDINAL     3
00022                         10  NUM-WEEK              PIC 9(02).              ** ORDINAL     4
00023                     05  COST-PER-UNIT.                                    ** ORDINAL     5
00024                         10  MANPOWER-PER-MANDAY PIC 9(03)V99.             ** ORDINAL     6
00025                         10  COMPUTER-PER-HOUR   PIC 9(03)V99.             ** ORDINAL     7
00026                     05  MANDAY-FACTOR         PIC 9(03)V99.              ** ORDINAL     8
00027                     05  FIRST-DAY-OF-WEEK     PIC X(01).                 ** ORDINAL     9
00028                     05  FIRST-DATE-OF-WEEK.                               ** ORDINAL    10
00029                         10  FIRST-YYYY            PIC 9(04).              ** ORDINAL    11
00030                         10  FIRST-MM              PIC 9(02).              ** ORDINAL    12
00031                         10  FIRST-DD              PIC 9(02).              ** ORDINAL    13
00032
00033                 01  HOLIDAY-REC.                                          ** WITHIN HDAY-FI
00034                     05  HDAY-KEY.                                         ** ORDINAL     1
00035                         10  HOLIDAY-YYYY          PIC 9(04).              ** ORDINAL     2
00036                         10  HOLIDAY-MM            PIC 9(02).              ** ORDINAL     3
00037                         10  HOLIDAY-DD            PIC 9(02).              ** ORDINAL     4
00038                     05  HOLIDAY-NAME          PIC X(15).                 ** ORDINAL     5
00039
00040                 01  STAFF-REC.                                            ** WITHIN STAF-FI
00041                     05  STAFF-ID              PIC X(10).                 ** ORDINAL     1
00042                     05  STAFF-NAME            PIC X(25).                 ** ORDINAL     2
00043                     05  AUTHORIZATION         PIC X(01).                 ** ORDINAL     3
00044
00045                 01  CUSTOMER-REC.                                         ** WITHIN CUST-FI
00046                     05  CUSTOMER-CODE         PIC X(05).                 ** ORDINAL     1
00047                     05  CUSTOMER-NAME         PIC X(25).                 ** ORDINAL     2
00048                     05  DEPT                  PIC X(20).                 ** ORDINAL     3
00049
*****        END OF SUB-SCHEMA SOURCE INPUT

PRIMARY KEY     00027    FIRST-DAY-OF-WEEK FOR AREA PARM-FILE
PRIMARY KEY     00034    HDAY-KEY FOR AREA HDAY-FILE
PRIMARY KEY     00041    STAFF-ID FOR AREA STAF-FILE
ALTERNATE KEY   00043    AUTHORIZATION FOR AREA STAF-FILE
PRIMARY KEY     00046    CUSTOMER-CODE FOR AREA CUST-FILE
ALTERNATE KEY   00048    DEPT FOR AREA CUST-FILE
```

```
        *****       RECORD MAPPING IS NEEDED FOR REALM -   PARM-FILE
        *****       RECORD MAPPING IS NEEDED FOR REALM -   HDAY-FILE
        *****       RECORD MAPPING IS NEEDED FOR REALM -   STAF-FILE
        *****       RECORD MAPPING IS NOT NEEDED FOR REALM -   CUST-FILE

        -----       BEGIN SUB-SCHEMA FILE MAINTENANCE              -----

        -----       END OF FILE MAINTENANCE                        -----
DDL COMPLETE.     0540008 CM USED.              0     DIAGNOSTICS.
    CP TIME USED=     0.610  SECONDS
```

```
00001          TITLE DIVISION.
00002              SS  UPTTWO WITHIN PRJTINF-DB.
00003
00004
00005          ALIAS DIVISION.
00006              AD  REALM SYSPARM BECOMES PARM-FILE.
00007              AD  REALM PROJECT BECOMES PRJT-FILE.
00008              AD  REALM PTEXT   BECOMES PTXT-FILE.
00009              AD  REALM STIME   BECOMES STME-FILE.
00010
00011
00012          REALM DIVISION.
00013              RD  PARM-FILE, PRJT-FILE, PTXT-FILE, STME-FILE.
00014
00015
00016          RECORD DIVISION.
00017
00018          01  SYSPARM-REC.                                          ** WITHIN PARM-FI
00019              05  HISTORY-RETAIN.                                   ** ORDINAL     1
00020                  10  NUM-YEAR              PIC 9(02).              ** ORDINAL     2
00021                  10  NUM-MONTH             PIC 9(02).              ** ORDINAL     3
00022                  10  NUM-WEEK              PIC 9(02).              ** ORDINAL     4
00023              05  COST-PER-UNIT.                                    ** ORDINAL     5
00024                  10  MANPOWER-PER-MANDAY   PIC 9(03)V99.           ** ORDINAL     6
00025                  10  COMPUTER-PER-HOUR     PIC 9(03)V99.           ** ORDINAL     7
00026              05  MANDAY-FACTOR             PIC 9(03)V99.           ** ORDINAL     8
00027              05  FIRST-DAY-OF-WEEK         PIC X(01).              ** ORDINAL     9
00028              05  FIRST-DATE-OF-WEEK.                               ** ORDINAL    10
00029                  10  FIRST-YYYY            PIC 9(04).              ** ORDINAL    11
00030                  10  FIRST-MM              PIC 9(02).              ** ORDINAL    12
00031                  10  FIRST-DD              PIC 9(02).              ** ORDINAL    13
00032
00033          01  PROJECT-REC.                                          ** WITHIN PRJT-FI
00034              05  PRJT-NO                   PIC X(10).              ** ORDINAL     1
00035              05  PRJT-TITLE.                                       ** ORDINAL     2
00036                  10  TITLE-FIRST           PIC X(65).              ** ORDINAL     3
00037                  10  TITLE-SECOND          PIC X(65).              ** ORDINAL     4
00038              05  PRJT-KEY-DATES.                                   ** ORDINAL     5
00039                  10  DATE-PROPOSED.                                ** ORDINAL     6
00040                      15  PROPOSED-YYYY     PIC 9(04).              ** ORDINAL     7
00041                      15  PROPOSED-MM       PIC 9(02).              ** ORDINAL     8
00042                      15  PROPOSED-DD       PIC 9(02).              ** ORDINAL     9
00043                  10  DATE-AUTHORIZED.                              ** ORDINAL    10
00044                      15  AUTHORIZED-YYYY   PIC 9(04).              ** ORDINAL    11
00045                      15  AUTHORIZED-MM     PIC 9(02).              ** ORDINAL    12
00046                      15  AUTHORIZED-DD     PIC 9(02).              ** ORDINAL    13
00047                  10  TARGET-DATE.                                  ** ORDINAL    14
00048                      15  TARGET-YYYY       PIC 9(04).              ** ORDINAL    15
00049                      15  TARGET-MM         PIC 9(02).              ** ORDINAL    16
00050                      15  TARGET-DD         PIC 9(02).              ** ORDINAL    17
00051                  10  COMPLETION-DATE.                              ** ORDINAL    18
00052                      15  COMPLETION-YYYY   PIC 9(04).              ** ORDINAL    19
00053                      15  COMPLETION-MM     PIC 9(02).              ** ORDINAL    20
00054                      15  COMPLETION-DD     PIC 9(02).              ** ORDINAL    21
00055              05  PERSONS.                                          ** ORDINAL    22
00056                  10  PRJT-LEADER           PIC X(10).              ** ORDINAL    23
00057                  10  PRJT-MANAGER          PIC X(10).              ** ORDINAL    24
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00058                         10  PRJT-USER             PIC X(05).          ** ORDINAL   25
00059                     05  ACCOUNT.                                      ** ORDINAL   26
00060                         10  SERVICE-ACCT          PIC X(10).          ** ORDINAL   27
00061                         10  COMPUTER-ACCT         PIC X(10).          ** ORDINAL   28
00062                     05  ESTIMATED-COST.                               ** ORDINAL   29
00063                         10  E-MANDAY              PIC 9(08)V99.       ** ORDINAL   30
00064                         10  E-COMP-HR             PIC 9(08)V99.       ** ORDINAL   31
00065                         10  E-OTHER               PIC 9(08)V99.       ** ORDINAL   32
00066                     05  PRJT-KEYWORDS.                                ** ORDINAL   33
00067                         10  TYPE-OF-APPL          PIC X(20).          ** ORDINAL   34
00068                         10  AREA-OF-SVC           PIC X(20).          ** ORDINAL   35
00069                         10  KW-1                  PIC X(09).          ** ORDINAL   36
00070                         10  KW-2                  PIC X(09).          ** ORDINAL   37
00071                         10  KW-3                  PIC X(09).          ** ORDINAL   38
00072                     05  PRJT-D-FLAG               PIC X(01).          ** ORDINAL   39
00073
00074                 01  PTEXT-REC.                                        ** WITHIN PTXT-FI
00075                     05  TEXT-KEY.                                     ** ORDINAL    1
00076                         10  PROJECT-NO            PIC X(10).          ** ORDINAL    2
00077                         10  TEXT-CODE             PIC X(01).          ** ORDINAL    3
00078                         10  LINE-NO               PIC 9(02).          ** ORDINAL    4
00079                     05  DETAIL-LINE               PIC X(64).          ** ORDINAL    5
00080
00081                 01  STIME-REC.                                        ** WITHIN STME-FI
00082                     05  TIME-KEY.                                     ** ORDINAL    1
00083                         10  S-STAFF-ID            PIC X(10).          ** ORDINAL    2
00084                         10  S-PRJT-NO             PIC X(10).          ** ORDINAL    3
00085                     05  STIME-D-FLAG              PIC X(01).          ** ORDINAL    4
00086                     05  YEAR-SUBTOTALS.                               ** ORDINAL    5
00087                         10  LATEST-YR             PIC 9(04).          ** ORDINAL    6
00088                         10  YR-SUB OCCURS 10 TIMES  PIC 9(04)V99.     ** ORDINAL    7
00089                     05  MONTH-SUBTOTALS.                              ** ORDINAL    8
00090                         10  LATEST-MON            PIC 9(02).          ** ORDINAL    9
00091                         10  MON-SUB OCCURS 24 TIMES  PIC 9(04)V99.    ** ORDINAL   10
00092                     05  WEEK-SUBTOTALS.                               ** ORDINAL   11
00093                         10  LATEST-WK-FTR         PIC 9(02).          ** ORDINAL   12
00094                         10  NUM-WK                PIC 9(02).          ** ORDINAL   13
00095                         10  WK-SUB OCCURS 1 TO 52 TIMES DEPENDING ON NUM-WK.  ** ORDINAL   14
00096                             15  WEEK-BEGIN-DATE.                      ** ORDINAL   15
00097                                 20  WEEK-YYYY     PIC 9(04).          ** ORDINAL   16
00098                                 20  WEEK-MM       PIC 9(02).          ** ORDINAL   17
00099                                 20  WEEK-DD       PIC 9(02).          ** ORDINAL   18
00100                             15  WEEK-SUB          PIC 9(02)V99.       ** ORDINAL   19
*****         END OF SUB-SCHEMA SOURCE INPUT

PRIMARY KEY    00027   FIRST-DAY-OF-WEEK FOR AREA PARM-FILE
PRIMARY KEY    00034   PRJT-NO FOR AREA PRJT-FILE
ALTERNATE KEY  00056   PRJT-LEADER FOR AREA PRJT-FILE
ALTERNATE KEY  00057   PRJT-MANAGER FOR AREA PRJT-FILE
ALTERNATE KEY  00058   PRJT-USER FOR AREA PRJT-FILE
ALTERNATE KEY  00060   SERVICE-ACCT FOR AREA PRJT-FILE
ALTERNATE KEY  00067   TYPE-OF-APPL FOR AREA PRJT-FILE
ALTERNATE KEY  00068   AREA-OF-SVC FOR AREA PRJT-FILE
ALTERNATE KEY  00069   KW-1 FOR AREA PRJT-FILE
ALTERNATE KEY  00070   KW-2 FOR AREA PRJT-FILE
ALTERNATE KEY  00071   KW-3 FOR AREA PRJT-FILE
PRIMARY KEY    00075   TEXT-KEY FOR AREA PTXT-FILE
PRIMARY KEY    00082   TIME-KEY FOR AREA STME-FILE
```

```
*****   RECORD MAPPING IS NEEDED FOR REALM -   PARM-FILE
*****   RECORD MAPPING IS NEEDED FOR REALM -   FRJT-FILE
*****   RECORD MAPPING IS NEEDED FOR REALM -   PTXT-FILE
*****   RECORD MAPPING IS NEEDED FOR REALM -   STME-FILE

-----   BEGIN SUB-SCHEMA FILE MAINTENANCE              -----

-----   END OF FILE MAINTENANCE                        -----
DDL COMPLETE.     054000B CM USED.          0     DIAGNOSTICS.
    CP TIME USED=     1.440  SECONDS
```

```
00001                TITLE DIVISION.
00002                    SS  RPTSUB WITHIN PRJTINF-DB.
00003
00004
00005                ALIAS DIVISION.
00006                    AD  REALM SYSPARM BECOMES PARM-FILE.
00007                    AD  REALM HOLIDAY BECOMES HDAY-FILE.
00008                    AD  REALM STAFF   BECOMES STAF-FILE.
00009                    AD  REALM PROJECT BECOMES PRJT-FILE.
00010                    AD  REALM STIME   BECOMES STME-FILE.
00011
00012
00013                REALM DIVISION.
00014                    RD  PARM-FILE, HDAY-FILE, STAF-FILE, PRJT-FILE, STME-FILE.
00015
00016
00017                RECORD DIVISION.
00018
00019                01  SYSPARM-REC.                                          ** WITHIN PARM-FI
00020                    05  HISTORY-RETAIN.                                   ** ORDINAL     1
00021                        10  NUM-YEAR              PIC 9(02).              ** ORDINAL     2
00022                        10  NUM-MONTH             PIC 9(02).              ** ORDINAL     3
00023                        10  NUM-WEEK              PIC 9(02).              ** ORDINAL     4
00024                    05  COST-PER-UNIT.                                    ** ORDINAL     5
00025                        10  MANPOWER-PER-MANDAY   PIC 9(03)V99.          ** ORDINAL     6
00026                        10  COMPUTER-PER-HOUR     PIC 9(03)V99.          ** ORDINAL     7
00027                    05  MANDAY-FACTOR             PIC 9(03)V99.          ** ORDINAL     8
00028                    05  FIRST-DAY-OF-WEEK         PIC X(01).             ** ORDINAL     9
00029                    05  FIRST-DATE-OF-WEEK.                               ** ORDINAL    10
00030                        10  FIRST-YYYY            PIC 9(04).              ** ORDINAL    11
00031                        10  FIRST-MM              PIC 9(02).              ** ORDINAL    12
00032                        10  FIRST-DD              PIC 9(02).              ** ORDINAL    13
00033
00034                01  HOLIDAY-REC.                                          ** WITHIN HDAY-FI
00035                    05  HDAY-KEY.                                         ** ORDINAL     1
00036                        10  HOLIDAY-YYYY          PIC 9(04).              ** ORDINAL     2
00037                        10  HOLIDAY-MM            PIC 9(02).              ** ORDINAL     3
00038                        10  HOLIDAY-DD            PIC 9(02).              ** ORDINAL     4
00039                    05  HOLIDAY-NAME              PIC X(15).              ** ORDINAL     5
00040
00041                01  STAFF-REC.                                            ** WITHIN STAF-FI
00042                    05  STAFF-ID                  PIC X(10).              ** ORDINAL     1
00043                    05  STAFF-NAME                PIC X(25).              ** ORDINAL     2
00044
00045                    05  AUTHORIZATION             PIC X(01).              ** ORDINAL     3
00046                01  PROJECT-REC.                                          ** WITHIN PRJT-FI
00047                    05  PRJT-NO                   PIC X(10).              ** ORDINAL     1
00048                    05  PRJT-TITLE.                                       ** ORDINAL     2
00049                        10  TITLE-FIRST           PIC X(65).              ** ORDINAL     3
00050                        10  TITLE-SECOND          PIC X(65).              ** ORDINAL     4
00051                    05  PRJT-KEY-DATES.                                   ** ORDINAL     5
00052                        10  DATE-PROPOSED.                                ** ORDINAL     6
00053                            15  PROPOSED-YYYY     PIC 9(04).              ** ORDINAL     7
00054                            15  PROPOSED-MM       PIC 9(02).              ** ORDINAL     8
00055                            15  PROPOSED-DD       PIC 9(02).              ** ORDINAL     9
00056                        10  DATE-AUTHORIZED.                              ** ORDINAL    10
00057                            15  AUTHORIZED-YYYY   PIC 9(04).              ** ORDINAL    11
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00058                          15  AUTHORIZED-MM    PIC 9(02).          ** ORDINAL   12
00059                          15  AUTHORIZED-DD    PIC 9(02).          ** ORDINAL   13
00060                      10  TARGET-DATE.                            ** ORDINAL   14
00061                          15  TARGET-YYYY      PIC 9(04).          ** ORDINAL   15
00062                          15  TARGET-MM        PIC 9(02).          ** ORDINAL   16
00063                          15  TARGET-DD        PIC 9(02).          ** ORDINAL   17
00064                      10  COMPLETION-DATE.                        ** ORDINAL   18
00065                          15  COMPLETION-YYYY  PIC 9(04).          ** ORDINAL   19
00066                          15  COMPLETION-MM    PIC 9(02).          ** ORDINAL   20
00067                          15  COMPLETION-DD    PIC 9(02).          ** ORDINAL   21
00068                  05  PERSONS.                                    ** ORDINAL   22
00069                      10  PRJT-LEADER          PIC X(10).          ** ORDINAL   23
00070                      10  PRJT-MANAGER         PIC X(10).          ** ORDINAL   24
00071                      10  PRJT-USER            PIC X(05).          ** ORDINAL   25
00072                  05  ACCOUNT.                                    ** ORDINAL   26
00073                      10  SERVICE-ACCT         PIC X(10).          ** ORDINAL   27
00074                      10  COMPUTER-ACCT        PIC X(10).          ** ORDINAL   28
00075                  05  ESTIMATED-COST.                             ** ORDINAL   29
00076                      10  E-MANDAY             PIC 9(08)V99.       ** ORDINAL   30
00077                      10  E-COMP-HR            PIC 9(08)V99.       ** ORDINAL   31
00078                      10  E-OTHER              PIC 9(08)V99.       ** ORDINAL   32
00079                  05  PRJT-KEYWORDS.                              ** ORDINAL   33
00080                      10  TYPE-OF-APPL         PIC X(20).          ** ORDINAL   34
00081                      10  AREA-OF-SVC          PIC X(20).          ** ORDINAL   35
00082                      10  KW-1                 PIC X(09).          ** ORDINAL   36
00083                      10  KW-2                 PIC X(09).          ** ORDINAL   37
00084                      10  KW-3                 PIC X(09).          ** ORDINAL   38
00085                  05  PRJT-D-FLAG              PIC X(01).          ** ORDINAL   39
00086
00087              01  STIME-REC.                                      ** WITHIN STME-FI
00088                  05  TIME-KEY.                                   ** ORDINAL    1
00089                      10  S-STAFF-ID           PIC X(10).          ** ORDINAL    2
00090                      10  S-PRJT-NO            PIC X(10).          ** ORDINAL    3
00091                  05  STIME-D-FLAG             PIC X(01).          ** ORDINAL    4
00092                  05  YEAR-SUBTOTALS.                             ** ORDINAL    5
00093                      10  LATEST-YR            PIC 9(04).          ** ORDINAL    6
00094                      10  YR-SUB OCCURS 10 TIMES  PIC 9(04)V99.    ** ORDINAL    7
00095                  05  MONTH-SUBTOTALS.                            ** ORDINAL    8
00096                      10  LATEST-MON           PIC 9(02).          ** ORDINAL    9
00097                      10  MON-SUB OCCURS 24 TIMES  PIC 9(04)V99.   ** ORDINAL   10
00098                  05  WEEK-SUBTOTALS.                             ** ORDINAL   11
00099                      10  LATEST-WK-PTR        PIC 9(02).          ** ORDINAL   12
00100                      10  NUM-WK               PIC 9(02).          ** ORDINAL   13
00101                      10  WK-SUB OCCURS 1 TO 52 TIMES DEPENDING ON NUM-WK.  ** ORDINAL   14
00102                          15  WEEK-BEGIN-DATE.                     ** ORDINAL   15
00103                              20  WEEK-YYYY    PIC 9(04).          ** ORDINAL   16
00104                              20  WEEK-MM      PIC 9(02).          ** ORDINAL   17
00105                              20  WEEK-DD      PIC 9(02).          ** ORDINAL   18
00106                          15  WEEK-SUB         PIC 9(02)V99.       ** ORDINAL   19
00107
00108
PRIMARY KEY      00028    FIRST-DAY-OF-WEEK FOR AREA PARM-FILE
PRIMARY KEY      00035    HDAY-KEY FOR AREA HDAY-FILE
PRIMARY KEY      00042    STAFF-ID FOR AREA STAF-FILE
ALTERNATE KEY    00045    AUTHORIZATION FOR AREA STAF-FILE
PRIMARY KEY      00047    PRJT-NO FOR AREA PRJT-FILE
ALTERNATE KEY    00069    PRJT-LEADER FOR AREA PRJT-FILE
ALTERNATE KEY    00070    PRJT-MANAGER FOR AREA PRJT-FILE
```

```
ALTERNATE KEY 00071        PRJT-USER FOR AREA PRJT-FILE
ALTERNATE KEY 00073        SERVICE-ACCT FOR AREA PRJT-FILE
ALTERNATE KEY 00080        TYPE-OF-APPL FOR AREA PRJT-FILE
ALTERNATE KEY 00081        AREA-OF-SVC FOR AREA PRJT-FILE
ALTERNATE KEY 00082        KW-1 FOR AREA PRJT-FILE
ALTERNATE KEY 00083        KW-2 FOR AREA PRJT-FILE
ALTERNATE KEY 00084        KW-3 FOR AREA PRJT-FILE
PRIMARY KEY   00088        TIME-KEY FOR AREA STME-FILE
              *****        RECORD MAPPING IS NEEDED FOR REALM -   PARM-FILE
              *****        RECORD MAPPING IS NEEDED FOR REALM -   HDAY-FILE
              *****        RECORD MAPPING IS NEEDED FOR REALM -   STAF-FILE
              *****        RECORD MAPPING IS NEEDED FOR REALM -   PRJT-FILE
              *****        RECORD MAPPING IS NEEDED FOR REALM -   STME-FILE
              00109                  RELATION DIVISION.
              00110                      RN IS TIME-REPORTING.
              00111                      RN IS TIME-ON-PRJT.
              *****        END OF SUB-SCHEMA SOURCE INPUT

              *****                  RELATION   STATISTICS                  *****
RELATION 001               TIME-REPORTING TRAVERSES AREA - STAF-FILE
                                                  AREA - STME-FILE
RELATION 002               TIME-ON-PRJT TRAVERSES AREA - PRJT-FILE
                                                  AREA - STME-FILE

              -----        BEGIN SUB-SCHEMA FILE MAINTENANCE              -----

              -----        END OF FILE MAINTENANCE                        -----
   DDL COMPLETE.     054000B CM USED.          0     DIAGNOSTICS.

     CP TIME USED=     1.522  SECONDS
```

```
00001                TITLE DIVISION.
00002                    SS  QURSUB WITHIN PRJTINF-DB.
00003
00004
00005                ALIAS DIVISION.
00006                    AD  REALM STAFF    BECOMES STAF-FILE.
00007                    AD  REALM CUSTOMR  BECOMES CUST-FILE.
00008                    AD  REALM PROJECT  BECOMES PRJT-FILE.
00009                    AD  REALM STIME    BECOMES STME-FILE.
00010
00011
00012                REALM DIVISION.
00013                    RD  STAF-FILE, CUST-FILE, PRJT-FILE, STME-FILE.
00014
00015
00016                RECORD DIVISION.
00017
00018                01  STAFF-REC.                                          ** WITHIN STAF-FI
00019                    05  STAFF-ID                PIC X(10).              ** ORDINAL    1
00020                    05  STAFF-NAME              PIC X(25).              ** ORDINAL    2
00021
00022                    05  AUTHORIZATION           PIC X(01).              ** ORDINAL    3
00023                01  CUSTOMER-REC.                                       ** WITHIN CUST-FI
00024                    05  CUSTOMER-CODE           PIC X(05).              ** ORDINAL    1
00025                    05  CUSTOMER-NAME           PIC X(25).              ** ORDINAL    2
00026                    05  DEPT                    PIC X(20).              ** ORDINAL    3
00027
00028                01  PROJECT-REC.                                        ** WITHIN PRJT-FI
00029                    05  PRJT-NO                 PIC X(10).              ** ORDINAL    1
00030                    05  PRJT-TITLE.                                     ** ORDINAL    2
00031                        10  TITLE-FIRST         PIC X(65).              ** ORDINAL    3
00032                        10  TITLE-SECOND        PIC X(65).              ** ORDINAL    4
00033                    05  PRJT-KEY-DATES.                                 ** ORDINAL    5
00034                        10  DATE-PROPOSED.                              ** ORDINAL    6
00035                            15  PROPOSED-YYYY   PIC 9(04).              ** ORDINAL    7
00036                            15  PROPOSED-MM     PIC 9(02).              ** ORDINAL    8
00037                            15  PROPOSED-DD     PIC 9(02).              ** ORDINAL    9
00038                        10  DATE-AUTHORIZED.                            ** ORDINAL   10
00039                            15  AUTHORIZED-YYYY PIC 9(04).              ** ORDINAL   11
00040                            15  AUTHORIZED-MM   PIC 9(02).              ** ORDINAL   12
00041                            15  AUTHORIZED-DD   PIC 9(02).              ** ORDINAL   13
00042                        10  TARGET-DATE.                                ** ORDINAL   14
00043                            15  TARGET-YYYY     PIC 9(04).              ** ORDINAL   15
00044                            15  TARGET-MM       PIC 9(02).              ** ORDINAL   16
00045                            15  TARGET-DD       PIC 9(02).              ** ORDINAL   17
00046                        10  COMPLETION-DATE.                            ** ORDINAL   18
00047                            15  COMPLETION-YYYY PIC 9(04).              ** ORDINAL   19
00048                            15  COMPLETION-MM   PIC 9(02).              ** ORDINAL   20
00049                            15  COMPLETION-DD   PIC 9(02).              ** ORDINAL   21
00050                    05  PERSONS.                                        ** ORDINAL   22
00051                        10  PRJT-LEADER         PIC X(10).              ** ORDINAL   23
00052                        10  PRJT-MANAGER        PIC X(10).              ** ORDINAL   24
00053                        10  PRJT-USER           PIC X(05).              ** ORDINAL   25
00054                    05  ACCOUNT.                                        ** ORDINAL   26
00055                        10  SERVICE-ACCT        PIC X(10).              ** ORDINAL   27
00056                        10  COMPUTER-ACCT       PIC X(10).              ** ORDINAL   28
00057                    05  ESTIMATED-COST.                                 ** ORDINAL   29
```

```
         00058                 10  E-MANDAY               PIC 9(08)V99.                        ** ORDINAL   30
         00059                 10  E-COMP-HR              PIC 9(08)V99.                        ** ORDINAL   31
         00060                 10  E-OTHER                PIC 9(08)V99.                        ** ORDINAL   32
         00061              05 PRJT-KEYWORDS.                                                  ** ORDINAL   33
         00062                 10  TYPE-OF-APPL           PIC X(20).                           ** ORDINAL   34
         00063                 10  AREA-OF-SVC            PIC X(20).                           ** ORDINAL   35
         00064                 10  KW-1                   PIC X(09).                           ** ORDINAL   36
         00065                 10  KW-2                   PIC X(09).                           ** ORDINAL   37
         00066                 10  KW-3                   PIC X(09).                           ** ORDINAL   38
         00067              05 PRJT-D-FLAG                PIC X(01).                           ** ORDINAL   39
         00068
         00069           01 STIME-REC.                                                         ** WITHIN STME-FI
         00070              05 TIME-KEY.                                                       ** ORDINAL    1
         00071                 10  S-STAFF-ID             PIC X(10).                           ** ORDINAL    2
         00072                 10  S-PRJT-NO              PIC X(10).                           ** ORDINAL    3
         00073              05 STIME-D-FLAG               PIC X(01).                           ** ORDINAL    4
         00074              05 YEAR-SUBTOTALS.                                                 ** ORDINAL    5
         00075                 10  LATEST-YR              PIC 9(04).                           ** ORDINAL    6
         00076                 10  YR-SUB OCCURS 10 TIMES  PIC 9(04)V99.                       ** ORDINAL    7
         00077              05 MONTH-SUBTOTALS.                                                ** ORDINAL    8
         00078                 10  LATEST-MON             PIC 9(02).                           ** ORDINAL    9
         00079                 10  MON-SUB OCCURS 24 TIMES  PIC 9(04)V99.                      ** ORDINAL   10
         00080              05 WEEK-SUBTOTALS.                                                 ** ORDINAL   11
         00081                 10  LATEST-WK-PTR          PIC 9(02).                           ** ORDINAL   12
         00082                 10  NUM-WK                 PIC 9(02).                           ** ORDINAL   13
         00083                 10  WK-SUB OCCURS 1 TO 52 TIMES DEPENDING ON NUM-WK.            ** ORDINAL   14
         00084                     15  WEEK-BEGIN-DATE.                                        ** ORDINAL   15
         00085                         20  WEEK-YYYY      PIC 9(04).                           ** ORDINAL   16
         00086                         20  WEEK-MM        PIC 9(02).                           ** ORDINAL   17
         00087                         20  WEEK-DD        PIC 9(02).                           ** ORDINAL   18
         00088                     15  WEEK-SUB           PIC 9(02)V99.                        ** ORDINAL   19
         00089
         00090
PRIMARY KEY     00019     STAFF-ID FOR AREA STAF-FILE
ALTERNATE KEY   00022     AUTHORIZATION FOR AREA STAF-FILE
PRIMARY KEY     00024     CUSTOMER-CODE FOR AREA CUST-FILE
ALTERNATE KEY   00026     DEPT FOR AREA CUST-FILE
PRIMARY KEY     00029     PRJT-NO FOR AREA PRJT-FILE
ALTERNATE KEY   00051     PRJT-LEADER FOR AREA PRJT-FILE
ALTERNATE KEY   00052     PRJT-MANAGER FOR AREA PRJT-FILE
ALTERNATE KEY   00053     PRJT-USER FOR AREA PRJT-FILE
ALTERNATE KEY   00055     SERVICE-ACCT FOR AREA PRJT-FILE
ALTERNATE KEY   00062     TYPE-OF-APPL FOR AREA PRJT-FILE
ALTERNATE KEY   00063     AREA-OF-SVC FOR AREA PRJT-FILE
ALTERNATE KEY   00064     KW-1 FOR AREA PRJT-FILE
ALTERNATE KEY   00065     KW-2 FOR AREA PRJT-FILE
ALTERNATE KEY   00066     KW-3 FOR AREA PRJT-FILE
PRIMARY KEY     00070     TIME-KEY FOR AREA STME-FILE
                *****     RECORD MAPPING IS NEEDED FOR REALM -    STAF-FILE
                *****     RECORD MAPPING IS NOT NEEDED FOR REALM -    CUST-FILE
                *****     RECORD MAPPING IS NEEDED FOR REALM -    PRJT-FILE
                *****     RECORD MAPPING IS NEEDED FOR REALM -    STME-FILE
                00091             RELATION DIVISION.
                00092                 RN IS TIME-REPORTING.
                00093                 RN IS TIME-ON-PRJT.
                *****     END OF SUB-SCHEMA SOURCE INPUT

                *****             RELATION   STATISTICS              *****
```

```
RELATION 001            TIME-REPORTING TRAVERSES AREA - STAF-FILE
                                                AREA - STME-FILE
RELATION 002            TIME-ON-PRJT TRAVERSES AREA - PRJT-FILE
                                               AREA - STME-FILE

          -----         BEGIN SUB-SCHEMA FILE MAINTENANCE          -----

          -----         END OF FILE MAINTENANCE                    -----
DDL COMPLETE.     0540003 CM USED.              0     DIAGNOSTICS.
    CP TIME USED=     1.282  SECONDS
```

APPENDIX E

USER GUIDE

The Project Information System provides the means of controlling and keeping track of the progress of various projects, as well as maintaining time reporting on individual Staff activities. To help the prospective users, this User Guide has been designed to outline the procedures for making use of the system. A more complete description can be found in Chapter 3 of the report.

E.1 Initialization of the System

The INIT program provides the function of initializing all database files. A predefined System Parameter record is created. No input is required and no formal report is generated. Only a message is printed to indicate the status of the run. It is important to note that this program can only be executed once.

Control cards for running program INIT.

```
JØBA
USER (Usernum, Password)
CHARGE (Chargenum)
GET (INIT)
INIT.
SAVE (SYSPARM)
SAVE (HOLIDAY)
SAVE (CUSTOMR, ICUST)
SAVE (STAFF, ISTAFF)
SAVE (PROJECT, IPRJT)
SAVE (PTEXT)
SAVE (STIME)
6/7/8/9
```

80 COLUMN DATA SHEET

TITLE TIME REPORTING TRANSACTION

DATE

BY

TYPE	ACTION	STAFF-ID	PROJECT-NO	BEGIN DATE	END DATE	TIME
				YYYYMMDD	YYYYMMDD	HHHH
82	C	00010	K1234	19780911	19780918	0100
82	C	00020	K1234	19780911	19780918	0250

E.2 Weekly Time Reporting Run

The program TIMERPT is run weekly to process the weekly time reporting transactions. The program updates the Staff-time record and accumulates the time into weekly, monthly and yearly subtotals. The transactions are submitted by each Staff member to confine his activities on the projects. A rejected transaction report is produced after each run. Note that this program has to be run weekly even if there is no input.

Control cards for running the program.

```
JOBB.
USER (Usernum, password)
CHARGE (chargenum)
ROUTE (ERR, DC=PR, FID = PI910, DEF)
GET (SYSPARM)
GET (PROJECT, IPRJT)
GET (STIME)
GET (TIMERPT)
TIMERPT.
REPLACE (SYSPARM)
REPLACE (STIME)
6/7/8/9
```

E.3 Record Updating

The record updating section consists of three programs. SORTREC, UPTONE and UPTTWO. The program SORTREC accepts all updating transactions and sorts them in ascending sequence of transaction type. Then the sorted file is split into SORTONE and SORTTWO. SORTONE, which contains all transactions for updating System Parameter, Holiday, Staff and Customer records, is input to program UPTONE. It is through this program that the

System Parameter can be modified; deletion and addition of Holiday record is done; new and revised data on Staff and Customer are processed. SORTTWO is read by the program UPTTWO, which updates the fields in Project, Project-text and Staff-time records.

Control cards for running the program.

```
JOBC.
USER (usernum, password)
CHARGE (chargenum)
ROUTE (PRT, DC=PR, FID=PI800, DEF)
ROUTE (ERR, DC=PR, FID=PI900, DEF)
GET (SORTREC)
SORTREC.
7/8/9

  transactions

7/8/9
GET (SYSPARM)
GET (HOLIDAY)
GET (CUSTOMR, ICUST)
GET (STAFF, ISTAFF)
REWIND (SORTONE)
GET (UPTONE)
UPTONE.
REPLACE (SYSPARM)
REPLACE (HOLIDAY)
REPLACE (STAFF, ISTAFF)
REPLACE (CUSTOMR, ICUST)
GET (PROJECT, IPRJT)
GET (PTEXT)
GET (STIME)
REWIND (SORTTWO)
GET (UPTTWO)
UPTTWO.
REPLACE (PROJECT, IPRJT)
REPLACE (PTEXT)
REPLACE (STIME)
6/7/8/9
```

80 COLUMN DATA SHEET

TITLE SYSTEM PARAMETER TRANSACTION

DATE

BY

TYPE	ACTION	HISTORY			COST / UNIT		MANDAY FACTOR	DAY	FIRST DATE		
		YR	MON	WK	MANPOWER ▲	COMPUTER ▲	▲		YYYY	MM	DD
10	A	2	12	26	150000	050000	00700	0	1978	09	11

80 COLUMN DATA SHEET

TITLE HOLIDAY TRANSACTIONS

DATE

BY

TYPE	ACTION	HOLIDAY DATE YYYY	MM	DD	NAME OF HOLIDAY
20	A	1978	01	01	NEW YEAR
20	A	1978	09	04	LABOUR DAY
20	A	1978	04	01	APRIL FOOL

TYPE	ACTION	HOLIDAY DATE YYYY	MM	DD
21	D	1978	04	01

TYPE	ACTION	HOLIDAY DATE YYYY	MM	DD	NAME OF HOLIDAY
22	C	1978	09	04	LABOR DAY

PUNCHED CARD DATA FORM

DATA DESCRIPTION: CUSTOMER TRANSACTION

PREPARED BY

DATE

PAGE 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
1																																																																												
2	TYPE		ACTION	CUSTOMER CODE					CUSTOMER NAME																												DEPARTMENT																																														
3																																																																																			
4	3	0	A	0	0	0	0	1	P	R	O	F	.		R	E	D	I	S	H																A	P	P	L	.		M	A	T	H	S	.																													
5	3	0	A	0	0	0	0	2	D	R	.		K	E	E	C	H																			C	O	M	P	.		C	E	N	T	E	R																													
6	3	0	A	0	0	0	0	3	P	R	O	F	.		M	A	S	T	E	R	S	O	N													C	O	M	P	.		C	E	N	T	E	R																													
7																																																																																		
8	TYPE		ACTION	CUSTOMER CODE																																																																																			
9																																																																																							
10	3	1	D	0	0	0	0	1																																																																														
11																																																																																					
12																																																																																					
13																																																																																					
14	TYPE		ACTION	CUSTOMER CODE					CUSTOMER NAME																																																																															
15																																																																																					
16	3	2	C	0	0	0	0	2	D	R		K	E	E	C	H																																																																							
17																																																																																				
18																																																																																					
19																																																																																					
20	TYPE		ACTION	CUSTOMER CODE					DEPARTMENT																																																																														
21																																																																																				
22	3	3	C	0	0	0	0	2	C	O	M	P	U	T	E	R		C	E	N	T	E	R																																																									
23	3	3	C	0	0	0	0	3	C	O	M	P	U	T	E	R		C	E	N	T	E	R																																																									
24																																																																																				
25																																																																																					

150

0 = ZERO 1 = ONE 2 = TWO

80 COLUMN DATA SHEET

TITLE STAFF TRANSACTION

DATE

BY

TYPE	ACTION	STAFF ID	STAFF NAME	CODE
40	A	00010	PAUL CHEUNG	A
40	A	00020	DORA CHEUNG	A
40	A	00030	DONALD CHEUNG	

TYPE	ACTION	STAFF ID
41	D	00030

TYPE	ACTION	STAFF ID	STAFF NAME
42	C	00010	PAUL N. K. CHEUNG

TYPE	ACTION	STAFF ID	CODE
43	C	00020	

PUNCHED CARD DATA FORM	DATA DESCRIPTION: PROJECT DEFINITION	PREPARED BY	DATE	PAGE 1 OF 3

TYPE	ACTION	PROJECT NUMBER
50	A	K1234

TYPE	ACTION	PROJECT NUMBER
51	D	

TYPE	ACTION	PROJECT NUMBER	LINE NUM	PROJECT TITLE
52	C	K1234	01	TRAFFIC FORECASTING SYSTEM
52	C	K1234	02	----------------------------

TYPE	ACTION	PROJECT NUMBER	PROPOSED BY	DATE PROPOSED YYYYMMDD
53	C	K1234	00002	19780807

TYPE	ACTION	PROJECT NUMBER	AUTHORIZED BY	DATE AUTHORIZED YYYYMMDD
54	C	K1234	00010	19780209

TYPE	ACTION	PROJECT NUMBER	TARGET DATE YYYYMMDD
55	C	K1234	19780915

0 = ZERO 1 = ONE 2 = TWO

ϕ = ALPHA O I = ALPHA I Ƶ = ALPHA Z

681 (REV. 12/74)

PUNCHED CARD DATA FORM	DATA DESCRIPTION: PROJECT DEFINITION	PREPARED BY:
		DATE:
		PAGE: 2

Col 1–2	Col 3	Col 4–13	Col 14–22
TYPE	ACTION	PROJECT NUMBER	PROJECT LEADER
56	C	K1234	00020

Col 1–2	Col 3	Col 4–13	Col 14–21	Col 22
TYPE	ACTION	PROJECT NUMBER	COMPLETION DATE YYYYMMDD	FLAG
57	C	K1234	19780831	1

Col 1–2	Col 3	Col 4–13	Col 14–22
TYPE	ACTION	PROJECT NUMBER	SERVICE ACCOUNT
58	C	K1234	ACCT20

Col 1–2	Col 3	Col 4–13	Col 14–22
TYPE	ACTION	PROJECT NUMBER	COMPUTER ACCOUNT
59	C	K1234	JSGRAD

Col 1–2	Col 3	Col 4–13	ESTIMATED COSTS		
TYPE	ACTION	PROJECT NUMBER	MANDAYS	COMPUTER HOUR	OTHER
62	C	K1234	0000030000	0000007500	0000009000

Col 1–2	Col 3	Col 4–13	Col 14–33
TYPE	ACTION	PROJECT NUMBER	TYPE OF APPLICATION
63	C	K1234	TRAFFIC

PUNCHED CARD DATA FORM

DATA DESCRIPTION: PROJECT DEFINITION

PREPARED BY

DATE

PAGE 3

TYPE	ACTION	PROJECT NUMBER	AREA OF SERVICE
64	C	N1234	BUDGET

TYPE	ACTION	PROJECT NUMBER	NO.	PROJECT KEYWORD
65	C	N1234	1	CRITICAL

PUNCHED CARD DATA FORM

DATA DESCRIPTION: PROJECT TEXT TRANSACTION

PREPARED BY:

DATE:

PAGE 1 OF 1

PROJECT DEFINITION

TYPE	ACTION	PROJECT NUMBER	CODE	LINE	PROJECT DESCRIPTION OR PROJECT NEWS
70	A	K1234	D	01	THIS PROJECT CONTAINS TOP SECRET.
70	A	K1234	D	02	NO PART SHOULD BE VIEWED WITHOUT WRITTEN PERMISSION.
70	A	K4321	N	01	THERE IS A MEETING ON FRIDAY 2.00 P.M. ROOM 304 GSS

TYPE	ACTION	PROJECT NUMBER	CODE	LINE
71	D	K1234	D	01
71	D	K1234	D	02

TYPE	ACTION	PROJECT NUMBER	CODE	LINE	PROJECT DESCRIPTION OR PROJECT NEWS
72	C	K4321	N	01	THERE IS A MEETING ON FRIDAY 3.00 P.M. ROOM 304 GSS

0 = ZERO 1 = ONE 2 = TWO

ϕ = ALPHA O I = ALPHA I Z = ALPHA Z

(12/74)

80 COLUMN DATA SHEET

TITLE STAFF-TIME TRANSACTION

DATE

BY

TYPE	ACTION	STAFF-ID	PROJECT-NO
80	A	00010	K1234
80	A	00020	K1234
80	A	00020	K4321

TYPE	ACTION	STAFF-ID	PROJECT-NO
81	D	00020	K4321

TYPE	ACTION	STAFF-ID	PROJECT-NO	BEGIN DATE			END DATE			TIME	
				YYYY	MM	DD	YYYY	MM	DD	HH	HH
82	C										

E.4 System Outputting

This program SYSPRT is for generating the standard and period end reports. Input is a single transaction which is used to define the time period and request the type of period end report. Period end reports should be suppressed for normal weekly run. The five types of report are PI100, PI110, PI200, PI300 and PI310. PI300 and PI310 are the period end report by project or staff.

Control cards for executing the program.

```
JOBD.
USER (usernum, password)
CHARGE (Chargenum)
ROUTE (PI100, DC=PR, FID=PI100, DEF)
ROUTE (PI110, DC=PR, FID=PI110, DEF)
ROUTE (PI200, DC=PR, FID=PI200, DEF)
ROUTE (PI300, DC=PR, FID=PI300, DEF)
ROUTE (PI310, DC=PR, FID=PI310, DEF)
GET (SYSPARM)
GET (HOLIDAY)
GET (STAFF, ISTAFF)
GET (SPOJECT, IPRJT)
GET (STIME)
GET (SYSRPT)
SYSRPT.
6/7/8/9
```

E.5 Deletion of Old Projects

Old Projects, that have been maintained in the database longer than history is retained, are deleted by running this program. No input is required. A deletion report is generated at the end of each run.

80 COLUMN DATA SHEET

TITLE PERIOD END TRANSACTION

DATE

BY

TYPE	ACTION	START DATE			END DATE		
		YYYY	MM	DD	YYYY	MM	DD
90	W	1978	01	01	1978	12	31

Control cards for running the program.

```
JOBE.
USER (usernum, password)
CHARGE (chargenum)
ROUTE (PI400, DC=PR, FID=PI400, DEF)
GET (SYSPARM)
GET (PROJECT, IPRJT)
GET (STIME)
GET (DELPRJT)
DELPRJT.
REPLACE (PROJECT, IPRJT)
REPLACE (STIME)
6/7/8/9
```

E.6 Query Reporting

Only one type of query reporting program has been implemented. It accesses the database and prints the information of projects with their corresponding Staff activities. Program QUCRT is run first to submit the criteria for selection of project, Customer, Service account, Staff and Project Leaders.

QURPT, retrieves the file created by the previous program, gathers the information from the database and output the print lines to a print file. QULIST retrieves the print file and displays the lines on the terminal.

Procedures to run the programs.

```
Sign on to a terminal.
/GET, QUCRT
/QUCRT
.
.
.  input selection criteria.
.
.
```

```
/REWIND, CRT
/GET, QURPT
/SUBMIT, QURPT, B
/STATUS, JN
     .
     .
     .   wait until QURPT has finished execution
     .   or sign-off and come back later.
     .
/GET, LST
/GET, QULIST
/QULIST
.
.
.   report from the query run.
.
.
Sign off
```

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