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.
ACKNOWLEDGEMENT

I wish to express my appreciation to my supervisor Professor J. Masterson for his guidance, assistance and valuable discussions throughout the duration of this work. I am thankful to Dr. Keech and Dr. Stephens for their useful contributions to this project.

I would like to thank all the faculty members, the graduate students and staff of the Department of Applied Mathematics, for their help in making my stay enjoyable.

Finally, I would like to dedicate this work to my wife May-Ying in appreciation of her sacrifices during this year.
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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 constraints. 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 Calendar 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 documentation, 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: $A(?) \neq V$ 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:** \( ?(E) \neq V \) 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:** \( ?(?) \neq V \) 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 thoroughly. 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

<table>
<thead>
<tr>
<th>PROJECT - NO</th>
<th>PROJECT TITLE</th>
<th>TIME REPORTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>12345</td>
<td>KEYPUNCH MACHINE -</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MAINTENANCE</td>
<td>2.5</td>
</tr>
<tr>
<td>45327</td>
<td>OVERHEAD</td>
<td>3.75</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>6.25 HRS.</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Transaction Type</th>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>A</td>
<td>Replacement of the System Parameter.</td>
</tr>
<tr>
<td>20</td>
<td>A</td>
<td>Addition of a Holiday record.</td>
</tr>
<tr>
<td>21</td>
<td>D</td>
<td>Deletion of a Holiday record.</td>
</tr>
<tr>
<td>22</td>
<td>C</td>
<td>Changing the name of the holiday.</td>
</tr>
<tr>
<td>30</td>
<td>A</td>
<td>Addition of a new Customer.</td>
</tr>
<tr>
<td>31</td>
<td>D</td>
<td>Deletion of a Customer record.</td>
</tr>
<tr>
<td>32</td>
<td>C</td>
<td>Changing of the Customer name.</td>
</tr>
<tr>
<td>33</td>
<td>C</td>
<td>Changing of the Department.</td>
</tr>
<tr>
<td>40</td>
<td>A</td>
<td>Addition of Staff record.</td>
</tr>
<tr>
<td>41</td>
<td>D</td>
<td>Deletion of Staff record.</td>
</tr>
<tr>
<td>42</td>
<td>C</td>
<td>Changing of the Staff Name field.</td>
</tr>
<tr>
<td>43</td>
<td>C</td>
<td>Changing of Authorization field.</td>
</tr>
<tr>
<td>50</td>
<td>A</td>
<td>Addition of Project record.</td>
</tr>
<tr>
<td>51</td>
<td>D</td>
<td>Deletion of Project record.</td>
</tr>
<tr>
<td>52</td>
<td>C</td>
<td>Changing Title fields.</td>
</tr>
<tr>
<td>53</td>
<td>C</td>
<td>Changing the Project Customer and Date-proposed.</td>
</tr>
<tr>
<td>Type</td>
<td>Action</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td>54</td>
<td>C</td>
<td>Changing the Project Manager and Date-authorized.</td>
</tr>
<tr>
<td>55</td>
<td>C</td>
<td>Changing the Target-date.</td>
</tr>
<tr>
<td>56</td>
<td>C</td>
<td>Changing the Project Leader.</td>
</tr>
<tr>
<td>57</td>
<td>C</td>
<td>Changing the Completion-date and Project Delete Flag.</td>
</tr>
<tr>
<td>58</td>
<td>C</td>
<td>Changing the Service Account.</td>
</tr>
<tr>
<td>59</td>
<td>C</td>
<td>Changing the Computer Account.</td>
</tr>
<tr>
<td>62</td>
<td>C</td>
<td>Changing the Estimated Costs.</td>
</tr>
<tr>
<td>63</td>
<td>C</td>
<td>Changing the Type of Application.</td>
</tr>
<tr>
<td>64</td>
<td>C</td>
<td>Changing the Area of Service.</td>
</tr>
<tr>
<td>65</td>
<td>C</td>
<td>Changing the keywords.</td>
</tr>
<tr>
<td>70</td>
<td>A</td>
<td>Addition of Project text record.</td>
</tr>
<tr>
<td>71</td>
<td>D</td>
<td>Deletion of Project text record.</td>
</tr>
<tr>
<td>72</td>
<td>C</td>
<td>Changing of one line of the Text.</td>
</tr>
<tr>
<td>80</td>
<td>A</td>
<td>Addition of Staff on project.</td>
</tr>
<tr>
<td>81</td>
<td>D</td>
<td>Deletion of Staff from project.</td>
</tr>
<tr>
<td>82</td>
<td>C</td>
<td>Changing of time spending.</td>
</tr>
</tbody>
</table>

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.

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

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

<table>
<thead>
<tr>
<th>Report number</th>
<th>Titles</th>
</tr>
</thead>
<tbody>
<tr>
<td>PI100</td>
<td>Project Activity Report by Project Manager.</td>
</tr>
<tr>
<td>PI110</td>
<td>Project Activity Report by Project Leader.</td>
</tr>
<tr>
<td>PI200</td>
<td>Staff Activity Report.</td>
</tr>
<tr>
<td>PI300</td>
<td>Period-end Report by Project.</td>
</tr>
<tr>
<td>PI310</td>
<td>Period-end Report by Staff.</td>
</tr>
</tbody>
</table>

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 criteria 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


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

<table>
<thead>
<tr>
<th>T-type</th>
<th>action</th>
<th>history retain</th>
<th>estimated cost unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>A</td>
<td>year</td>
<td>month</td>
</tr>
</tbody>
</table>

field explanation:

a) T-type - transaction type always 10  
   Record key of the file

b) Action - always A  

b) History Retain -
   
   year - number of yearly subtotals to be retained  
   
   month - number of monthly subtotals to be retained  
   
   week - number of weekly subtotals to be retained  

   d) Estimated cost unit -
   
   manpower - manpower cost per manday  
   
   computer - computer cost per hour  

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

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

\[1\] Record key of the file
g) First date of week - the corresponding start
date of the week in YYYY-MM-DD format

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.

<table>
<thead>
<tr>
<th>T-type</th>
<th>Action</th>
<th>Holiday Date</th>
<th>name of holiday</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>A</td>
<td>YYYY</td>
<td>MM</td>
</tr>
<tr>
<td>21</td>
<td>D</td>
<td>YYYY</td>
<td>MM</td>
</tr>
<tr>
<td>22</td>
<td>C</td>
<td>YYYY</td>
<td>MM</td>
</tr>
</tbody>
</table>

field explanation:

a) T-type - transaction type 20, 21 or 22
b) Action - A, D or C
c) Holiday Date - the date of the holiday
d) Name of Holiday

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
field explanation:

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

b) Action - A, D or C

c) Customer code\(^1\) - A unique code assigned by department

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

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

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 |  |  | 
41 | D |  |  |
42 | C |  |  |
43 | C |  |  |

field explanation:

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

b) Action - A, D or C

c) Staff-ID\(^1\) - A unique identification of the Staff

d) Staff-name - name of the Staff

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

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

<table>
<thead>
<tr>
<th>T-type</th>
<th>Action</th>
<th>Project no</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>C</td>
<td>Project no</td>
</tr>
<tr>
<td>53</td>
<td>C</td>
<td>Project no</td>
</tr>
<tr>
<td>54</td>
<td>C</td>
<td>Project no</td>
</tr>
<tr>
<td>55</td>
<td>C</td>
<td>Project no</td>
</tr>
<tr>
<td>56</td>
<td>C</td>
<td>Project no</td>
</tr>
<tr>
<td>57</td>
<td>C</td>
<td>Project no</td>
</tr>
<tr>
<td>58</td>
<td>C</td>
<td>Project no</td>
</tr>
<tr>
<td>59</td>
<td>C</td>
<td>Project no</td>
</tr>
<tr>
<td>62</td>
<td>C</td>
<td>Project no</td>
</tr>
<tr>
<td>63</td>
<td>C</td>
<td>Project no</td>
</tr>
<tr>
<td>64</td>
<td>C</td>
<td>Project no</td>
</tr>
<tr>
<td>65</td>
<td>C</td>
<td>Project no</td>
</tr>
</tbody>
</table>

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

c) Project no\(^1\) - a unique code which identifies individual projects

d) Line no. - either 1 or 2

e) Project title - title of the project maximum 130 characters

f) Proposed by - contains the code of a customer who proposed the project

g) Date proposed - in YYYY-MM-DD format

h) Authorized by - contains the Staff-ID of the Project Manager who gives permission to develop the project

i) Date authorized in YYYY-MM-DD

j) Target date in YYYY-MM-DD format

k) Project Leader - contains the Staff-ID of the Project Leader

l) Completion-date - in YYYY-MM-DD format

m) Delete flag either '0' or '1', '1' indicates the project is completed

n) Service account

o) Computer account

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.

<table>
<thead>
<tr>
<th>T-type</th>
<th>Action</th>
<th>Project no</th>
<th>Text code</th>
<th>line no</th>
<th>text</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 - Project number  
AN-10
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.

<table>
<thead>
<tr>
<th>T-type</th>
<th>Action</th>
<th>Staff-ID</th>
<th>Project-no</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>82</td>
<td>C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date of week beginning</th>
<th>YYYY</th>
<th>MM</th>
<th>DD</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Date of week ending</th>
<th>time</th>
</tr>
</thead>
<tbody>
<tr>
<td>YYYY</td>
<td>MM</td>
</tr>
</tbody>
</table>

Field explanation:

a) T-type - transaction type 80, 81 or 32
b) Action - A, D or C

Project-no, text code and line no form the concatenated key,
c) **Staff-ID** - the identification code of the Staff on the project AN-10

d) **Project-no** - 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 subtotal report may be requested.

<table>
<thead>
<tr>
<th>T-type</th>
<th>Report type</th>
<th>Start date</th>
<th>end date</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td></td>
<td>YYYY MM DD</td>
<td>YYYY MM DD</td>
</tr>
</tbody>
</table>

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

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

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

<table>
<thead>
<tr>
<th>Program</th>
<th>Compile Time (Sec)</th>
<th>Execution Time (Sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>INIT</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>TIMERPT</td>
<td>21</td>
<td>17</td>
</tr>
<tr>
<td>SORTREC</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>UPTONE 1</td>
<td>37</td>
<td>12</td>
</tr>
<tr>
<td>UPTTWO 1</td>
<td>46</td>
<td>23</td>
</tr>
<tr>
<td>SYSRPT 1</td>
<td>75</td>
<td>20</td>
</tr>
<tr>
<td>DELPRJT</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>QUCRT</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>QURPT</td>
<td>14</td>
<td>19</td>
</tr>
<tr>
<td>QU LIST</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

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 improve 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

TIME REPORTING 1.0
  - INPUT VIA TERMINAL 1.1
  - WEEKLY BATCH INPUT 1.2

SYSTEM INFORMATION UPDATING 2.0
  - RECORD UPDATING 2.1
  - TERMINAL UPDATING 2.2

WEEKLY SYSTEM OUTPUTS 3.0
  - PERIOD END REPORTS 3.1
  - HISTORY AND DELETION REPORTS 3.2

QUERY OUTPUTS 4.0
  - REPORTS BY STAFF 4.1
  - REPORTS BY PROJECT 4.2
  - LIST STAFF ACTIVITIES 4.3
  - LIST PROJECT ACTIVITIES 4.4
  - LIST OTHER INFORMATION 4.5

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

1. START
2. GET SYSTEM PARAMETER RECORD
3. CALCULATE THEORETICAL FIRST OF CURRENT WEEK
4. NOTED A YEAR OR MONTH CHANGE DURING THE WEEK
5. STAFF-TIME AREA IN DB
6. CYCLE THE STAFF-TIME RECORDS
7. STAFF-TIME AREA IN DB
8. UPDATE SYSTEM PARAMETER RECORD
9. STAFF-TIME AREA IN DB
10. TIME-REPORTING TRANSACTION
11. TRANSACTION FILE CREATED BY TERMINAL INPUT PROGRAM
12. ROTATED STAFF-TIME AREA IN DB
13. PROCESS TIME REPORTING TRANSACTIONS
14. END
15. UPDATE STAFF-TIME AREA IN DB
16. UPDATE STAFF-TIME AREA IN DB
17. REJECTED TRANSACTION REPORT

SYSPARM AREA IN DB

GET SYSTEM PARAMETER RECORD

CALCULATE THEORETICAL FIRST OF CURRENT WEEK

NOTED A YEAR OR MONTH CHANGE DURING THE WEEK

STAFF-TIME AREA IN DB

CYCLE THE STAFF-TIME RECORDS

STAFF-TIME AREA IN DB

UPDATE SYSTEM PARAMETER RECORD

STAFF-TIME AREA IN DB

TIME-REPORTING TRANSACTION

TRANSACTION FILE CREATED BY TERMINAL INPUT PROGRAM

ROTATED STAFF-TIME AREA IN DB

PROCESS TIME REPORTING TRANSACTIONS

END

UPDATE STAFF-TIME AREA IN DB

UPDATE STAFF-TIME AREA IN DB

REJECTED TRANSACTION REPORT
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

START

SYSTEM PARAMETERS INPUT

UPDATING SYSTEM PARAMETER

UPDATING SYSTEM RECORD

UPDATING HOLIDAY RECORD

UPDATING CUSTOMER RECORD

UPDATING STAFF RECORD

UPDATING PROJECT INFORMATION

UPDATING MESSAGES

UPDATING MESSAGES

UPDATING MESSAGES

UPDATING MESSAGES

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

START

ACCEPT TRANSACTION

VALIDATE THE INPUT

PRINT REJECTED TRANSACTION

GENERATE STAFF ACTIVITY REPORT

GENERATE PROJECT ACTIVITY REPORT

DELETE OLD PROJECTS AND PRINT REPORT

END

PERIOD END REPORT TRANSACTION

STAFF ACTIVITY REPORT

REJECTED TRANSACTION

REJECTED TRANSACTION

PROJECT ACTIVITY REPORT

PROJECT ACTIVITY REPORT

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

START

ACCEPT STAFF IDENTIFICATION

LIST STAFF NUMBER OR NAME

ANALYZE LISTING CRITERIA

LIST TODAY'S AND PREVIOUS COMMITMENT

STAFF'S WORKING ACTIVITIES

END

LISTING OPTIONS
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 following 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 INIT

PROGRAM TIMERPT

PROGRAM SYSRPT

PROGRAM DELRPT

PROGRAM SORTREC

PROGRAM UPTONE

PROGRAM UPTWO

PROGRAM QUCRT

PROGRAM QURPT

PROGRAM QULIST

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

- SYSVARM
  - FILE

  - HOLIDAY
    - FILE

  - STAFF
    - FILE

  - USER
    - FILE

  - PROJECT
    - FILE

  - PROJECT TEXT
    - FILE

  - STAFF-TIME
    - FILE
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

START

OPEN I-O SYS.PARM FILE

GET SYSTEM PARAMETERS

CALCULATE THE FIRST DATE OF THE CURRENT WEEK

FLAG MONTH AND YEAR CHANGE DURING THE WEEK

OPEN I-O STAFF-TIME FILE

CYCLE ALL STAFF-TIME RECORDS

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

A

CLOSE STAFF-TIME FILE

UPDATE SYSTEM PARAMETERS

CLOSE SYSPARM FILE

OPEN STAFF-TIME, READ AND PRINT FILES

STAFF-TIME REPORTING

CLOSE STAFF-TIME READ AND PRINT FILES

END
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: TIMEPT
REMARK: SECTION - "CYCLE ALL STAFF-TIME RECORDS"
PAGE : 10F1

START

READ STAFF-TIME RECORD

CYCLE WEEKLY SUBTOTALS

INITIALIZE CURRENT SUBTOTALS

YEAR CHANGE?
N
MONTH CHANGE?
N
A
REWRITE STAFF-TIME RECORD
RETURN

A-1
CYCLE WEEKLY AND YEARLY SUBTOTALS
A-1
CYCLE WEEKLY AND MONTHLY SUBTOTALS
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: TIMERPT
REMARK: SECTION - "STAFF - TIME REPORTING"
PAGE: 1 OF 2

START

ACCEPT TIME TRANSACTION

VALIDATE DATES ON TRANSACTION

VALIDATE PROJECT COMPLETION

CHANGE TIME FROM HOUR TO MAN-DAY

READ CORR. STAFF - TIME RECORD

VALIDATE STAFF'S COMMITMENT ON PROJECT

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

Diagram:

- **P**
  - **MONTH OR YEAR CHANGE?**
    - **N** → **ACCUMULATE TOTAL AS CURRENT WEEK'S** → **B-2**
    - **Y** → **ACCUMULATE TOTAL AS CURRENT WEEK** → **B-2**
  - **Y** → **PSENDO WEEK?**
    - **N** → **ACCUMULATE TOTAL AS LAST WEEK'S INPUT**
    - **Y** → **REWRI TE STAFF-TIME RECORD** → **RETURN**
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: SORTREC, UPTONE AND UPTTWO
REMARKS: OVERVIEW
PAGE: 1 OF 1
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: SORTRC
REMARK: MAINLINE SECTION
PAGE: 1 OF 1

START

ACCEPT ALL TRANSACTIONS

SORT TRANSACTION IN ASCENDING ORDER BY TYPE

TYPE IS 250

Y

WRITE TO SORTTWO FILE

A-1

N

WRITE TO SORTONE FILE

A

DISPLAY ALL TRANSACTIONS

END
START

UPDATE SYSTEM PARAMETERS

UPDATE HOLIDAY RECORDS

UPDATE CUSTOMER RECORD

UPDATE STAFF RECORD

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

START

OPEN SYSPARAM AREA

VERIFY TRANS.
EVERY FIELD
SHOULD BE
FILLED

READ OLD
SYSTEM PARAM
RECORD

REWRITE
SYSTEM PARAMETER
RECORD

PRINT BOTH
OLD & NEW
SYSTEM
PARAM.

CLOSE SYSPARAM AREA

RETURN
START

TYPE IS 20?

CREATE NEW HOLIDAY RECORD

TYPE IS 21?

DELETE THE HOLIDAY RECORD

TYPE IS 22?

UPDATE THE HOLIDAY NAME FIELD

GENERATE INVALID TRANSACTION MESSAGE

READ NEXT TRANSACTION

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

START

Type is 30?

Y → CREATE NEW RECORD

N → TYPE IS 31?

Y → DELETE THE OLD RECORD

N → TYPE IS 32?

Y → UPDATE CUSTOMER-NAME FIELD

N → TYPE IS 33?

Y → UPDATE DEPARTMENT FIELD

N → GENERATE INVALID TRANSACTION MESSAGE

RETURN

A

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

START

TYPE IS 40?

Y

CREATE NEW STAFF RECORD

A-1

N

TYPE IS 41?

Y

DELETE THE STAFF RECORD

A-1

N

TYPE IS 42?

Y

UPDATE THE STAFF NAME

A-7

N

TYPE IS 43?

Y

UPDATE THE AUTHORIZATION CODE

A-1

N

GENERATE INVALID TRANSACTION MESSAGE

READ NEXT TRANSACTION

RETURN

A
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: UPTWO
REMARK: MAINLINE SECTION
PAGE: 1 OF 1

START

UPDATE PROJECT RECORD

UPDATE PROJECT TEXT RECORD

UPDATE STAFF-TIME RECORD

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

START

TYPE IS 50 ?
Y -> CREATE NEW PROJECT RECORD -> C-3
N

TYPE IS 51 ?
Y -> FLAG THE PROJECT RECORD -> C-3
N

TYPE IS 52 ?
Y -> UPDATE THE PROJECT TITLE -> C-3
N

TYPE IS 53 ?
Y -> UPDATE THE PROJECT USER & PROPOSED DATE -> C-3
N

TYPE IS 54 ?
Y -> UPDATE THE PROJECT MANAGER & AUTHORIZED DATE -> C-3
N

TYPE IS 55 ?
Y -> UPDATE THE TARGET DATE FIELD -> C-3
N

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

A

TYPE IS 56?

Y

UPDATE THE PROJECT LEADER FIELD

C-3

N

TYPE IS 57?

Y

UPDATE COMPLETION DATE AND DELETE FLAG

C-3

N

TYPE IS 58?

Y

UPDATE SERVICE ACT FIELD

C-3

N

TYPE IS 59?

Y

UPDATE COMPUTER ACCOUNT

C-3

N

TYPE IS 62?

Y

UPDATE ESTIMATED COSTS FIELDS

C-3

N

TYPE IS 63?

Y

UPDATE TYPE-OF-APPL FIELD

C-3

B-3

N
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: UPTWO
REMARK: UPDATE PROJECT RECORD SECTION
PAGE: 3 of 3.
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: CPTTW0
REMARK: UPDATE PROJECT TEXT SECTION
PAGE: 10 OF 1

START

TYPE IS 70 ?

Y

CREATE NEW PROJECT TEXT RECORD

A-1

N

TYPE IS 71 ?

Y

DELETE THE PROJECT TEXT RECORD

A-1

N

TYPE IS 72 ?

Y

UPDATE THE DETAIL-LINE FIELD

A-1

N

GENERATE INVALID TRANSACTION MESSAGE

A

READ NEXT TRANSACTION

RETURN
START

TYPE IS 80?

CREATE NEW TRANSACTION

TYPE IS 81?

REMOVE STAFF FROM PROJECT BY SETTING THE DELETE FLAG

TYPE IS 82?

MODIFY THE TIME SUBTOTALS

GENERATE INVALID TRANSACTION MESSAGE

READ NEXT TRANSACTION

RETURN

A7

A7

A7
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

START

READ TRANSACTION 90

EOF ON INPUT?

A-2

CALCULATE THE PERIOD INDICE

PRODUCE PI 100 REPORT

PRODUCE PI 110 REPORT

PRODUCE PI 200 REPORT

B-2
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: SYSRPT
REMARK: MAINLINE SECTION
PAGE: 2 of 2
SYSTEM: PROJECT
PROGRAM: SYSRPT
REMARK: PRODUCE
PAGE: 1 OF 1

INFORMATION SYSTEM
PI/100 REPORT SECTION

START

RETRIEVE MANAGER RECORD

GET ALL PROJECT RECORD UNDER THE SAME MANAGER

RETRIEVE ALL STAFF-TIME RECORDS THAT WORK ON THE PROJECT

SUMMARIZE THE TIME SUBTOTALS

PRINT THE PI/100 REPORT

RETURN
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: SYSRPT
REMARK: PRODUCE P110 REPORT SECTION
PAGE: 1 OF 1

START

RETRIEVE THE PROJECT RECORD

GET THE PROJECT LEADER INFORMATION

GET ALL STAFF RECORDS THAT IS ON THE PROJECT

SUMMARIZE THE TIME SUBTOTALS

PRINT THE P110 REPORT

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

START

READ TIME REPORTING RELATION

END OF FILE

COND. CODE IS 627

COND. CODE IS 632

PRINT REPORT LINE

SET END OF FILE FLAG

PRINT PI200 HEADINGS

RETURN
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: SYSRPT
REMARK: PRODUCE PI 300 REPORT
PAGE: 1 OF 1

START

READ TIME-RECORDING RELATION

EOF?

COND. CODE IS 627?

COND. CODE IS 632?

SELECT THE TIME SUBTOTALS

OUTPUT PERIOD END REPORT LINE

RETURN

SET EOF FLAG ON

A-1

A7

PRINT PI 300 READING

B-1

A
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: DELPRJT
REMARK: OVERVIEW
PAGE: 1 of 1.
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: DELPRJ
REMARK: MAINLINE SECTION
PAGE: 1 OF 1

START

OPEN
PROJECT
FILE

DELETE
OLD
PROJECT

CLOSE
PROJECT
FILE

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

START
READ PROJECT FILE

EOF?

Y
SET EOF FLAG ON

A1

N
DELETE FLAG IS ON?

Y
COMPLETION DATE EXCEEDS DATE OF HIS-TORY?

N
DELETE PROJECT AND ALL ASSOCIATED STAFF-TIME RECORD

A1

N
PRINT DELETION REPORT

A1

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

START

OPEN ALL FILES

ACCEPT LISTING CRITERIA

GET PROJECT RECORD

CLOSE ALL FILES

END
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: QUERP
REMARK: GET-PROJECT-RECORD SECTION
PAGE: 102
SYSTEM: PROJECT INFORMATION SYSTEM
PROGRAM: QURPT
REMARK: GENERATE QUERY REPORT SECTION
PAGE: 1 OF 1

START

GET PROJECT LEADER INFORMATION

GET USER INFORMATION

FORMAT BRIEF REPORT

DETAIL REPORT NOT REQUESTED?

Y

A-1

N

GET ALL STAFF TIME RECORDS OF THE PROJECT

FORMAT DETAIL REPORT

RETURN

A
APPENDIX C

INPUT AND OUTPUT SAMPLES LISTING
**Punched Card Data Form**

**Data Description**

**System Parameter & Period End**

**Transaction**

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2 = TWO  
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I = ALPHA 1  
7 = ALPHA 7
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**Prepared By:**

**Date:**

**Page 1 of 8**
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A = ALPHA A  1 = ALPHA I  2 = ALPHA Z
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0 = ZERO 1 = ONE 2 = TWO
A = ALPHA A 1 = ALPHA I 2 = ALPHA Z
**80 COLUMN DATA SHEET**

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NUMBER OF ERROR ENCOUNTERED: 0
APPENDIX D

A LISTING OF THE PROGRAMS

The Schema and Subschemes runs have been enclosed. A complete listing of the programs can be obtained through the Department of Applied Mathematics.
00001  SCHEMA NAME IS PRJTINF-DIR.
00002  AREA NAME IS SYSPARM.
00003  AREA NAME IS HOLIDAY.
00004  AREA NAME IS STAFF.
00005  AREA NAME IS CUSTOMER.
00006  AREA NAME IS PROJECT.
00007  AREA NAME IS PTEXT.
00008  AREA NAME IS STIME.

00010  *
00011  FILE NAME SYSPARM
00012  FILE ORGANIZATION INDEXED SEQUENTIAL
00013  RECORD FORMAT FIXED
00014  RECORD SIZE 30 CHARACTERS

00016  RECORD NAME IS SYSPARM-REC WITHIN SYSPARM,
00017
00018  01 NUM-YEAR PIC 9(02). CHECK VALUE 0 THRU 10.
00019  01 NUM-MONTH PIC 9(02). CHECK VALUE 0 THRU 24.
00020  01 NUM-WEEK PIC 9(02). CHECK VALUE 0 THRU 52.
00021  01 MANPOWER-PER-MANDAY PIC 9(03). CHECK VALUE 0 THRU 24.
00022  01 COMPUTER-PER-HOUR PIC 9(03). CHECK VALUE 0 THRU 24.
00023  01 MANDAY-FACTOR PIC 9(03). CHECK VALUE 0 THRU 24.
00024  01 FIRST-DAY-OF-WEEK PIC 9(01). CHECK VALUE 0 THRU 6.
00025  01 FIRST-YYYY PIC 9(04). CHECK VALUE 0 THRU 2050.
00026  01 FIRST-MM PIC 9(02). CHECK VALUE 0 THRU 12.
00027  01 FIRST-DD PIC 9(02). CHECK VALUE 0 THRU 31.

00029  *
00030  FILE NAME HOLIDAY
00031  FILE ORGANIZATION INDEXED SEQUENTIAL
00032  RECORD FORMAT FIXED
00033  RECORD SIZE 23 CHARACTERS

00035  RECORD NAME IS HOLIDAY-REC WITHIN HOLIDAY,
00036  01 HOLIDAY-YYYY PIC 9(04). CHECK VALUE 0000 THRU 2050.
00058 01 HOLIDAY-MM  PIC  #9(2)#  CHECK VALUE  0 THRU  12.
00059 01 HOLIDAY-DD  PIC  #9(2)#  CHECK VALUE  0 THRU  31.
00060 01 HOLIDAY-NAME  PIC  F(15)#.

/*
FILE NAME: STAFF
FILE ORGANIZATION: INDEXED SEQUENTIAL
RECORD FORMAT: FIXED
RECORD SIZE: 36 CHARACTERS
*/

00067 01 STAFF-ID  PIC  #X(10)#.
00068 01 STAFF-NAME  PIC  #X(25)#.
00069 01 AUTHORIZATION  CHECK VALUE  # # #A#.

00070 01 RECORD NAME IS STAFF-REC WITHIN STAFF.

/*
FILE NAME: CUSTOMER
FILE ORGANIZATION: INDEXED SEQUENTIAL
RECORD FORMAT: FIXED
RECORD SIZE: 50 CHARACTERS
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00072 01 CUSTOMER-CODE  PIC  #X(10)#.
00073 01 CUSTOMER-NAME  PIC  #X(25)#.
00074 01 DEPT  PIC  #X(20)#.

00075 01 RECORD NAME IS CUSTOMER-REC WITHIN CUSTOMER.

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FILE NAME: PROJECT
FILE ORGANIZATION: INDEXED SEQUENTIAL
RECORD FORMAT: FIXED
RECORD SIZE: 315 CHARACTERS
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00078 01 TITLE-FIRST  PIC  #X(65)#.
00079 01 TITLE-SECOND  PIC  #X(65)#.
00080 01 PROPOSED-YYYY  PIC  #9(10)#.

00081 01 RECORD NAME IS PROJECT-REC WITHIN PROJECT.
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* RECORD SIZE 77 CHARACTERS
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FILE ORGANIZATION: INDEXED SEQUENTIAL
RECORD FORMAT: VARIABLE-RECORD
RECORD SIZE: 135 TO 759 CHARACTERS

RECORD NAME: IS STIME-REC-WITHIN-STIME.

01 S-STAFF-ID PIC X(10).
01 S-PRJ-NO PIC X(10).
01 S-FLAG PIC X(10).
01 LATEST-YR PIC 9(04).
01 LATEST-MN PIC 9(04).
01 LATEST-WK PIC 9(04).
01 NUM-WK PIC 9(04).
05 WEEK-YYYY PIC 9(04).
05 WEEK-MM PIC 9(04).
05 WEEK-DD PIC 9(04).
05 WEEK-SUB PIC 9(04).

DATA CONTROL:
AREA NAME IS SYSPARM
KEY IS FIRST-DAY-OF-WEEK
DUPLICATES ARE NOT ALLOWED.
AREA NAME IS HOLIDAY
KEY IDENTIFIER IS HOLIDAY-YYYY
HOLIDAY-MM HOLIDAY-DD
DUPLICATES ARE NOT ALLOWED.
AREA NAME IS STAFF
KEY IS STAFF-ID
DUPLICATES ARE NOT ALLOWED.
KEY IS ALTERNATE AUTHORIZATION
DUPLICATES ARE INDEXED.
AREA NAME IS CUSTOMER
KEY IS CUSTOMER-CODE
DUPLICATES ARE NOT ALLOWED.
KEY IS ALTERNATE DEPT
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All records are within the source listing with no specific subset.
10 WK-SUB OCCURS 1 TO 52 TIMES DEPENDING ON NUM-WK.
15 WEEK-BEGIN-DATE.
20 WEEK-MM PIC 9(02).
20 WEEK-YY PIC 9(04).
20 WEEK-DD PIC 9(03).
15 WEEK-SUB PIC 9(03)V99.

PRIMARY KEY 00031 FIRST-DAY-OF-WEEK FOR AREA PARM-FILE
PRIMARY KEY 00032 HOAY-KEY FOR AREA HOAY-FILE
PRIMARY KEY 00045 STAFF-ID FOR AREA STAFF-FILE
ALTERNATE KEY 00048 AUTHORIZATION FOR AREA STAFF-FILE
PRIMARY KEY 00050 CUSTOMER-QUOTE-FOR-AREA CUST-FILE
ALTERNATE KEY 00052 DEPT-FOR AREA CUST-FILE
PRIMARY KEY 00055 PROJ-ID FOR AREA PROJ-FILE
ALTERNATE KEY 00077 PROJ-LEADER FOR AREA PROJ-FILE
ALTERNATE KEY 00078 PROJ-MANAGER FOR AREA PROJ-FILE
ALTERNATE KEY 00079 PROJ-USER FOR AREA PROJ-FILE
ALTERNATE KEY 00091 SERVICE-ACCOUNT FOR AREA PROJ-FILE
ALTERNATE KEY 00092 TYPE-OF-APPL FOR AREA PROJ-FILE
ALTERNATE KEY 00093 AREA-OF-SVC FOR AREA PROJ-FILE
ALTERNATE KEY 00094 KH-1 FOR AREA PROJ-FILE
ALTERNATE KEY 00095 KH-3 FOR AREA PROJ-FILE
ALTERNATE KEY 00096 KH-4 FOR AREA PROJ-FILE
ALTERNATE KEY 00097 KH-5 FOR AREA PROJ-FILE
ALTERNATE KEY 00098 KH-6 FOR AREA PROJ-FILE
ALTERNATE KEY 00099 KH-7 FOR AREA PROJ-FILE
ALTERNATE KEY 00100 KH-8 FOR AREA PROJ-FILE
ALTERNATE KEY 00101 KH-9 FOR AREA PROJ-FILE
ALTERNATE KEY 00102 TIME-KEY FOR AREA TIME-FILE
PRIMARY KEY 00103 TYPE-KEY FOR AREA STHM-FILE

***** RELATION DIVISION.
***** ON IS TIME-REPORTING.
***** ON IS TIME-ON-PRJT.
****** END OF SUB-SHEMA SOURCE INPUT.

RELATION 001
TIME-REPORTING TRAVERS AREA - STAFF-FILE
RELATION 002
TIME-ON-PRJT TRAVERS AREA - PROJ-FILE

BEGIN SUB-SHEMA FILE MAINTENANCE

DDL COMPLETE. 05:40:DH CH USED.
CP TIME USED= 1.592 SECONDS
* SOURCE LISTING * DDL 2.1 (78136) - 460 78/09/12, 13.57.32.  

** SOURCE LISTING **

** TITLE DIVISION:**

** SS TIMESUB WITHIN PRJTFINF-DB. **

** ALIAS DIVISION:**

AD REALM SYSPARM BECOMES PARM-FILE.
AD REALM PROJECT BECOMES PRJT-FILE.
AD REALM STIME BECOMES STME-FILE.

** REALM DIVISION:**

RD PARM-FILE, STME-FILE, PRJT-FILE.

** RECORD DIVISION:**

** 01 SYSPARM-REC. **

** 05 HISTORY-RETAIN. **

10 NUM-YEAR PIC 9(02).
10 NUM-MONTH PIC 9(02).
10 NUM-WEEK PIC 9(02).

** 05 COST-PER-UNIT. **

10 MANPOWER-COST-PER-MANHOUR PIC 9(03)V99.
10 COMPUTER-COST-PER-HOUR PIC 9(03)V99.

** 05 MANDAY-FACTOR. **

10 FIRST-DAY-OF-WEEK PIC X(01).
10 FIRST-YDAY PIC 9(02).
10 FIRST-HD PIC 9(02).
10 FIRST-DO PIC 9(02).

** 10 PROJECT-REC. **

** 05 PRJT-NO PIC X(10). **

** 05 PRJT-O-FLAG PIC X(10). **

** 01 STIME-REC. **

** 05 TIME-KEY. **

10 S-PRJT-NO PIC X(10).
10 S-STAFF-ID PIC X(10).

** 05 STIME-FLAG PIC X(01). **

** 05 YEAR-SUFTOTALS. **

10 LATEST-Y YEAR-SUFTOTALS PIC 9(04).
10 TR-SUFTOTALS OCCURS 10 TIMES PIC 9(04)V99.

** 05 MONTH-SUFTOTALS. **

10 LATEST-MONTH PIC 9(02).
10 TR-SUFTOTALS OCCURS 24 TIMES PIC 9(04)V99.

** 05 WEEK-SUFTOTALS. **

10 LATEST-WK-PTR PIC 9(02).
10 LATEST-WK-PTR PIC 9(02).
10 NUM-WK PIC 9(02).
10 WK-SUFTOTALS OCCURS 1 TO 52 TIMES DEPENDING ON NUM-WK.

** 15 WEEK-BEGIN-DAY. **

15 WEEK-BEGIN-DAY PIC 9(04).
15 WEEK-BEGIN-DAY PIC 9(04).
15 WEEK-BEGIN-DAY PIC 9(04).
15 WEEK-BEGIN-DAY PIC 9(04).
15 WEEK-BEGIN-DAY PIC 9(04).

15 FIRST-SUFTOTALS PIC 9(04)V99.

*** 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

DOL COMPLETE. 0540380 CH USED. 0 DIAGNOSTICS.

CPU TIME USED= 0.754 SECONDS
TITLE DIVISION.
  SS UPTONE WITHIN PRUTINF-09.

ALIAS DIVISION.
  AD REALM SYSPPM BECOMES PARM-FILE.
  AD REALM HOLIDAY BECOMES HDAY-FILE.
  AD REALM STAFF BECOMES STAF-FILE.
  AD REALM CUSTOMR BECOMES CUST-FILE.

REALM DIVISION.
  PARM-FILE, HDAY-FILE, STAF-FILE, CUST-FILE.

RECORD DIVISION.
  01 SYSPARM-REC.
    05 HISTORY-RETAIN.
      10 NUM-YEAR PIC 9(02).
      10 NUM-MONTH PIC 9(02).
      10 NUM-WEEK PIC 9(02).
      05 COST-PER-UNIT PIC 9(03)V99.
      10 HANPPES-PER-MANDAY PIC 9(03)V99.
      10 COMPUTER-PER-HOUR PIC 9(03)V99.
      05 HANPPES-FACTOR PIC 9(03)V99.
      05 FIRST-DAY-OF-WEK PIC X(01).
      10 FIRST-HH PIC 9(02).
      10 FIRST-DD PIC 9(02).
  01 HOLIDAY-REC.
    05 HDAY-KEY.
      10 HOLIDAY-YYYY PIC 9(04).
      10 HOLIDAY-MM PIC 9(02).
      10 HOLIDAY-DD PIC 9(02).
      05 HOLIDAY-NAME PIC X(15).
  01 STAFF-REC.
    03 STAFF-ID.
      05 STAFF-NAME PIC X(25).
      05 AUTHORIZATION PIC X(01).
  01 CUSTOMER-REC.
    03 CUSTOMER-CODE PIC X(05).
    03 CUSTOMER-NAME PIC X(25).
      05 DEPT PIC X(20).

END OF SUB-SCHMMA 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 00044 AUTHORIZATION FOR AREA STAF-FILE
PRIMARY KEY 00045 CUST-KEY FOR AREA CUST-FILE
ALTERNATE KEY 00049 DEPT FOR AREA CUST-FILE
***** RECORD MAPPING IS NEEDED FOR REALM - PARM-FILE
***** RECORD MAPPING IS NEEDED FOR REALM - HOAY-FILE
***** RECORD MAPPING IS NEEDED FOR REALM - STAF-FILE
***** RECORD MAPPING IS NOT NEEDED FOR REALM - CUST-FILE

BEGIN SUB-SCHHEMA FILE MAINTENANCE

DDL COMPLETE. 05400037 CM USED.
CP TIME USED= 0.610 SECONDS
RECORD MAPPING IS NEEDED FOR REALM - FILE

BEGIN SUB-SCHEMA FILE MAINTENANCE

END OF FILE MAINTENANCE

DDL COMPLETE. 054000B CM USED. 0 DIAGNOSTICS.

CP TIME USED = 1.440 SECONDS
**SOURCE LISTING**  
DOL 2.1 (78136) - 460  78/09/12. 13.57.22.  PAGE 1

**TITLE DIVISION.**

**SOURCE LISTING** DOL 2.1 (78136) - 460  78/09/12. 13.57.22.  PAGE 1

**SOURCE LISTING** DOL 2.1 (78136) - 460  78/09/12. 13.57.22.  PAGE 1

**ALIAS DIVISION.**

AD REALM SYSPARM BECOMES PARK-FILE.
AD REALM HOLIDAY BECOMES HOAY-FILE.
AD REALM STAFF BECOMES STAF-FILE.
AD REALM PROJECT BECOMES PRJT-FILE.
AD REALM STIME BECOMES STME-FILE.

**REALM DIVISION.**

RD PARK-FILE, HOAY-FILE, STAF-FILE, PRJT-FILE, STME-FILE.

**RECORD DIVISION.**

01 SYSPARM-REC.
   05 HISTORY-RETN.
      10 - NUM-YEAR.
          PIC 9(02).
      10 - NUM-MONTH.
          PIC 9(02).
      10 - NUM-WEEK.
          PIC 9(02).
      05 COST-FR-UNIT.
          10 - MANPOWER-FR-MONTH PIC 9(01)V99.
          10 - COMPUTE-FR-HOUR PIC 9(02)V99.
      05 MANDAY-FACT.
          05 FIRST-DAY-OF-MONTH PIC X(01).
          05 FIRST-DAY-OF-WEEK PIC X(01).
      05 HOLIDAY-REC.
          05 HOAY-KEY.
             10 - HOLIDAY-YYYY.
                PIC 9(04).
             10 - HOLIDAY-MM.
                PIC 9(02).
             10 - HOLIDAY-DD.
                PIC 9(02).
          05 HOLIDAY-NAME PIC X(15).  
      05 STAFF-REC.
          05 STAFF-ID.
             PIC X(10).  
          05 STAFF-NAME PIC X(25).
      05 PROJECT-REC.
          05 PRJT-NO.
             PIC X(10).  
          05 PRJT-TITLE.
             10 - TITLE-FIRST.
                PIC X(65).
             10 - TITLE-SECOND.
                PIC X(65).
          05 PRJT-KEY-DATES.
             10 - DATE-PROPOSED.
                PIC 9(04).
             15 - PROPOSED-MM PIC 9(02).
             15 - PROPOSED-DD PIC 9(02).
             10 - DATE-AUTHORIZED.
                  15 - AUTHORIZED-YYYY PIC 9(04).
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**Primary Key**
- PRIMARY KEY 00035 - FIRST-DAY-OF-WEEK FOR AREA PARM-FILE
- PRIMARY KEY 00036 - MON-DAY-KEY FOR AREA HOURLY-FILE
- PRIMARY KEY 00037 - STAFF-ID FOR AREA STAFF-FILE
- PRIMARY KEY 00042 - AUTHORIZATION FOR AREA STAFF-FILE
- PRIMARY KEY 00047 - PRJ-NO FOR AREA PRJ-FILE
- PRIMARY KEY 00054 - PRJ-LEADER FOR AREA PRJ-FILE
- PRIMARY KEY 00057 - PRJ-MANAGER FOR AREA PRJ-FILE
- PRIMARY KEY 00058 - PRJ-USER FOR AREA PRJ-FILE
- PRIMARY KEY 00059 - ACCOUNT FOR AREA PRJ-FILE
- PRIMARY KEY 00060 - SERVICE-ACCT FOR AREA PRJ-FILE
- PRIMARY KEY 00061 - COMPUTER-ACCT FOR AREA PRJ-FILE
- PRIMARY KEY 00062 - ESTIMATED-COST FOR AREA PRJ-FILE
- PRIMARY KEY 00063 - E-COMP-HR FOR AREA PRJ-FILE
- PRIMARY KEY 00064 - E-OTHER FOR AREA PRJ-FILE
- PRIMARY KEY 00065 - PRJ-KEYWORDS FOR AREA PRJ-FILE
- PRIMARY KEY 00066 - TYPE-OF-APPL FOR AREA PRJ-FILE
- PRIMARY KEY 00067 - AREA-OF-SVC FOR AREA PRJ-FILE
- PRIMARY KEY 00068 - KW-1 FOR AREA PRJ-FILE
- PRIMARY KEY 00069 - KW-2 FOR AREA PRJ-FILE
- PRIMARY KEY 00070 - KW-3 FOR AREA PRJ-FILE
- PRIMARY KEY 00071 - PRJ-D-FLAG FOR AREA PRJ-FILE
- PRIMARY KEY 00072 - TIME-REC FOR AREA PRJ-FILE
- PRIMARY KEY 00073 - TIME-KEY FOR AREA PRJ-FILE
- PRIMARY KEY 00074 - STAFF-ID FOR AREA PRJ-FILE
- PRIMARY KEY 00075 - STAFF-NO FOR AREA PRJ-FILE
- PRIMARY KEY 00076 - YEAR-SUMTOTALS FOR AREA PRJ-FILE
- PRIMARY KEY 00077 - LATEST-YR FOR AREA PRJ-FILE
- PRIMARY KEY 00078 - YR-SUB OCCURS 10 TIMES FOR AREA PRJ-FILE
- PRIMARY KEY 00079 - YEAR-SUM TOTALS FOR AREA PRJ-FILE
- PRIMARY KEY 00080 - LATEST-MON FOR AREA PRJ-FILE
- PRIMARY KEY 00081 - MON-SUB OCCURS 24 TIMES FOR AREA PRJ-FILE
- PRIMARY KEY 00082 - MONTH-SUMTOTALS FOR AREA PRJ-FILE
- PRIMARY KEY 00083 - LATEST-WK-PTR FOR AREA PRJ-FILE
- PRIMARY KEY 00084 - NUM-WK FOR AREA PRJ-FILE
- PRIMARY KEY 00085 - WEEK-SUB OCCURS 1 TO 52 TIMES DEPENDING ON NUM-WK FOR AREA PRJ-FILE
- PRIMARY KEY 00086 - WEK-BEG-DATE FOR AREA PRJ-FILE
- PRIMARY KEY 00087 - WEEK-MM FOR AREA PRJ-FILE
- PRIMARY KEY 00088 - WEEK-CD FOR AREA PRJ-FILE
- PRIMARY KEY 00089 - WEEK-SUB FOR AREA PRJ-FILE

**Alternate Key**
- ALTERNATE KEY 00042 - AUTHORIZATION FOR AREA STAFF-FILE
- ALTERNATE KEY 00059 - PRJ-LEADER FOR AREA PRJ-FILE
- ALTERNATE KEY 00070 - PRJ-D-FLAG FOR AREA PRJ-FILE

**Other**
- 00054 - 15 AUTHORIZED-MM PIC 9(2).
- 00055 - 15 AUTHORIZED-DD PIC 9(2).
- 00056 - 10 TARGET-DATE PIC 9(2).
- 00057 - 15 TARGET-MM PIC 9(2).
- 00058 - 15 TARGET-DD PIC 9(2).
- 00059 - 10 COMPLETION-DATE PIC 9(2).
- 00060 - 15 COMPLETION-MM PIC 9(2).
- 00061 - 15 COMPLETION-DD PIC 9(2).
- 00062 - 05 PERSONS PIC 9(5).
- 00063 - 10 PRJ-LEADER PIC X(10).
- 00064 - 10 PRJ-MANAGER PIC X(10).
- 00065 - 10 PRJ-USER PIC X(10).
- 00066 - 10 ACCOUNT PIC X(10).
- 00067 - 10 SERVICE-ACCT PIC X(10).
- 00068 - 10 COMPUTER-ACCT PIC X(10).
- 00069 - 05 ESTIMATED-COST PIC X(10).
- 00070 - 10 E-COMP-HR PIC 9(3).
- 00071 - 10 E-OTHER PIC 9(3).
- 00072 - 10 PRJ-KEYWORDS PIC X(20).
- 00073 - 10 TYPE-OF-APPL PIC X(20).
- 00074 - 10 AREA-OF-SVC PIC X(20).
- 00075 - 10 KW-1 PIC X(9).
- 00076 - 10 KW-2 PIC X(9).
- 00077 - 10 KW-3 PIC X(9).
- 00078 - 05 PRJ-D-FLAG PIC X(10).
- 00079 - 01 TIME-REC PIC X(10).
- 00080 - 05 TIME-KEY PIC X(10).
- 00081 - 10 STAFF-ID PIC X(10).
- 00082 - 10 STAFF-NO PIC X(10).
- 00083 - 05 YEAR-SUMTOTALS PIC 9(4).
- 00084 - 10 LATEST-YR PIC 9(4).
- 00085 - 10 YR-SUB OCCURS 10 TIMES PIC 9(4)99.
- 00086 - 05 MONTH-SUMTOTALS PIC 9(4).
- 00087 - 10 LATEST-MON PIC 9(2).
- 00088 - 10 MON-SUB OCCURS 24 TIMES PIC 9(4)99.
- 00089 - 05 WEEK-SUMTOTALS PIC 9(4).
- 00090 - 10 LATEST-WK-PTR PIC 9(2).
- 00091 - 10 NUM-WK PIC 9(2).
- 00092 - 10 WEEK-SUB OCCURS 1 TO 52 TIMES DEPENDING ON NUM-WK PIC 9(5).
- 00093 - 15 WEK-BEG-DATE PIC 9(2).
- 00094 - 20 WEEK-MM PIC 9(2).
- 00095 - 20 WEEK-CD PIC 9(2).
- 00096 - 15 WEEK-SUB PIC 9(5)99.
ALTERNATE KEY 00071 - PRJT-USER FOR AREA PRJT-FILE
ALTERNATE KEY 00073 - SERVICE-ACC FOR AREA PRJT-FILE
ALTERNATE KEY 00090 - TYPE-OF-APPL FOR AREA PRJT-FILE
ALTERNATE KEY 00094 - AREA-OF-SVC FOR AREA PRJT-FILE
ALTERNATE KEY 00095 - KW-1 FOR AREA PRJT-FILE
ALTERNATE KEY 00096 - KW-2 FOR AREA PRJT-FILE
ALTERNATE KEY 00096 - KW-3 FOR AREA PRJT-FILE
PRIMARY KEY 00044 - TIME-KEY FOR AREA STME-FILE

00099 - RELATION DIVISION.
00110 - RN IS TIME-REPORTING.
00111 - END OF SUB-SCHEMA SOURCE INPUT

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

BEGIN SUB-SCHEMA FILE MAINTENANCE

DOL COMPLETE: 0548093:CM USED. 0 DIAGNOSTICS.
CP TIME USED: 1.522 SECONDS
TITLE DIVISION.
SS 'OURSIR WITHIN PRJTINF-DB.

ALIAS DIVISION.
AD REALM STAFF BECOMES STAF-FILE.
AD REALM CUSTOMER BECOMES CUST-FILE.
AD REALM PROJECT BECOMES PRJT-FILE.
AD REALM STIME BECOMES STME-FILE.

REALM DIVISION.
AD STAF-FILE, CUST-FILE, PRJT-FILE, STME-FILE.

RECORD DIVISION.
01 STAFF-REC.
  05 STAFF-ID PIC X(10).
  05 STAFF-NAME PIC X(20).
01 AUTHORIZATION PIC X(10).
01 CUSTOMER-REC.
  05 CUSTOMER-CODE PIC X(10).
  05 CUSTOMER-NAME PIC X(20).
  05 DEPT PIC X(20).
01 PROJECT-REC.
  05 PRJT-NO PIC X(10).
  10 PRJT-TITLE PIC X(10).
    10 TITLE-FIRST PIC X(105).
    10 TITLE-SECOND PIC X(105).
  05 PRJT-KEY-DATES.
    10 DATE-PROPOSED PIC X(10).
      15 PROPOSED-YYYY PIC 9(04).
      15 PROPOSED-MM PIC 9(02).
      15 PROPOSED-DD PIC 9(02).
    10 DATE-AUTHORIZED PIC X(10).
      15 AUTHORIZED-YYYY PIC 9(04).
      15 AUTHORIZED-MM PIC 9(02).
      15 AUTHORIZED-DD PIC 9(02).
    10 TARGET-DATE PIC X(10).
      15 TARGET-YYYY PIC 9(04).
      15 TARGET-MM PIC 9(02).
      15 TARGET-DD PIC 9(02).
      10 COMPLETION-DATE PIC X(10).
        15 COMPLETION-YYYY PIC 9(04).
        15 COMPLETION-MM PIC 9(02).
        15 COMPLETION-DD PIC 9(02).
05 PRJT-LEADER PIC X(10).
05 PRJT-_MANAGER PIC X(10).
05 PRJT-USER PIC X(10).
05 ACCOUNT PIC X(10).
  10 SERVICE-ACCT PIC X(10).
  10 COMPUTER-ACCT PIC X(10).
  05 ESTIMATED-COST.
RELATION J01
TIME-REPORTING TRAVERSES AREA = STAF-FILE
RELATION J02
TIME-ON-PRJT TRAVERSES AREA = PRJT-FILE

BEGIN SUB-SCHEMA FILE MAINTENANCE

END OF FILE MAINTENANCE

DDL COMPLETE, 05400090 CM USED.
CP TIME USED = 1.242 SECONDS

0 DIAGNOSTICS.
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.

JOB A
USER (Usernum, Password)
CHARGE (Charge num)
GET (INIT)
INIT.
SAVE (SYSPARM)
SAVE (HOLIDAY)
SAVE (CUSTOMR, ICUST)
SAVE (STAFF, ISTAFF)
SAVE (PROJECT, IPRJT)
SAVE (PTEXT)
SAVE (STIME)
6/7/8/9

144
<table>
<thead>
<tr>
<th>PROJECT-NO</th>
<th>BEGIN DATE</th>
<th>END DATE</th>
<th>TIME</th>
</tr>
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<tbody>
<tr>
<td>1234</td>
<td>19780911</td>
<td>19780918</td>
<td>0100</td>
</tr>
<tr>
<td>1234</td>
<td>19780911</td>
<td>19780912</td>
<td>0250</td>
</tr>
</tbody>
</table>
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
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<th>ACTION</th>
<th>HISTORY</th>
<th>COST/UNIT</th>
<th>MANPOWER</th>
<th>COMPUTER</th>
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<td>12</td>
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<td>0700</td>
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**Title**: SYSTEM PARAMETER

**Transaction**
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<td>20A</td>
<td>4</td>
<td>19780101</td>
<td>NEW YEAR</td>
</tr>
<tr>
<td>2CA</td>
<td>4</td>
<td>19780904</td>
<td>LABOUR DAY</td>
</tr>
<tr>
<td>20A</td>
<td>4</td>
<td>19780401</td>
<td>APRIL FOOL</td>
</tr>
<tr>
<td>21D</td>
<td>4</td>
<td>19780404</td>
<td></td>
</tr>
<tr>
<td>22C</td>
<td>4</td>
<td>19780904</td>
<td>LABOR DAY</td>
</tr>
<tr>
<td>TYPE</td>
<td>CUSTOMER CODE</td>
<td>CUSTOMER NAME</td>
<td>DEPARTMENT</td>
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<td>---------------</td>
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<td>000001</td>
<td>PROF. REDISH</td>
<td>APPL. MATHS.</td>
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<tr>
<td>30A</td>
<td>000002</td>
<td>DR. KEECH</td>
<td>COMP. CENTER</td>
</tr>
<tr>
<td>30A</td>
<td>000003</td>
<td>PROF. MASTERSON</td>
<td>COMP. CENTER</td>
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<tr>
<td>31D</td>
<td>000001</td>
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<tr>
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<td>DR. KEECH</td>
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<tr>
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<td>A</td>
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0 = ZERO  1 = ONE  2 = TWO
6 = ALPHA 0  I = ALPHA 1  Z = ALPHA Z
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<table>
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<td>--------</td>
<td>----------</td>
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</tr>
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<td></td>
</tr>
<tr>
<td>81</td>
<td>D</td>
<td>4,3,2,1</td>
<td></td>
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</table>

<table>
<thead>
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<th>Action</th>
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<th>Project No</th>
<th>Begin Date</th>
<th>End Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>82</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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 (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

<table>
<thead>
<tr>
<th>TYPE</th>
<th>ACTION</th>
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<tbody>
<tr>
<td>W</td>
<td>19780101</td>
<td>19781231</td>
<td></td>
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</table>
Control cards for running the program.

JOBE.
USER (username, password)
CHARGE (chargenum)
ROUTE (PI400, DC=PR, FID=PI400, DEF)
GET (SYSPARM)
GET (PROJECT, IPRJT)
GET (STIME)
GET (DELPRT)
DELPRT.
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.
/GRT, 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
BIBLIOGRAPHY


