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DST SEMINAR ON

Application of Computers to Bibliographical Information Processing: Some Developments in India (Bangalore) (10-13 July 1978)

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COMPUTERISED REFERRAL SERVICE: A CASE STUDY*

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Abstract

Describes the attempt to develop a software package for computerised referral service taking Machine Tools as a case study. The system was developed ax DRTC using an ICL 1901 computer and the program was written in COBOL Language. The creation of the files and answering of queries are explained. Sample copies of output are attached.

0 INTRODUCTION

Plainly two types of computerised information systems have beer recognised in the literature. They are

1 Data Providing Systems; and
2 Reference providing systems.

Normally in Reference Providing Systems, reference is given to documents. It has been realised that

* Based on a project report submitted to Documentation Research and Training Centre in 1977

institutions and specialists form important sources of information and hence reference to institutions and specialists have to be included in such reference providing systems.

1 OBJECTIVE

An attempt has been made to develop a software for computerised Referral Service in DRTC, taking Machine Tools as a case study which provides reference to institutions and specialists apart from documents. The methodology adopted can be used for establishing a computerised Referral Service in the National Information Systems for various disciplines. This paper reports the development of this software.

2 SYSTEMS OVERVIEW

The programs developed can be used to:

1 Create a data base on disk;

2 Retrieve and print the relevant records using the Search Expression formulated on the basis of user's query/requirements; and

3 Print the data base in a suitable format for reference purposes.

The system flow chart for the whole system is given in Appendix 1. The system is designed for answering queries requiring information about information sources as answers. The questions will usually be of the following nature:

1 Where can I get information about ... ?

2 Is there any specialist/consultant whom I can contact to solve this problem ... ?

3 Is there any institution which can give me Technical guidance on ...? etc.

3 STORAGE MEDIA AND FILE ORGANISATION

31 Storage Media

The system uses magnetic disk considering the following; features of it.

1 The direct access nature of magnetic disk (2); and

2 The ease with which records in the file can be addressed or inserted (1).

32 File Organisation

The system uses the inverted File Organisation considering the following advantages of it.

1 Only pertinent items are examined in the Main File as unwanted items are eliminated in the inverted index search;

2 Acceptable search times are obtained; and

3 The system is easily amenable for Boolean Search (5).

The system uses indexed sequential File considering the following advantage's of it:

1 It is efficient since the access time required in an indexed sequential file is less than in a serial file; and

2 It is easy to create and implement an indexed sequential file than Random files.

4 INPUT

The data base for the system consists of two files namely REFERRAL-DATA and KEYDIRECTORY on disk.

Data about the following type of information sources are collected for inclusion in the file REFERRAL-DATA.

1 Documentary sources like Directories, Handbooks, Abstracting and indexing periodicals etc;

2 Institutional sources; and

3 Specialist Sources.

For any information source to be included in the system necessary and sufficient data elements for complete identification of the sources are collected. For example: title, author; editor etc in the case of documentary sources; Name of the institution, address, subjects of specialisation etc in the case of specialist sources of information. For collecting information about institutional and specialist sources questionnaires were used. Worksheets for the differenr sources were prepared and these were used for collecting the necessary data elements from the questionnaires.

The descriptors or keywords assigned to information sources along with the record numbers, are collected in $5^{i:}$ x 3" slips. These form the input for KEYDIRECTORY, Each term in the KEYDIRECTORY is assigned a four digited numeric code.

5 PROGRAM DESCRIPTION

51 Program Identification

Name of the program	Computerised Referral Servicr
Acronym	CORS
Authors	Kuppuswamy, S
	Mahakuteshwar, H Y
	Manavalan, V
	Rajashekar, T S

52 Computer Requirements

We used an ICL 1901 computer with a memory size of 16k words with the following software packages from ICL

1. #= XRMJ (For transferring data from cards to magnetic tape)
2. =#=XSMM (For merging records from different magnetic tapes to one magnetic tape)
3. =#= XPJC (For allocation of file area on disk)
4. # XPJC (For transferring of data from magnetic tape to area allotted on disk)

Peripharals used were:

- One disk
- Four tape drives
- Card Reader
- Line Printer

53 Input Files

531 Referral Data

The file organisation is indexed sequential and access mode is Random. A physical record contains a maximum of 4,096 characters or 1,024 words.

The file contains three types of logical records.

1 Record containing information about a document * which is 580 characters in length;

2 Record containing information about an institution which is 264 characters in length; and

3 Record containing information about a specialist which is 196 characters in length.

The length of each field in the record is fixed so that any irrelevant data element can be left blank. Sample copy of input for the file is given in Appendix 2.

532 Keydirectory

The file organisation is indexed sequential and access mode is random. A physical record contains a maximum of 4096 characters or 1024 words,

The logical record is 31 words or 124 characters

in length. Thus a physical record contains 33 logical records.

The length of each field in the record is fixed so that any irrelevant data element can be left blank. A sample copy of input for the file is given in Appendix 3.

54 Retrieval of Information Source for a Query

Different steps involved in processing a query are:

1 Receiving the queries;
2 Formulating profile words and term codes;
3 Formulating search expression;
4 Input for query processing; and
5 Output.

541 Receiving the Queries

For collecting queries from the user a worksheet has been used. These can be supplied to the users of the system so that they can send their enquiries in the worksheets.

542 Formulating Profile Words and Term Codes

After processing the query, the relevant data elements necessary for the search, which constitute the profile words are found. Next the corresponding four digited numeric codes for each of these profile words are picked up. These along with an alpha code for a profile word, is filled up in a form having

distinct coloums for the alpha code; term code and profile word.

543 Formulating Search Expression

Search Expression is formulated by using the alpha code which are given by the Search Editor and the appropriate Boolean operators. And, Or, Not are used with the symbols +, *, - respectively.

544 Input for Query Processing

The input for query processing are:

1 The two magnetic disk files REFERRAL-DATA and. KEYDIRECTORY; and

2 The following query cards.

a) Control card;
b) User Information card;
c) Profile Word card; and
d) Search Expression card.

5441 Control Card

The control card determines

a) . Whether retrieval of information source for a query is required or printing of data base Is required.

b) Whether all the three types of Information sources are required or only one or two as answer.

The card design for this control card is given in Table 1.

Table 1 : Control Card Design

S N	No of characters	Character Position	Description	Remarks
1	1	1	Document	Numeric
2	1	2	Institution	Numeric
3	1	3	Specialist	Numeric
4	1	4	Data base Printing or retrieval (DPR)	Data base On printer if DFR=1 Retrieve if DPR =2
	76	5-80	Blank	

5442 User Information Card

The user information card gives the following information about the user;

1 The name of the user;
2 Address of the user; and
3 'The date of enquiry.

The user information card design is given in Table 2.

- Manavalan, Rajashekar and Others

Table 2: User Information Card Design

Card No	No of chara-cters	Character position	Description	Remarks
1	25	1-25	Name of user	Alphanumeric
	100	26-80	Address	Alphanumeric
2		1-45	Address (Contd)	Alphanumeric
	8	46-53	Date of Enquiry	Alphanumeric
	27	54-80	Blank	

5443 Profile Word Card

The profile word card contains alpha code and term code for each profile word. The number of profile words that can be used at a time for a user is 26. The profile Word Card Design is given in Table 3.

Table 3: Profile Word Card Design

S	No of chara-cters	Character Position	Description	rtemarks
1	1	1	Alpha code	Alphanumeric
2	3	2-4	Blank	-do-
3	4	5-8	Term code	Numeric
4	3	9-11	Blank	Alphanumeric
5	48	12-59	Profile word	-:::-
6	20	60-80	Blank	-do-

3 Profile word cards - a maximum of 26 cards - are read and stored in the array forming WORD-TABLE as follows:

```
01  WORD TABLE.
02  W-T OCCURS 26 TIMES.
03  WT-ALPHA PIC 1(6).
03  FILLER PIC X (3).
03  WT-CGDE PIC 9(A).
03  FILLER PIC X (3).
03  WT-KW PIC X (48).
```

When, the above table is being built up, the profile words, along with the alpha code and the term code are also printed on the line-printer.

4 A single Search Expression Card is read and stored in SE-CARD. An expression card can have a maximum of 80 characters, including the last character, hash mark.

5 Next, Search Expression is converted into Polish Notation and stored in POLISH. The detailed conversional process has been discussed in detail by RaviChandra Rao (4) and Ranjita Maitra (3).

6 -The characters in POLISH which contain the converted Search Expression; are moved one at a time to BO and checked foi operand/operator. The operands (A, B, C. etc) are moved to STACK till BC contains an operator (+, -, *) . Afterwaras, the operands stored in STACK are taken one at a time and the

respective Term Code from the WORD-TABLE is moved to T-KEY, the SYMBOLIC KEY for KEYDIRECTORY. Using 'SEEK' statement, the particular record for the term code in question is read from KEY-DIRECTORY into one of the four areas 1N1 1N2, FINAL 1, FINAL 2 in the memory. In the same way, all the records for the Term codes represented by the alpha codes in STACK are read into the above said areas. It may be noted here that those records contain the two digited alpha keys (AA, AB, etc) which are the- keys according to which the information sources are arranged in REFERRAL-DATA . •

*

7 Depending *on* the operator existing in BO, the keys in the above mentioned records are compared and common set of keys satisfying the Boolean operators is stored in FINAL 1 which is available for storing in-formation at this stage.

8 The procedure described in steps 6 and 7 is repeated and the subsequent result is stored in FINAL 2.

9 When FINAL 1 and FINAL 2 contain the results the next character in POLISH will always be an operators. Depending on this operator, the keys in FINAL 1 and FINAL 2 are compared and the common sot of keys are stored in either 1N1 or 1N2.

10 The above described steps are repeated till the character hash mark is sensed which indicates that the processing of Polish Notation is over.

11 Provision is made in the program by which the result obtained from the complete processing of Polish Notation is always stored in FINAL 1.

12 Next, the keys from FINAL 1 are moved one at a time to R-KEY which is the SYMBOLIC KEY of REFERRAL-DATA. Using a SEEK statement, the respective record from REFERRAL-DATA is read and printed along with the heading and sub-heading which is controlled by the program.

13 After printing all the records for the keys in FINAL 1 the next card is read. If it is an end card, it indicates that the search expression cards for one user is over. If it is not the end card, the above procedure from steps 4 onwards is repeated to process the search expression.

14 After completing the readings of all the Search Expressions for a given profile cards and processing all the corresponding Polish Notation by repeating the procedure from step 4 onwards, another set of cards are read. The procedure is repeated from Step 1 onwards.

.7 DATA BASE PRINTING

The printout of the one of the files namely REFRRAL-DATA could be got by using this program. There is a prevision for choosing the type of information source for the printing sample copies of the printout for all three information sources are given in Appendix 5.

8 FEEDBACK ANALYSIS

In Referral Service, it is very important to know whether the information source supplied to a user for his enquiry has really met his need. This can be done by sending a feedback letter which could be sent back by the user along with the search output.

91 CONCLUSION

The work reported in this paper is a combined students project work. The programs require further modifications and finer refinements if it is to be used in an operational environment. But the methodology could be adopted for establishing a regular operational system.

92 ACKNOWLEDGEMENTS

We are grateful to Prof A Neelarneghan for guiding us in this project. We thank Mr H G Suryanarayana and staff members of ICL Computer Centre, Bangalore for their cooperation in testing this program. We are also grateful to DRTC Faculty members for their encouragement and help throughout the development of this program.

93 BIBLIOGRAPHICAL REFERENCES

1 Sec 31 MEADOW (C T). Applied Data Management. 1976.

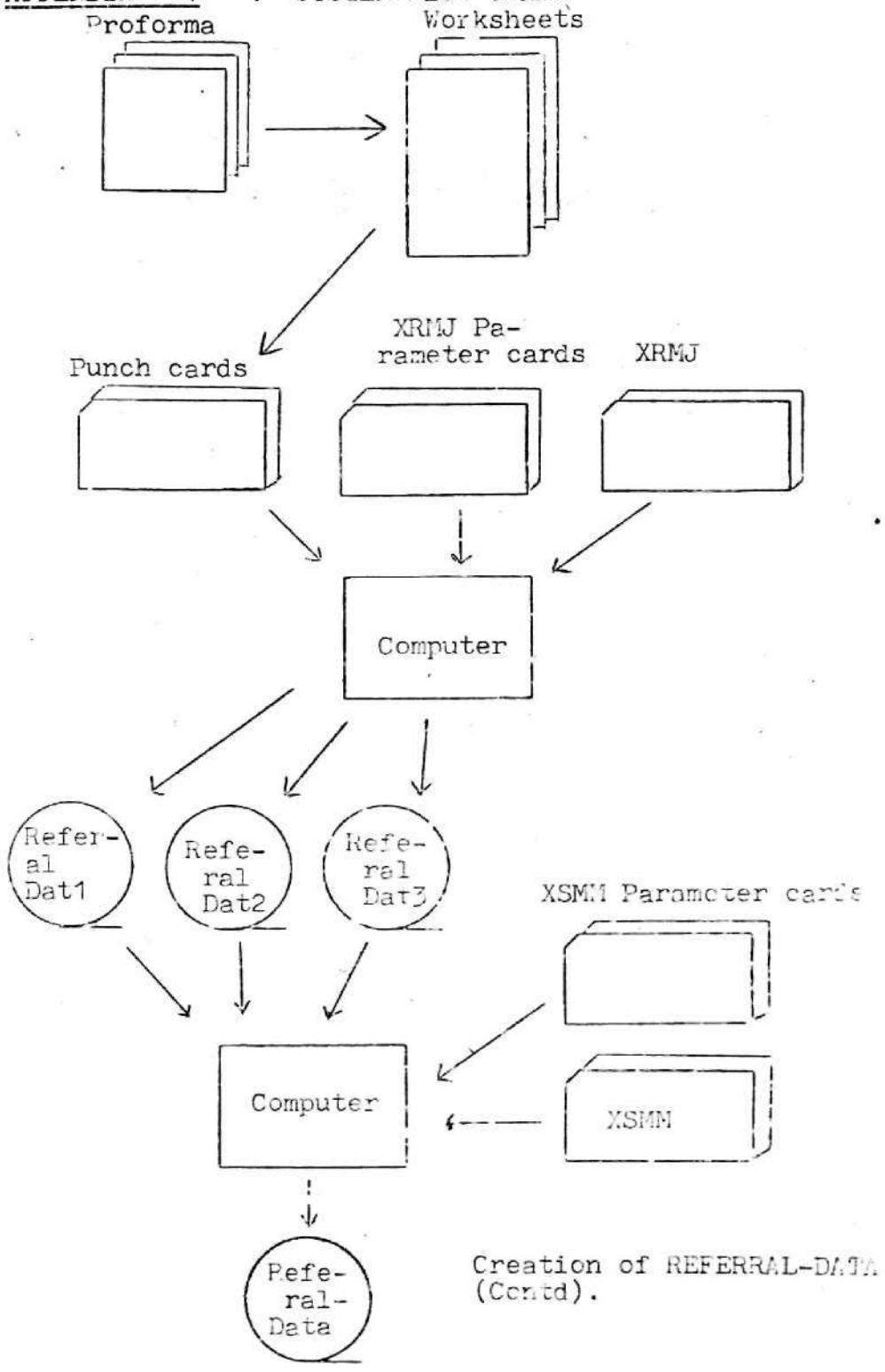
2 Sec 31 PHILIPPA KIS (A S) and KA2MIER (L J). Information Systems Through. COBOL. 1974.

Sec 6 RANJITA MAITRA. Computer based personnel Information System (Project submitted in partial fulfilment of Associateship in Documentation of the Indian Statistical Institute). 1976.

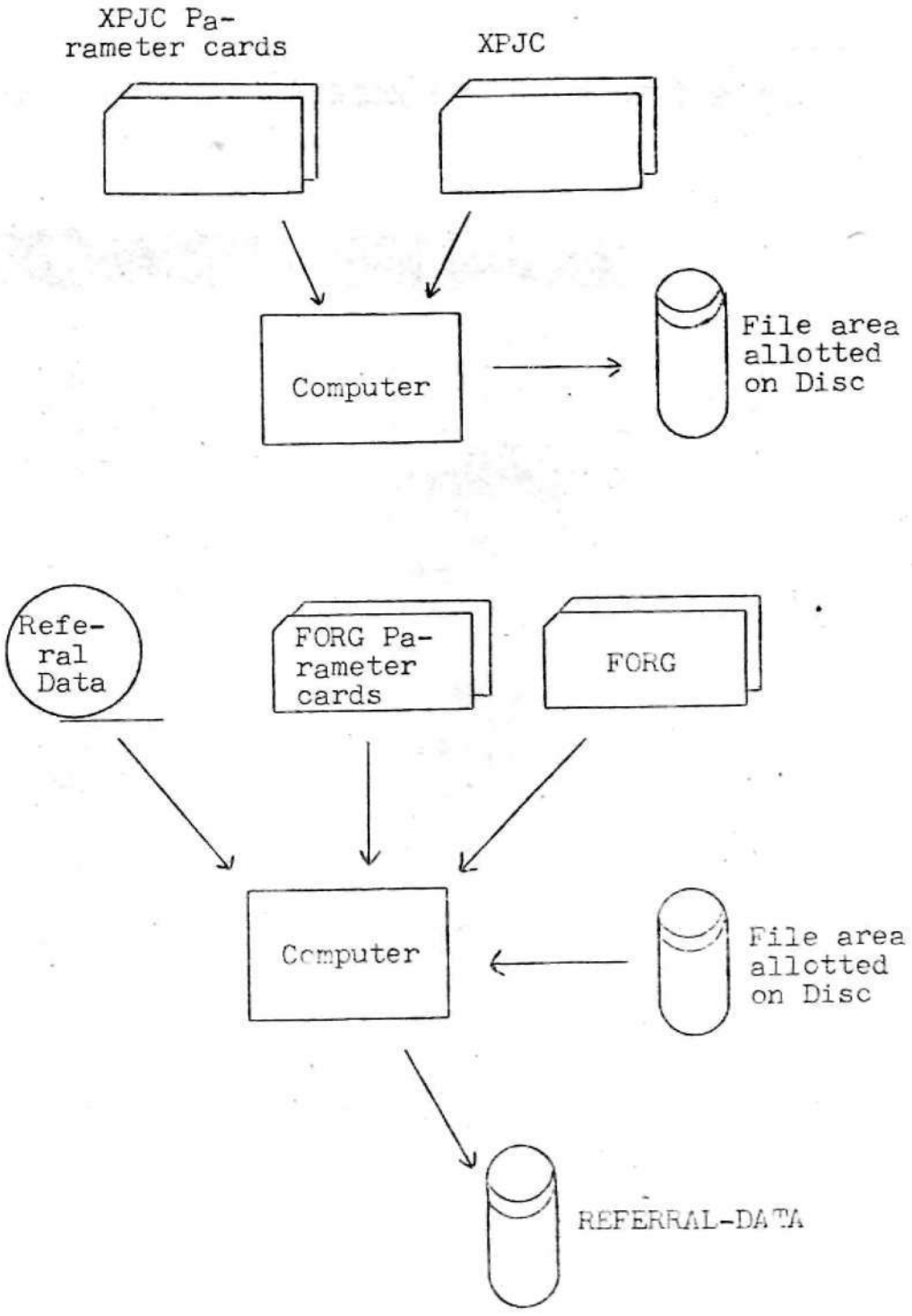
Sec 6 RAVICHANDRA RAO (I K). Generalised Approach to Computer Based Information Storage, Retrieval and Dissemination (Project submitted in partial fulfilment of Associateship in Documentation of the Indian Statistical Institute).- 1975.

Sec 32 SALTON (G). Automatic Information Organization and Retrieval. 1968.

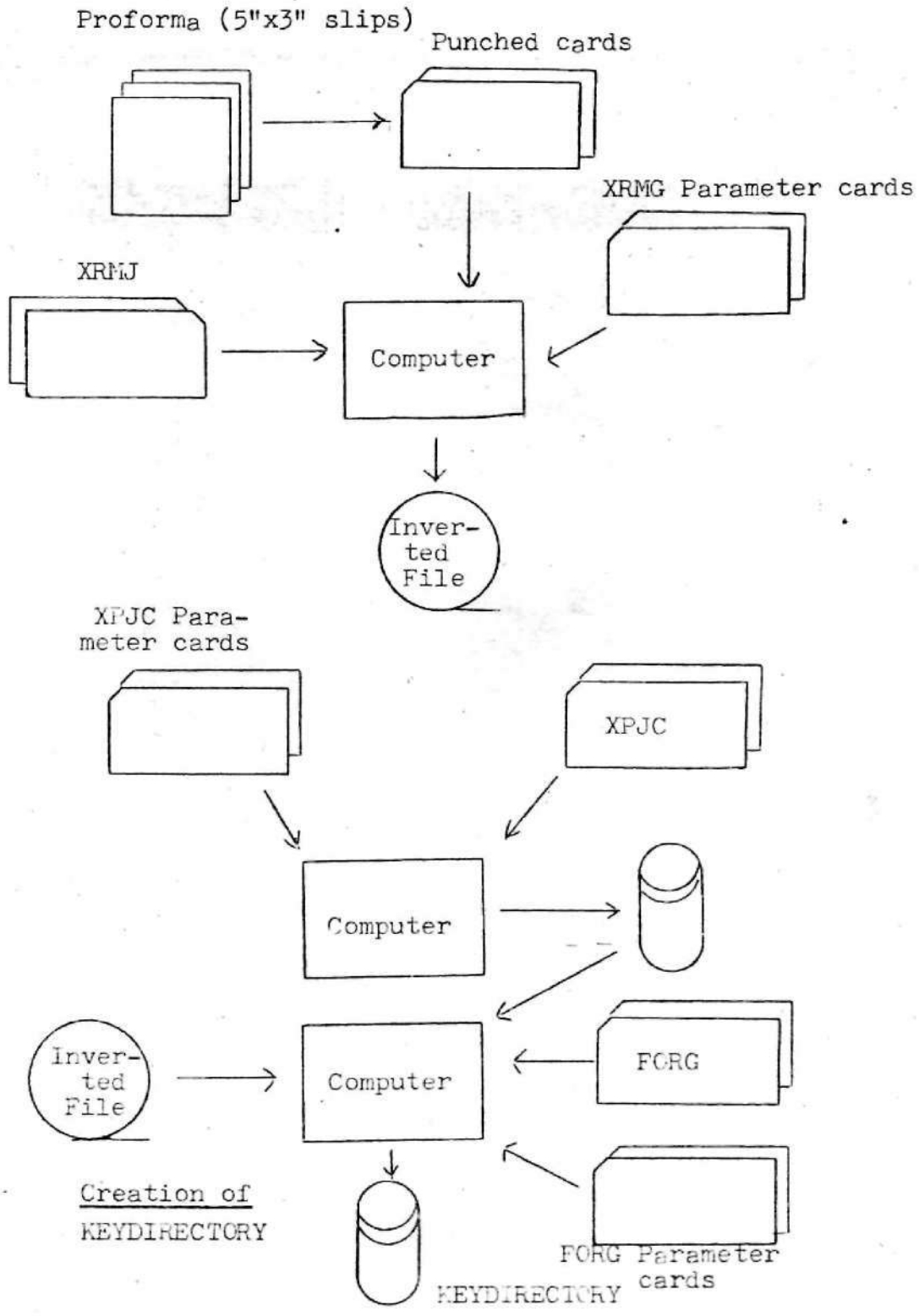
APPENDIX - 1 : SYSTEM FLOW CHART

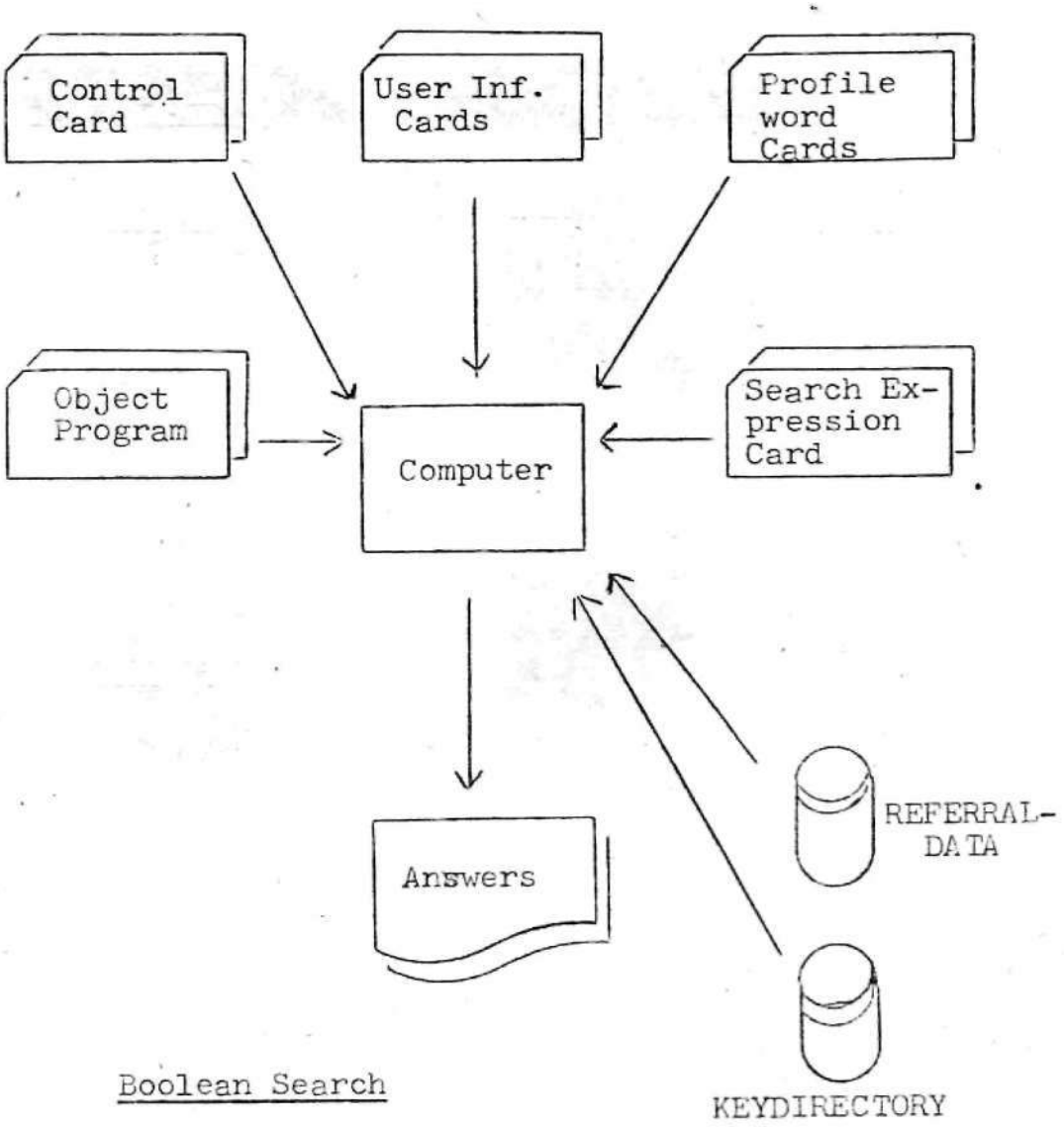


Creation of REFERRAL-DATA (Contd).

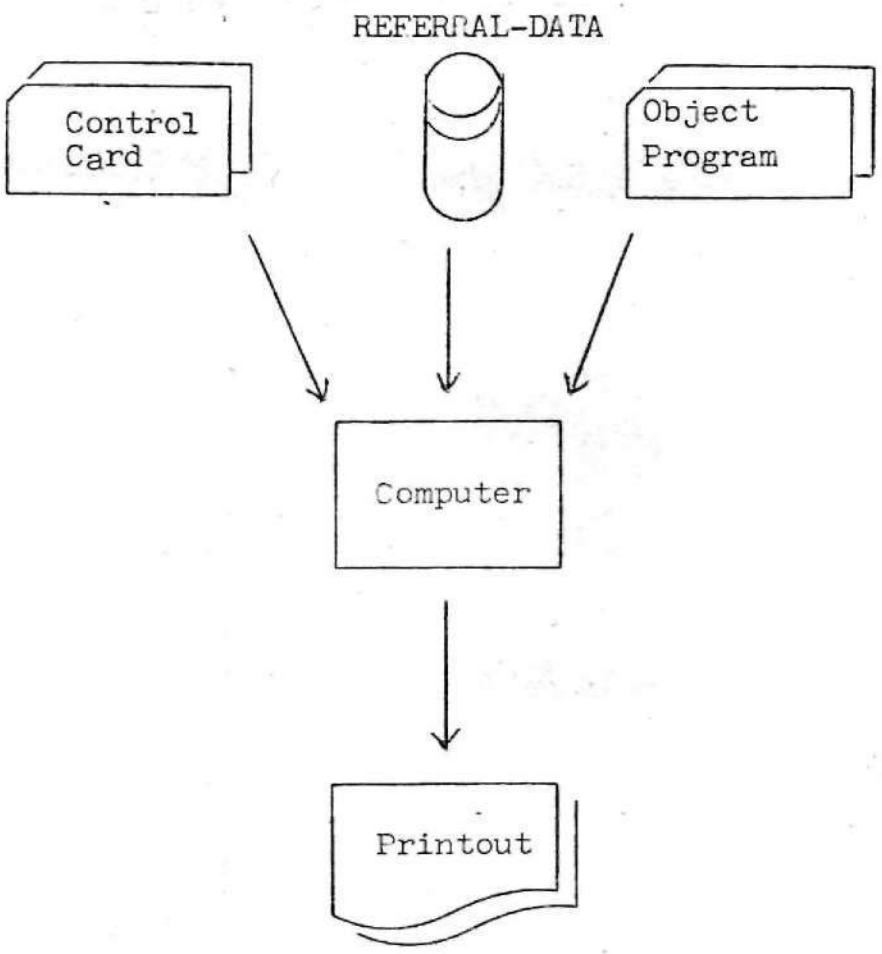


Creation of REFERRAL-DATA


Proforma (5"x3" slips)
Punched cards
XRMG Parameter cards
XRMJ
Computer
Inver-
ted
File
XPJC Para-
meter cards
XPJC
Computer
Inver-
ted
File
Computer
FORG
Creation of
KEYDIRECTORY
FORG Parameter
cards
KEYDIRECTORY



Boolean Search



Data-Base Printing

APPENDIX - 2

SAMPLE COPY OF INPUT FOR THE FILE REFRRAL-DATA

GENERAD LISTING (XRLP) 07/07/77

```
 1 METAL WORKING ABSTRACTS                                    BANGALORE,INDIA          AA01
 2                                                                        4            AA02
 3 CENTRAL MACHINE TOOL INSTITUTE                                                      AA03
 4 TECHNICAL INFORMATION SERVICES, CENTRAL MACHINE TOOL INSTITUTE, TUMKUR ROAD,        AA04
 5 BANGALORE-560022/       TECHNICAL INFORMATION CENTRE ,HINDUSTAN MACHINE T00L        AA05
 6 T LTD ,HMT POST ,BANGALORE-560031/              2ND SAT.,SUN.        32081         AA06
 7 SUN.                  34441MON. TO SAT. 08 45 TO 16.15 HRS./                       AA07
 8          MOM. TO FRI. 07.15 TO 16.30 HRS  ,SAT  07.15 TO 12.00 HRS./               AA08
 9 MACHINE AND TOOL DIRECTORY                      23WHKAT0N,USA          75         AB01
10                                  R H SFIOTTA              0716                    AB02
11 HITCHOCK PUBLISHING COMPANY                                                        AB03
12 TECHNICAL INFORMATION SERVICES ,CENTRAL MACHINE TOOL INSTITUTE TUMKUR ROAD,        AB04
13 BANGALORE-560022/       TECHNICAL INFORMATION CENTRE ,HINDUSTAN MACHINE TO0L      AB05
14 S LTD ,HMT POST .BANCAL0RE-560031/             2ND SAT.,SUN.        32081         AB06
15 SUN.                  34441MON. TO SAT. 08, 45 TO 16.15 HRS./                      AB07
16          MON. TO FRI. 07.15 TO 16.30 HRS. ,SAT. 07.15 TO 12.00 HRS./               AB08
17 ITALIAN MACHINE TOOLS                          05MILANO,ITALY         70         AC01
18                                                       0362                         AC02
19 UNIONE COSTRUTTORI ITALIANI MACHINE UTENSILI                                       AC03
20 TECHNICAL INFORMATION SERVICES ,CENTRAL MACHINE TOOL INSTITUTE , TUMKUR ROAD,     ACO4
21 BANGALORE-560022/       TECHNICAL INFORMATION CENTRE .HINDUSTAN MACHINE TOOLACO5
22 S LTD ,HMT POST ,BANGALORE-560031/             2ND SAT.,SUN.        32081         AC06
23 SUN,                  34441M0N. TO SAT, 08.45 TO 16.15 HRS./                       AC07
24          MON. TO FRI. 07.15 TO 16.30 HRS. ,SAT  07.15 TO 12.00 HRS./               AC08
25 BRITISH MACHINE TOOLS AND EQUIPMENT            LONDON,UK              74         AD01
26                                                       0348                         AD02
27 MACHINE TOOL TRADES ASSOCIATION                                                    AD03
28 TECHNICAL INFORMATION SERVICES ,CENTRAL MACHINE TOOL INSTITUTE .TUMKUR ROAD,     ADO4
29 BANGALORE-560022/ (                                                                ADO5
30                                                2ND SAT.,SUN.        32081         ADO6
```

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APPENDIX - 3

884 04422AB
885 04431FEEDS SAMPLE COPY OF INPUT FOR THE FILE KEYDIRECTORY
886 04432AG
887 04441FEELER GAGES
888 04442AB
889 04451FILE CUTTING MACHINES KB
890 04452
891 04461FILING MACHINES KA
892 04462ADAI
893 04471FILES
894 04472ABAGAJ
895 04481FILTERS
896 04482AB
897 04491FINANCIAL ASSISTANCE KB
898 04492
899 04501FINE BLANKING FRESSES
900 04502AB
901 04511FINE BORING MACHINES KB
902 04512ADAI
903 04521FINISHING
904 04522AJ
905 04531FINISHING SCREW THREADS
906 04532AJ "
907 0454FITS
908 04542AG
909 04551FIXTURE CLAMPS
910 04552AB
911 04561FIXTURES KC
912 04562AAABADAGAIAJ SLSC
913 04571FLAME CUTTIi.G

APPENDIX - 4

RETRIEVAL OF INFORMATION SOURCE : SAMPLE OUTPUT

09/08/77 INFORMATION SOURCES FOR MACHINE TOOLS PAGE NO.

NAME OF THE ENQUIRER: H Y MAHAKUTESHWAR

ADDRESS: DRTC
112 11TH CROSS ROAD
MALLESHWARAM
BANGALORE-560003

DATE OF ENQUIRY: 23/07/77

PROFILE WORDS

A.C.	CODE	PROFILE WORDS
A	0368	DRILLING MACHINES
3	0736	MANUFACTURERS ADDRESS
C	0651	ITALY
D	0010	ABRASIVES
E	0014	ADAPTIVE CONTROL
F	0048	ATTACHMENTS
G	0064	BALANCING MACHINES
	0084	BEARING S

09/0877 INFORMATION SOURCES FOR MACHINE TOOLS PAGE NO.
F+H#

DOCUMENTARY SOURCES S.NO. 1

TITLE: DIRECTORY OF AGENTS

AUTHOR: .

EDITION: 02

EDITOR:

PLACE OF PUBLICATION: BANGALORE, INDIA

PUBLISHER:CENTRAL MACHINE TOOL INSTITUTE

YEA?. OF PUBLICATION: 76

NO. OF PAGES: 0140

FREQUENCY:

ISM/ISSN

LOCATION 1 :

ADDRESS: TECHNICAL INFORMATION SERVICES
CENTRAL MACHINE TOOL INSTITUTE
TUHKUR ROAD
BANGALORE-560022

HOLIDAYS: 2ND SAT.,SUN.

WORKING HRS. MON. TO SAT. 08.45 TO 16.15 HRS.

PHONE NO.: 32061

LOCATION 2:

ADDRESS: TECHNICAL INFORMATION CENTRE
HINDUSTAN MACHINE TOOLS LTD
HMT POST
BANGAL0RE-56O031

HOLIDAYS: SUN.

WORKING HRS.: MON. TO FRI. 07.15 TO 16.30 HRS.
SAT. 07.15 TO 12.00 HRS.

PHONE NO: 34441

07/03/77 INFORM/,TION SOURCES FOR MACHINE TOOLS PAGE NO. 6

INSTITUTIONAL SOURCES S.No. 1

INSTITUTION ADDRESS: CENTRAL MACHINE TOOL INSTITUTE
TUMKUR ROAD
BANGALORE-560022

PHONE NO.i 32081
POINT OF CONTACT: TECHNICAL INFORMATION SERVICES

HOLIDAYS: 2ND SAT.,SUN.

WORKING HRS,: MON. TC SAT. 08.45 TO 16.15 HRS-

APPENDIX - 5.

PRINTING OF DATA-BASE : SAMPLE COPY

08/08/77 INFORMATION SOURCES FOR MACHINE TOOLS PAGE NO. 1

DOCUMENTARY SOURCES S.NO. 1

TITLE: METAL WORKING ABSTRACTS
AUTHOR:
EDITION:
EDITOR:
PLACE OF PUBLICATION: BANGALORE,INDIA
PUBLISHER,CENTRAL MACHINE TOOL INSTITUTE
YEAR OF PUBLICATION:
NO. OF PAGES:
FREQUEI IC Y: MONTHLY
.ISBN/ISSN:
LOCATION 1 :
ADDRESS: TECHNICAL INFORMATION SERVICES
CENTRAL MACHINE TOOL INSTITUTE
TUMKUR ROAD
BANGALORE-560022
HOLIDAYS: 2ND SAT.,SUN.
WORKING HRS. : MOH. TO SAT. OS.45 TO 16.15 HRS.
PHONE NO.: 32081
LOCATION 2:
ADDRESS: TECHNICAL INFORMATION CENTRE
HINDUSTAN MACHINE TOOLS LTD
HMT POST
BANGALORS-560031
HOLIDAYS: SUN.
WORKING HRS. : HON. TO FRI., 07.15 TO 16-30 HRS.
SAT. 07.15 TO 12.00 HRS.
PHONE NO.: 34441

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INSTITUTION ADDRESS: CENTRAL MACHINE TOOL INSTITUTE
TUMKUR ROAD
BANGALORE-560022

FKONE NO.: 32081
POINT OF CONTACT: TECHNICAL INFORMATION SERVICES
HOLIDAYS: 2ND SAT.,SUN.
WORKING HRS.: MOM. TO SAT. 08.45 TO 16.15 HRS.

INSTITUTIONAL SOURCES S.NO. 2

INSTITUTION ADDRESS: HINDUSTAN MACHINE TOOLS LTD
HMT POST
BANGALORE-560051

PHONE NO.: 34441
POINT OF CONTACT: TECHNICAL INFORMATION CENTRE
HOLIDAYS: SUN.
WORKING HRS.: HON. TO FRI. 07.15 TO 16.30 HRS.
SAT. €7.15 TO 12.00 HRS.

08/08/77 INFORMATION SOURCES FOR MACHINE TOOLS PAGE NO. 1

SPECIALIST SOURCES S.NO. 1

NAME: R S BIR
ADDRESS: DIRECTOR AND CHIEF DESIGN CONSULTANT
INDIA DESIGN CENTRE
15 PEENYA INDUSTRIAL AREA
BANGALORE-562139
PHONE NO.: 38261
WORKING MRS.: MON. TO SAT. 08.30 TO 17.00 HRS. '

SPECIALIST SOURCES S.NO 2

NAME: D N RAMAKRISHNA
ADDRESS: CONSULTANT
INDIA DESIGN CENTRE
1B PEENYA INDUSTRIAL AREA
BANGALORE-562139
PHONE NO.: 38261
VOTING HRS. : MON. 10 SAT. 06.30 *TO* 17.00 HRS