

**Some modifications to the  
Query Files and Purge commands  
For a better management  
of spooled Piles**

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INTRODUCTION

The modifications to the commands QUERY and PURGE, dealt with in this paper, are the first step in the total reorganization of the complete spooling system of the CP-67. The aim of this reorganization is to improve the reliability of the system. In order to do this the following two immediate precautions have been taken:

- a) the improvement of the automatic recovery procedures of the system (see CNUCE Publication n. 68)
- b) the anticipation of "dangerous" situations by providing operator and users with a series of commands which allow them to keep the spool files under control. This aspect of the problem is particularly important because, in contrast with normal procedure in systems of virtual machines (in which every machine is protected against the errors produced by other machines), an abnormal situation in the spool files inevitably compromises the working of the entire system.

A third change, necessary if the reliability of the system is to be increased, concerns the control of the open files. If the system fails, the open spool files, i.e. those either being read or written in spooling areas, are at once lost. It should be remembered that such files are often the result of long computations which must then inevitably be repeated and that situations of this type are anything but infrequent given the considerable movement of spool files in the system. This later problem will be tackled only subsequently, after the first two have been solved, as these are more urgent and their solution is a necessary preliminary condition for dealing with the third.

The present organization of the spool via the control program does not permit either the checking of the state of the spool or the intervention of the operator during spooling operations.

The new commands used correctly allow:

- a) to control the spooling operations

- b) to have available on request, statistical data and measures for checking the state of the spool.

The organization of the CP-67 spool does not enable the occupation of the spooling areas to be controlled. This defect in the system has heavy consequences if the files existing in the spool should completely fill the areas allotted to them. If this happens the only possibility is to cancel all the spool files. In order to minimize, as much as possible, the risk of being forced into taking such a drastic solution, the existing organization offers only one alternative: that is to assign to the spool at the moment of allocation, an area much greater than that normally occupied by the spool files.

Thus even over-loads caused by large files created in error, can be contained.

However, this provision does not represent a definite solution as although. It reduces it, still it does not eliminate the risk of saturation. It is also clearly disadvantageous that it demands the existence of large areas of auxiliary memory that remain, almost always, unused and could be exploited much more profitably.

In order to solve, definitely, this problem we have introduced a control on the occupation of the spooling areas which functions at two levels:

- 1) automatically. The system notifies the operator if the percentage of the area occupied is more than that which has been determined as critical (at the moment this limit has been fixed at 80 percent of the available area).
- 2) the operator and the users can request informations necessary to them on the occupation in records of the spooling areas at any moment.

These provisions required the following measures:

- 1) to introduce into the CP modules which control the spooling areas, counters which must be brought constantly up to date and which supply information on the level of occupation of the spooling areas.
- 2) to associate to each spool file its size in records.
- 3) to create a series of tools capable of withdrawing the data supplied by the system and of translating it into a form which will be easily interpretable by the operator and by the users.

Instead of introducing new commands it was found preferable to modify the QUERY and PURGE commands, already in existence in the CP-67, by supplying them with new parameters so that:

- 1) the necessary modifications to the system were kept to a minimum

2) the original properties of the standard commands were retained.

In this way the CP-67 spool has been given all the features contained in the CONTROL PROGRAM of the VM. In particular, a series of parameters of the modified commands were associated to a privileged class, thus creating privileged machines for the checking of and intervening into all the spooling operations performed by the users of the system. Finally, to avoid introducing a new privileged class (the spooling operator class) which is instead, present in the CP of the VM, the functions of the spooling operator have been given to the system operator.

The CP-67 organizes spool files into three chains: files being read (READERS), files being punched (PUNCHES) and files being printed (PRINTERS).

The files being printed (or punched) are described by records all with the same structure. However for files being read different structures are possible because in this chain three types of files are brought together: normal reader (RDR), remote printer (RMPRT) and remote punch (RMPUN); the

last two being created by the command ROUTE and used for the transmission of informations from remote printers and punchers. In practice, in the records of the remote printer and remote punch files some control and separator characters are retained which do not appear in the normal readers. The machines which deal with files of this type contain, in addition to the usual reader, one or two special readers, to which only remote printer and punch files are sent.

The standard QUERY and PURGE commands do not permit distinctions to be made within a chain: in particular they do not permit for distinctions to be made among the various types of files being read. To us, it seemed useful to provide the system with commands which allow for this possibility.

The requisite modification was light, as it was possible to exploit the existing CP-spool organization which already recognized these three types.

One of our objectives has been to have very selective commands available in order to control the spooling more effectively.

Thus apart from providing users with a tool which is in

any case useful in their work, we propose to localize in a very selective way the causes of possible malfunctionings so that they may be limited and the damage can be kept to a minimum. The ability to select files of one type only out of all those being read is, of course, a first step towards achieving this objective and this has been done by increasing the selectivity of the QUERY and PURGE commands making them capable of identifying individual files. In order to be selected a particular file needs an identifier.

The CP of VM assigns to each spool file an identifier based on the date and hour of the creation of that file. This identifier, specified as a parameter of the command, permits the certain identification of the file.

The CP-67 does not have this property but it was not thought opportune to modify the system so as to make it equal to that of the VM. As an identifier for a file, to be used only in the command PURGE, it was decided to use the position (first, second,...) of that file in the chain to which it belongs. This number is, however, supplied,

together with other information, by the QUERY command and permits the achievement of the original aim without any great modification. It was not thought useful to look for better solutions to the problem of spool file identification because this is the subject of researches already under way. The results of these will be part of the work of the restructuring of the spool. At this point we hope to explicit again the structure of the commands, making only slight modifications.

## THE USER'S QUERY COMMAND

The standard QUERY FILES command is limited to give only a global view of the spool situation. It prints on the terminal the number of files which the user has on each of three queues (reader, printer and punch).

There are two limitations in this operation:

- 1) the absence of information concerning the size of the spool files.
- 2) the lack of selectivity.

A remedy has been made to meet the first limitation:

- 1) The QUERY FILES command has been modified. In its new version it associates to the number of each file; (the files have been divided into their respective queues) the number of occupied records. (these too have been divided according to their queues)
- 2) The QUERY PRINTER (or PUNCH or READER) command

has been re-introduced. These new commands give detailed information on all the files which a user has on a spool chain (distinguished by the appropriate parameter)

The information thus obtained is:

- a) the file identifier: this is the order number of the file in the queue to which it belongs and is used as a parameter by the modified PURGE command.
- b) the file size in records is given.
- c) the files belonging to the READER queue are identified by type: normal reader, remote printer or remote punch.

These new commands also solve satisfactorily the problem of the standard command's lack of selectivity; in fact they supply informations subdivided file by file. Thus, this new organization keeps the standard command which now, however,

supplies a more complete message.

Format:

```
| FILES (F) |  
| QUERY (Q) | | READER (RDR) |  
| PRINTER (PRT) |  
| PUNCH (PUN) |
```

Examples of replies:

1) query files

FILES: 4 RDR, 3 PRT, 2 PUN

RECORDS: 15 RDR, 16 PRT, 6 PUN

2) query printer

NO. FILES IN PRINTER: 3

FILE NO. REC. NO.

1 5

2 7

3 4

3) query reader

NO. FILES IN READER: 4

FILE NO. REC. NO. TYPE

1 3 RDR

2 5 RMPRT

3 2 RDR

4 5 RMPUN

### THE OPERATOR'S QUERY COMMAND

The standard QUERY FILES command given by the operator's machine, prints at the console the total number of spool files, present at that moment subdivided by queues.

It can be seen at once that this command has the same limitations as the analogous class D QUERY FILES command (that of the user):

- 1) it is impossible to obtain information on the state of occupation of the spooling area.
- 2) it is impossible to separate files according to their individual virtual machines (lack of selectivity).

In order to solve the first problem, the already existing QUERY FILES command was modified so that a reply message could be obtained which detailed not only the number of files, as previously (when the standard command was given), but also the total occupation of the spooling area both by

percentage and by the number of records.

This solution required the introduction of two counters:

- 1) one, which is brought up to date every time the system is initialized (CPINIT module), contains the total number of records available for spool operations;
- 2) the other, defined in the module which saves and sets free records of the spool area (RECFREE), contains the total number of records in use.

Every time that areas of auxiliary memory destined for spooling are requested or set free, the system updates the counters and calculates what percentage of the spooling area is occupied.

If this percentage is more than 80 percent the system operator is notified by a message at the console and an alarm signal.

The operator then decides which virtual machines are principally responsible for this over-load situation; he

requests these machines to remove their files from the spool and if it should be necessary by means of the modified PURGE command he frees space by cancelling the files of one or more of the virtual machines.

The system operator is informed by another message as soon as the occupation of the spooling areas is reduced to below the critical limit.

The lack of selectivity of the system is resolved by giving the QUERY FILES command a second parameter which can be:

- 1) The USERID of a virtual machine. In this case the files number and relative occupation records subdivided by queue, are typed at the console in the same way as the user QUERY FILES command does.
- 2) ALL. In this second case, the operator receives a list of all the virtual machines which have spool files; the number of files of each machine subdivided by queue are listed and the total occupation in records is given.

format:

```
QUERY (Q) FILES (F) | USERID |  
                    | ALL |
```

The reply message to the QUERY FILES command is not addressed to the operator's console as in the case of all the other replies to the console functions, but is reproduced on the printer with precedence over all the other files to be printed.

This is because, generally, (and particularly in the situations in which it will be necessary to use this command) the number of virtual machines with spool files is large and their printing would keep the console busy for a long time delaying all the subsequent messages sent to it.

Example

QUERY FILES ALL

The reply given at the printer would be like this:

FILES: 53 RDR, 2 PRT, 3 PUN

NC. RECORDS IN USE 3143, LEFT 42241, SPCOLING AREA 06 PER  
CENT FULL

USERID	READERS	PRINTERS	PUNCH	NC. RECCRDS
USER1	40	NO	1	3020
USER2	NO	2	1	20
USER3	13	NO	1	103

Notice that the heading of the printout is the same as that typed at the console by the QUERY FILES command.

## THE USER'S SELECTIVE PURGE COMMAND

The standard command allows the user to cancel all the files present in the spooling area from its own virtual input/output units. It admits only one parameter which specifies the unit (the spool file queue) to which the file belongs.

As in the READERS queue remote printer and remote punch files are also put together, we have allowed for the possibility of type selection.

Finally, in order to select an individual file from the queue indicated by the first parameter, we have added a second parameter, which gives the order number (first, second, etc) of the file in the queue. This parameter is used as an identifier of the file and can be obtained from the modified QUERY FILES command. In this way it is possible to withdraw from the spooling area only the file whose identifier has been given as a second parameter.

Format and parameters:

```
      | PRINTER (PR) |  
PURGE (P) | READER (R) | <n. file>  
      | PUNCH (PU) |  
      | RMPRT |  
      | RMPUN |
```

If the second parameter is not specified, the command cancels all the files of the chain. Thus the features of the standard PURGE command are kept with the exception of the READERS files.

In the later case in order to cancel all these files, it may be necessary to give the command three times assigning as parameter in turn READER, RMPRT, RMPUN.

If the second parameter is present, only the file identified by that number is cancelled. It should be noticed that in the case of files being read, the order number refers to the whole READERS queue without type distinction (see QUERY command).

## THE OPERATOR'S SELECTIVE PURGE COMMAND

The standard organization of the CP-67 spooling system does not allow for privileged machines with the capability of intervening in the spool files of other virtual machines.

The PURGE command given by the operator cancels only the files of the operator's machine, which do not usually carry out spooling operations.

This command, more than that of the user, should be considered in relation to the modified QUERY command from which the necessary information is obtained for controlling the intervention of the operator's machine.

The new command allows for:

- 1) The PURGE selecting user files.

We have allowed for the following possibilities:

- a) the cancelling of all the spool files of a virtual machine any the queue to which they belong;
- b) the cancelling of all the files of a virtual machine which are found on one of the spool chains;
- c) the cancelling of all the files of all the virtual

machines present in one of the spool chains.

The command's selectivity is limited to individual chains of a virtual machine's files; in order to make it even more selective it would have been necessary to make the structure of the QUERY command much more complex. Moreover, considering that the command was designed to remedy errors made by the users that could affect the efficient functioning of the system, further improvement of the selectivity would be unnecessary.

2) The PURGE of files addressed to a specific unit.

This completely new possibility, allows for the cancelling of files addressed to a unit by means of the SPOOL command and is often very useful, in particular in the case of files addressed to dedicated or otherwise unavailable units.

Format:

		DEVICE ADDRESS		
		READER (R)		
		PRINTER (PRT)		
PURGE (P)		PUNCH (PUN)		USERID
		RMPRT		ALL
		RMPUN		
		ALL		

The PURGE of files addressed to a specific unit is the only command to need just one parameter; in every other case two parameters must be specified.

If just one parameter is specified, the system interprets this as the address of one unit; it carries out a control in order to verify the parameter's validity by comparing it with those contained in a table; if the answer is positive, then the command is carried out.

The admitted address are 00E, 00F, 00A; these being, at present, the only units to which a file can be sent.

The organization of these addresses in a table has been designed so that the number of units may be increased without difficulty; in these cases it is only necessary to add the new address to the table without altering the search mechanism.

In the selective PURGE of user files, the first parameter, which indicates the chains and the possible types of spool files, can be READER, PRINTER, PUNCH, RMPRT, RMPUN and ALL: in this last case the files of all the chains are cancelled.

If it is necessary to cancel the files relatively to the chains and types indicated in the first parameter, whatever machine they belong to, then the second parameter is ALL.

Otherwise the system interprets it as the USERID of a virtual machine, it checks the existence of this and then carries out the search.

The combination of parameters ALL ALL is not permitted.

MODIFICATIONS MADE TO THE CP-67

The realization of the new QUERY command has made the following changes necessary:

1) the introduction of a routine in the CFSQRY module in order to control QUERY RDR, PRT, PUN which were created and modified in the LOGFILES module, so that it is possible to analyze the parameters of the new QUERY FILES command and to use them in order to obtain the required information.

Given the importance of these modifications (the LOGFILES module has been completely rewritten), instead of describing the operations effected in words, we have preferred to illustrate them by means of a detailed flow-chart. This is given in appendix A of this note.

2) The introduction of counters recording the total number of the spool records available and those occupied at any

given moment and the regular updating of these counters.

The calculation of the number of records available for the spool, is placed inside the CPINIT module, which initializes the system. In particular, it creates an allocation table for each unit of auxiliary memory which gives, among other things, information on the purpose to which that memory area will be put.

By analysing all the chains of the allocation table, it is possible to calculate the number of cylinders and therefore of records available for spooling and paging operations.

In the same CPINIT module the counter recording the number of records occupied is also initialized; in fact the system always keeps available an area sufficiently large to contain the memory dump and it can have files ready to be put into the spool at the moment of initialization (for example spool files which belong to previous sessions and were saved before the ending of that session).

This last mentioned counter initialized by CPINIT, is

then controlled by the RECFREE module which is called every time it is necessary to allocate or set free a spool record.

3) The modification of the format of the table which the system uses to describe each spool file (SFBLCK) in order to specify the file size in records.

This required modifications being made on all the modules which create spool files (i.e. SFBLCK). These are:

MVIOEXEC- This controls files being printed and being punched, including those sent to the reader, by means of the XFER or RCUTE commands.

NRIOEXEC- This controls files sent to the real card reader.

DSKDUMP- This is executed when the system crashes and it creates a spool file containing the memory dump.

The implementation of the new PURGE command has meant that it has been necessary to completely rewrite the routine which controls the command (entry point PURGE of the CFSSEI module).

It has been necessary:

- 1) to write a new series of instructions in order that the parameters may be analyzed by the command in its new form.
  
- 2) To reconstruct the search loop and to eliminate one or more of the files selected by the parameters. In order to do this, we decided to associate a flag to each group of parameters and to use just one search loop determined according to the value of the flag, instead of repeating the same loop for all the combinations of parameters. In this way, we have managed to save considerably both on the number of instructions and the elaboration time though the program has, of course, become more complex.

In the appendix B the flow-chart describing the functioning of the routine is given.

## CONCLUSIONS

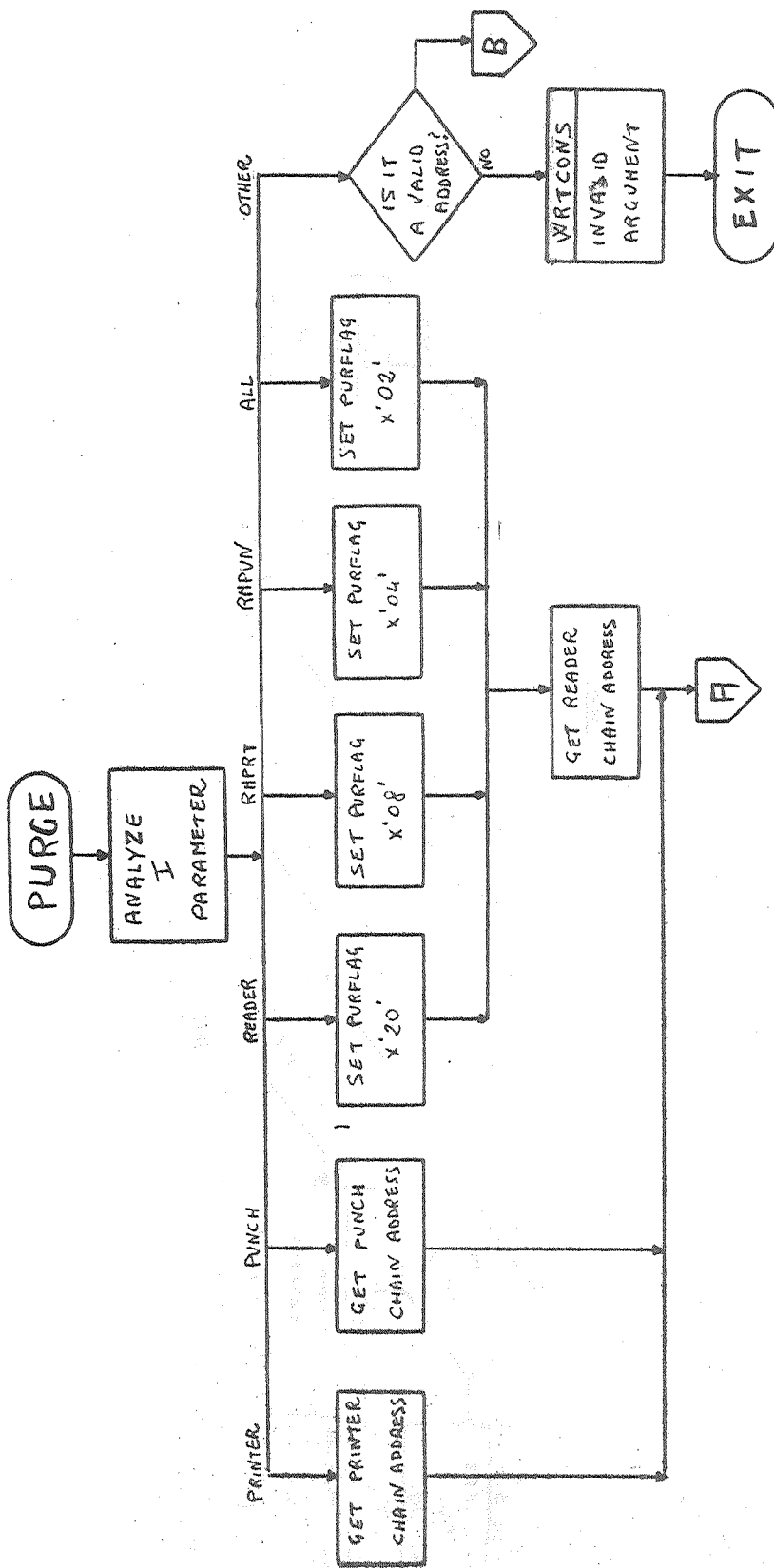
In our work the problems of the remote users have been given a particular importance. This is because we feel that the remote users make up the greater part of the users of our computer center.

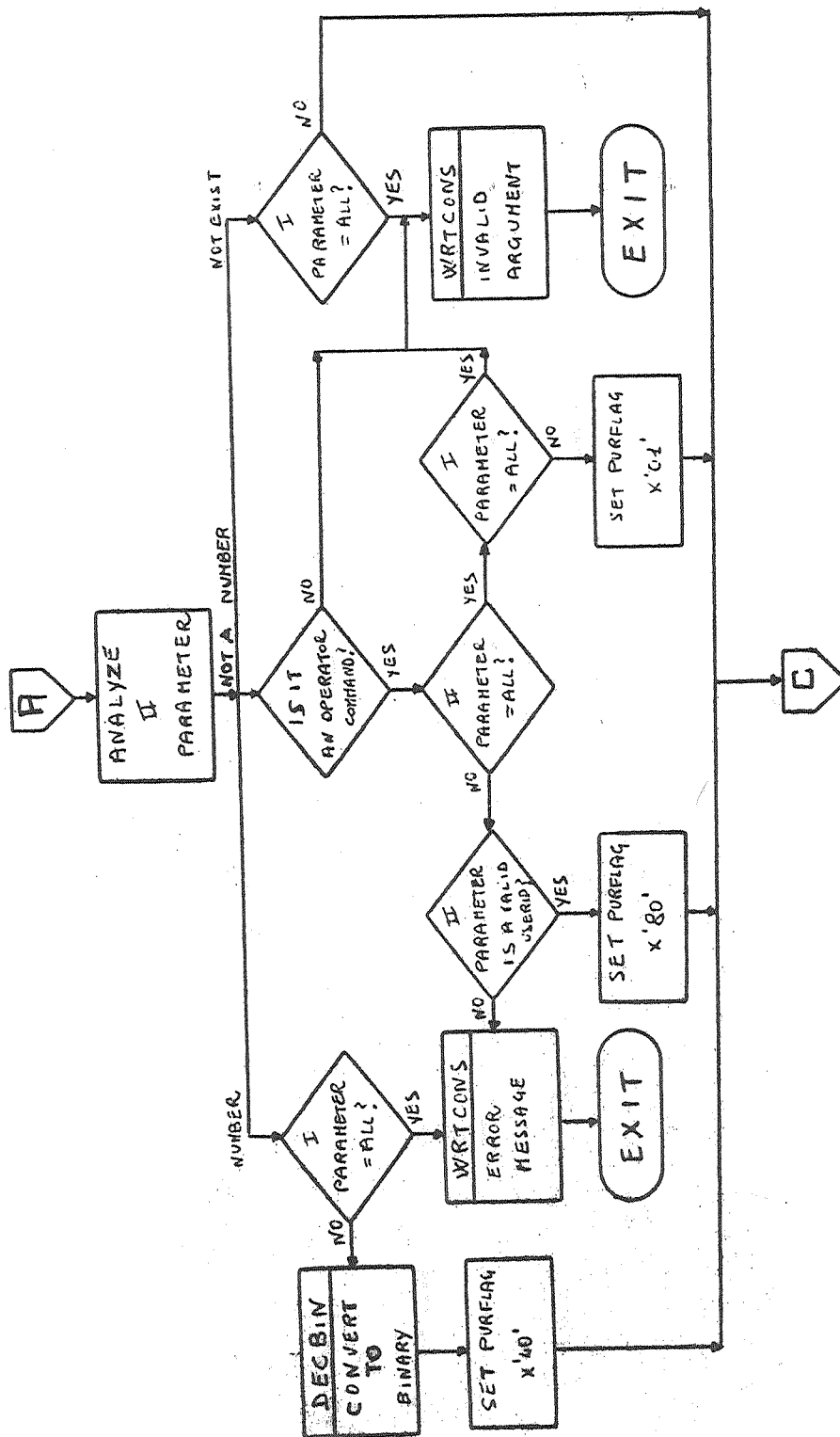
They perform many spool operations in order to transfer files from their virtual machines to the machines controlling the linking lines and vice-versa and they often hold in spool the same file for long periods of time (often for some days).

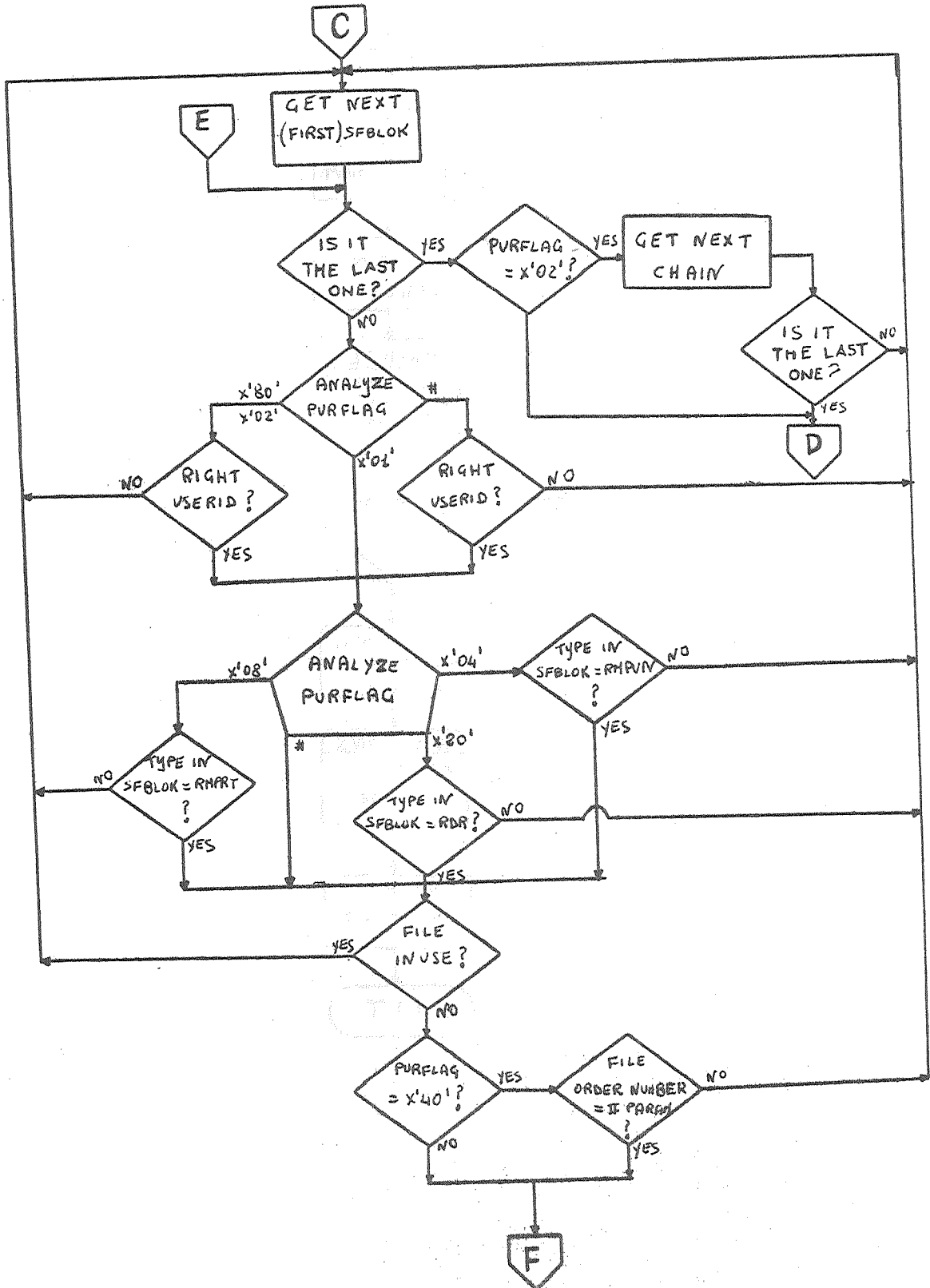
Thus the remote user is particularly vulnerable to all the failing of the system, in particular to those caused by abnormal spool situations.

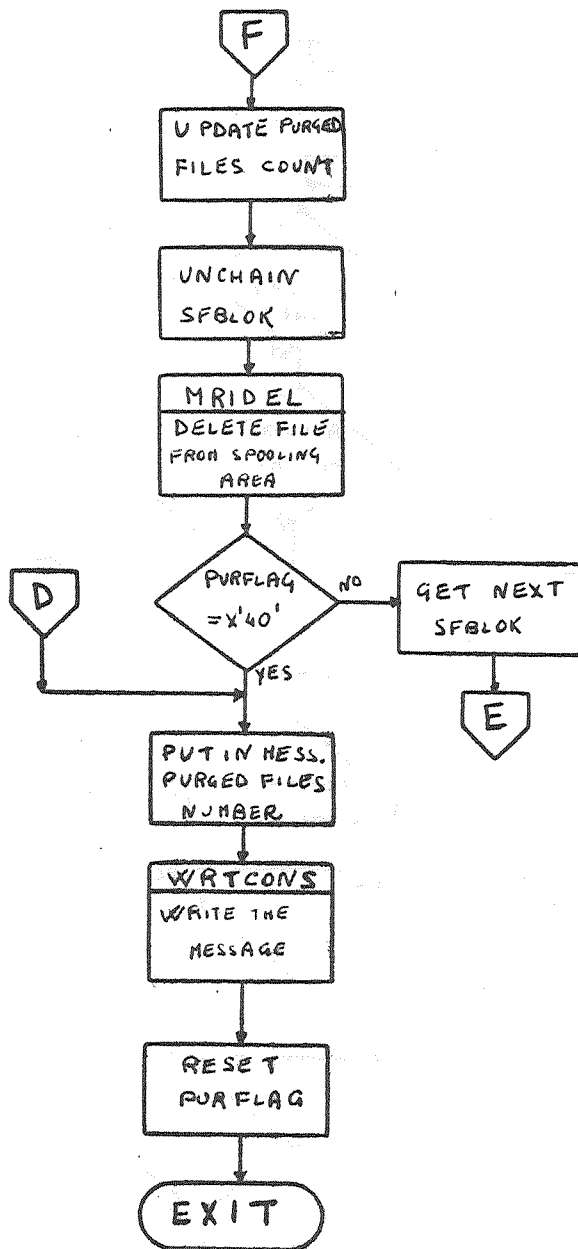
This group of commands has been developed in order to supply the operator and the users with tools which will help them at the moment, until we can by making modifications of the type mentioned in the introduction to this paper, improve the reliability of the spooling system in particular and of the whole computer system in general.

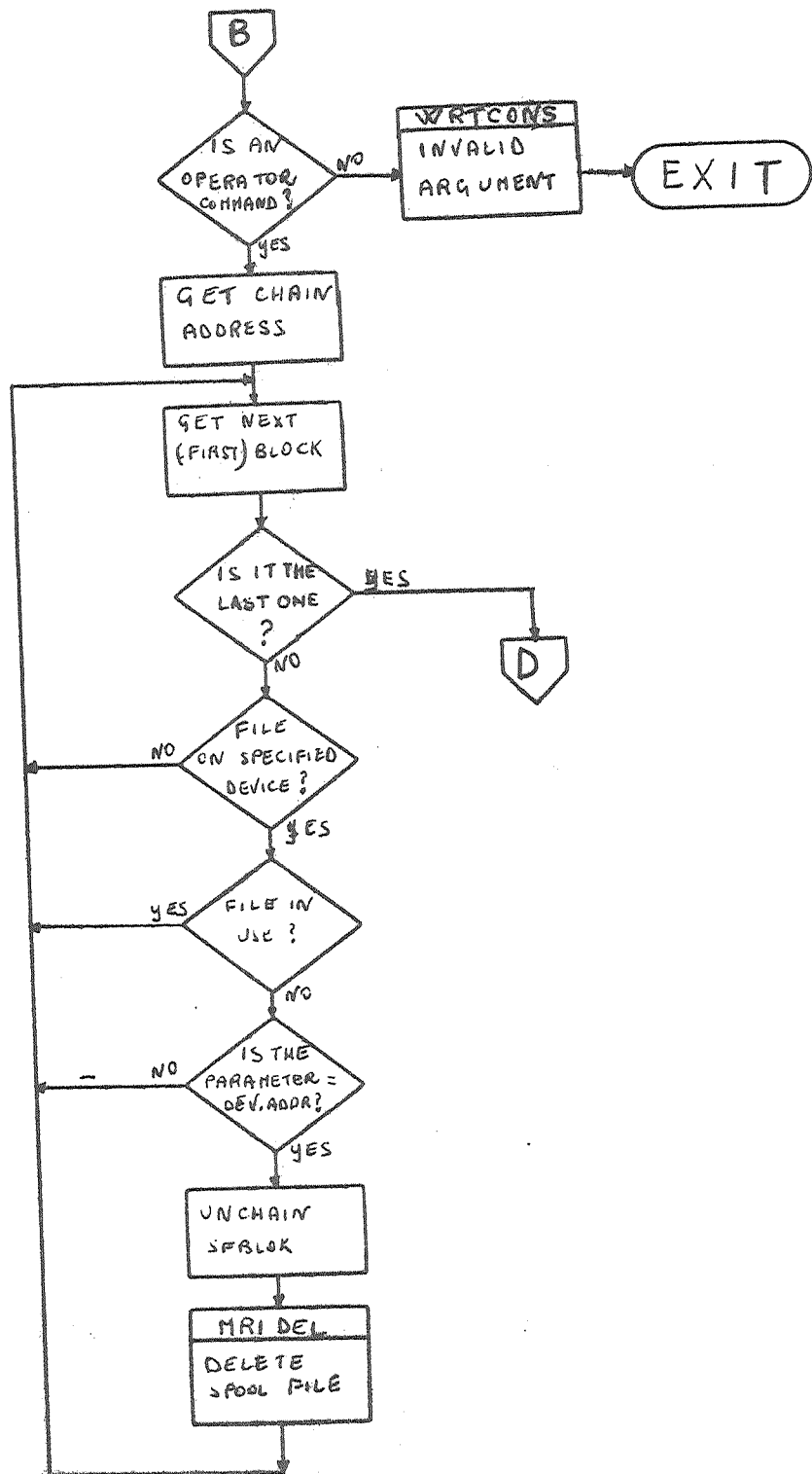
APPENDIX A



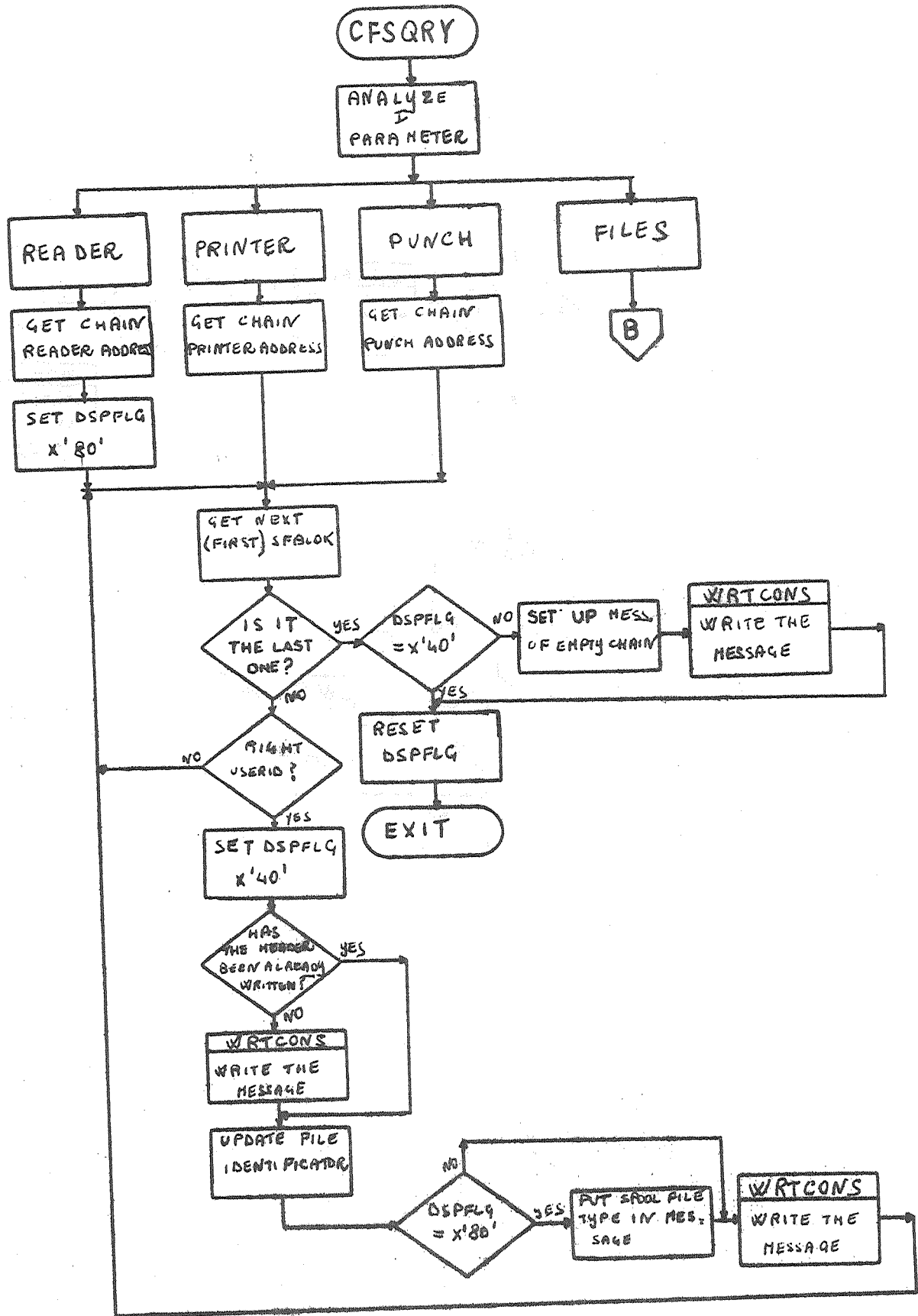


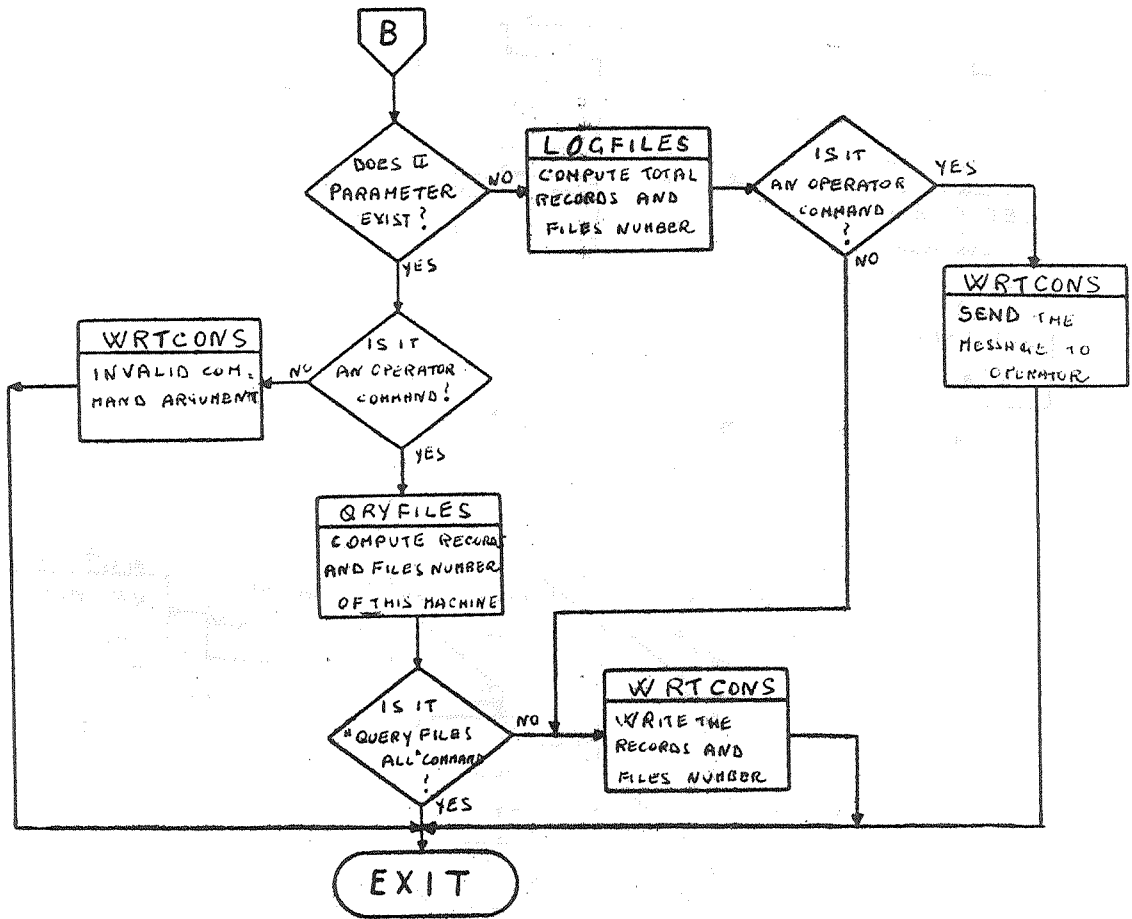


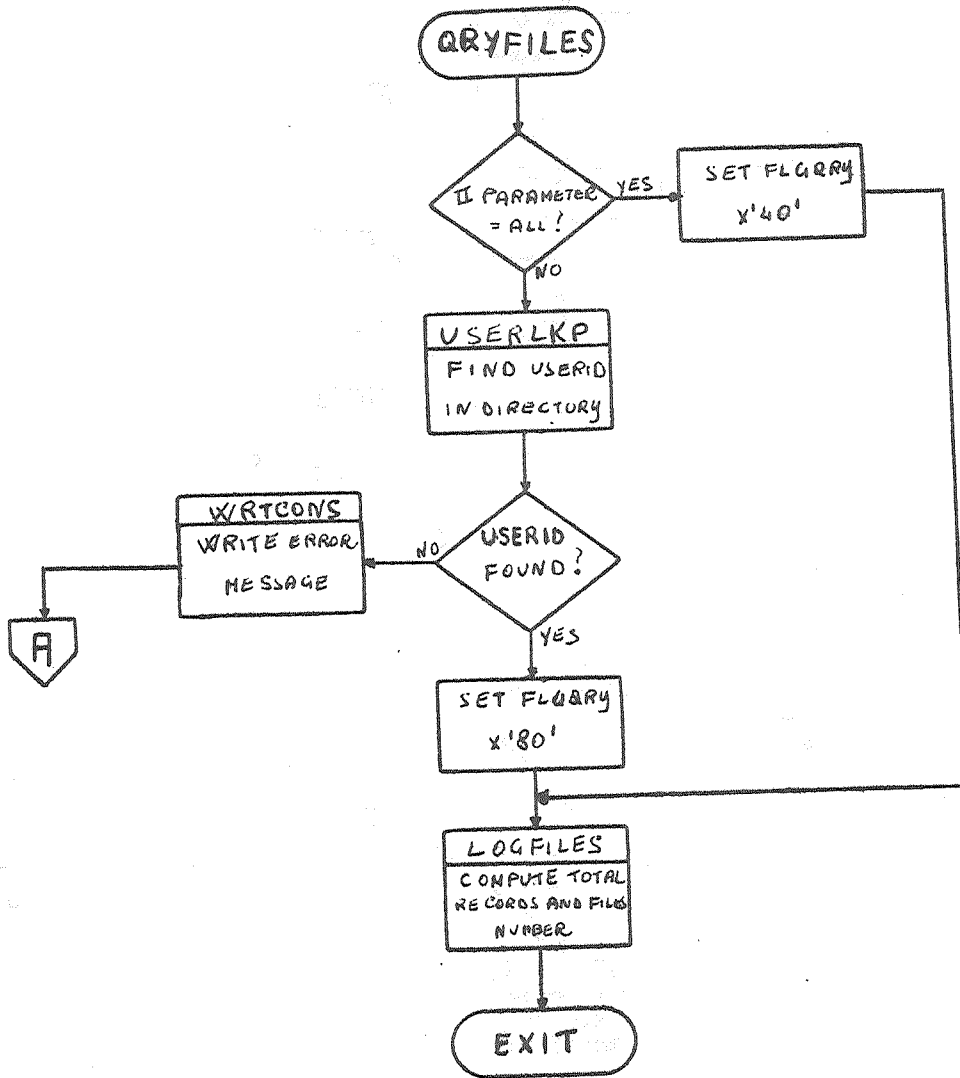


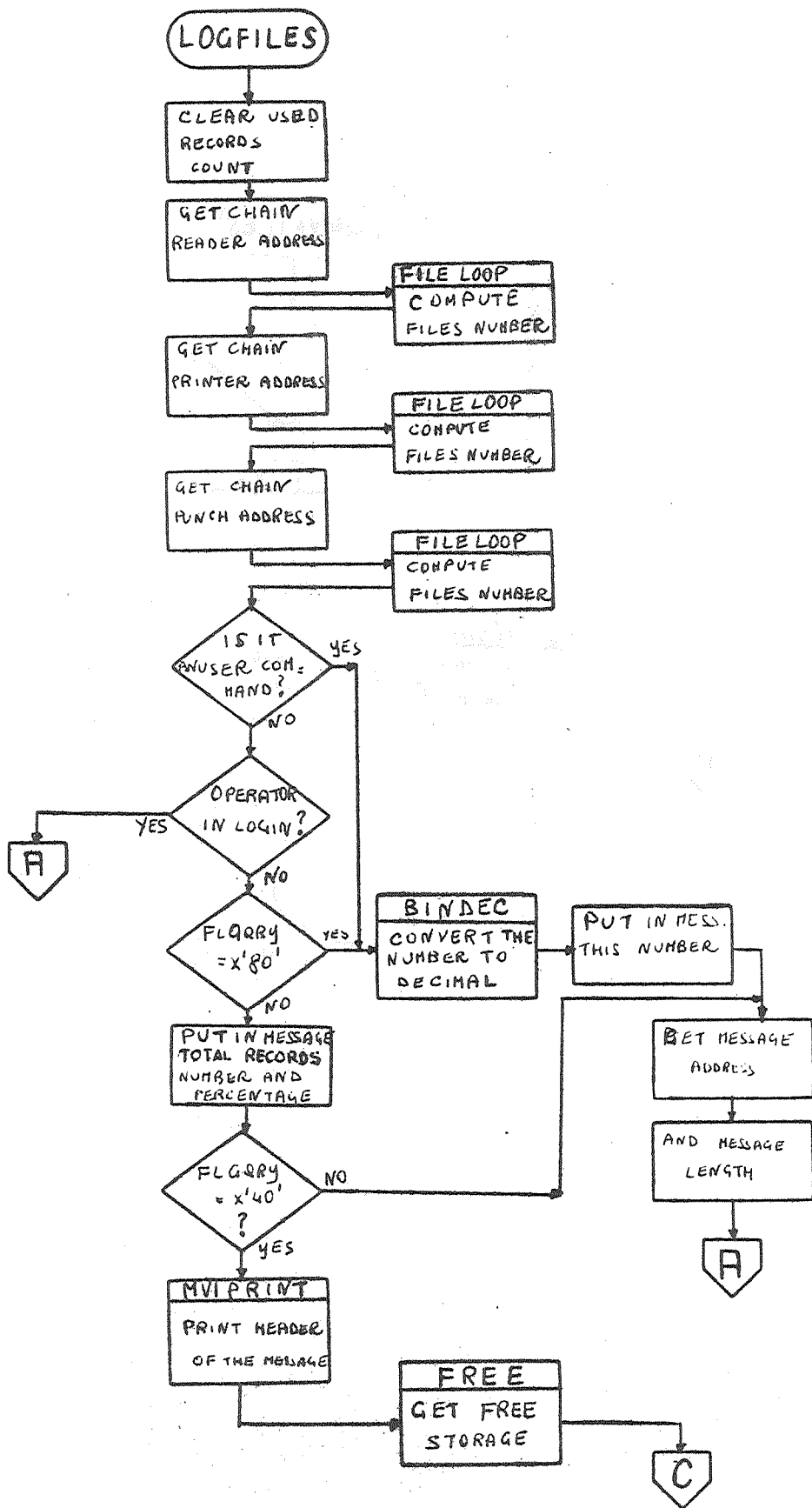


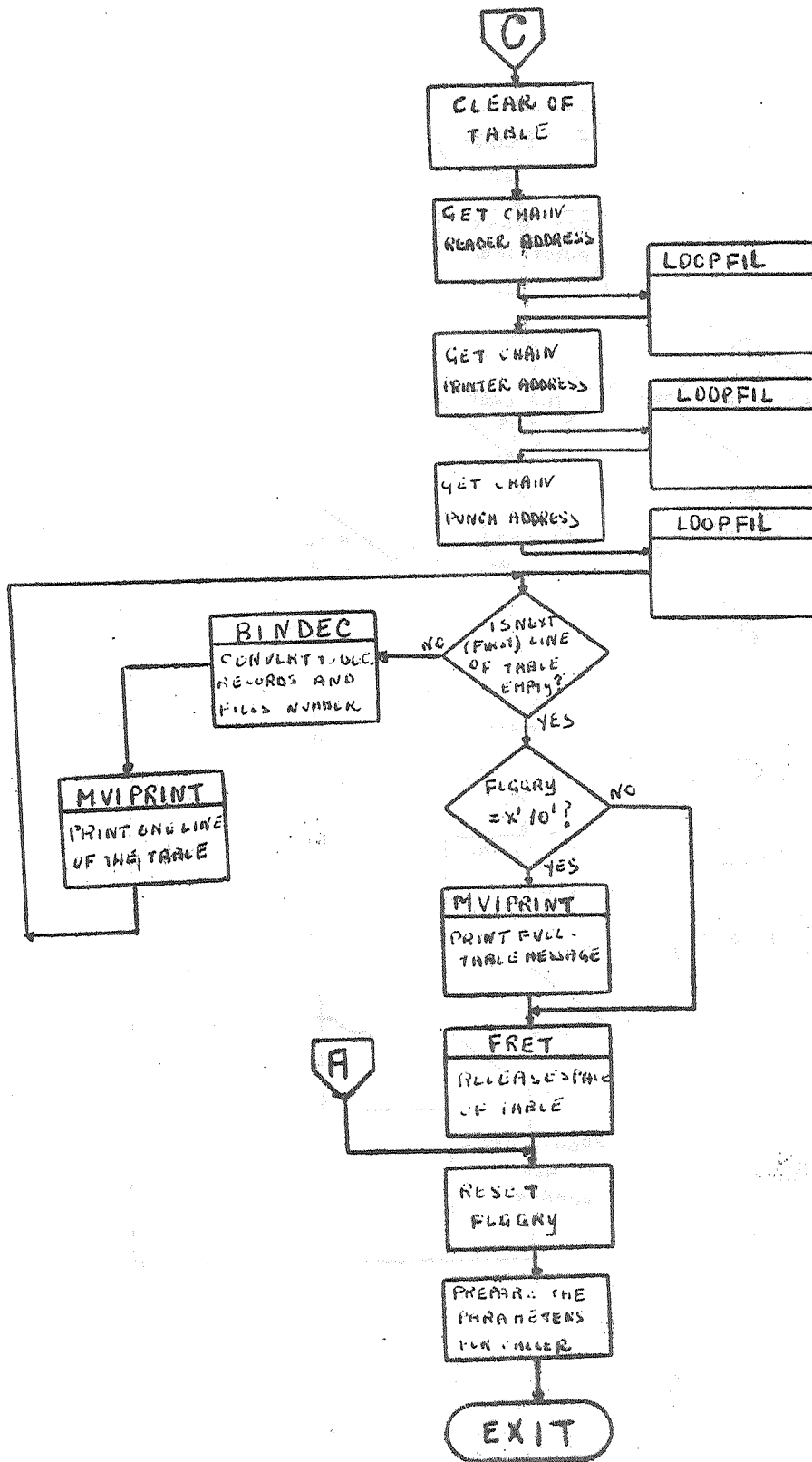
APPENDIX B

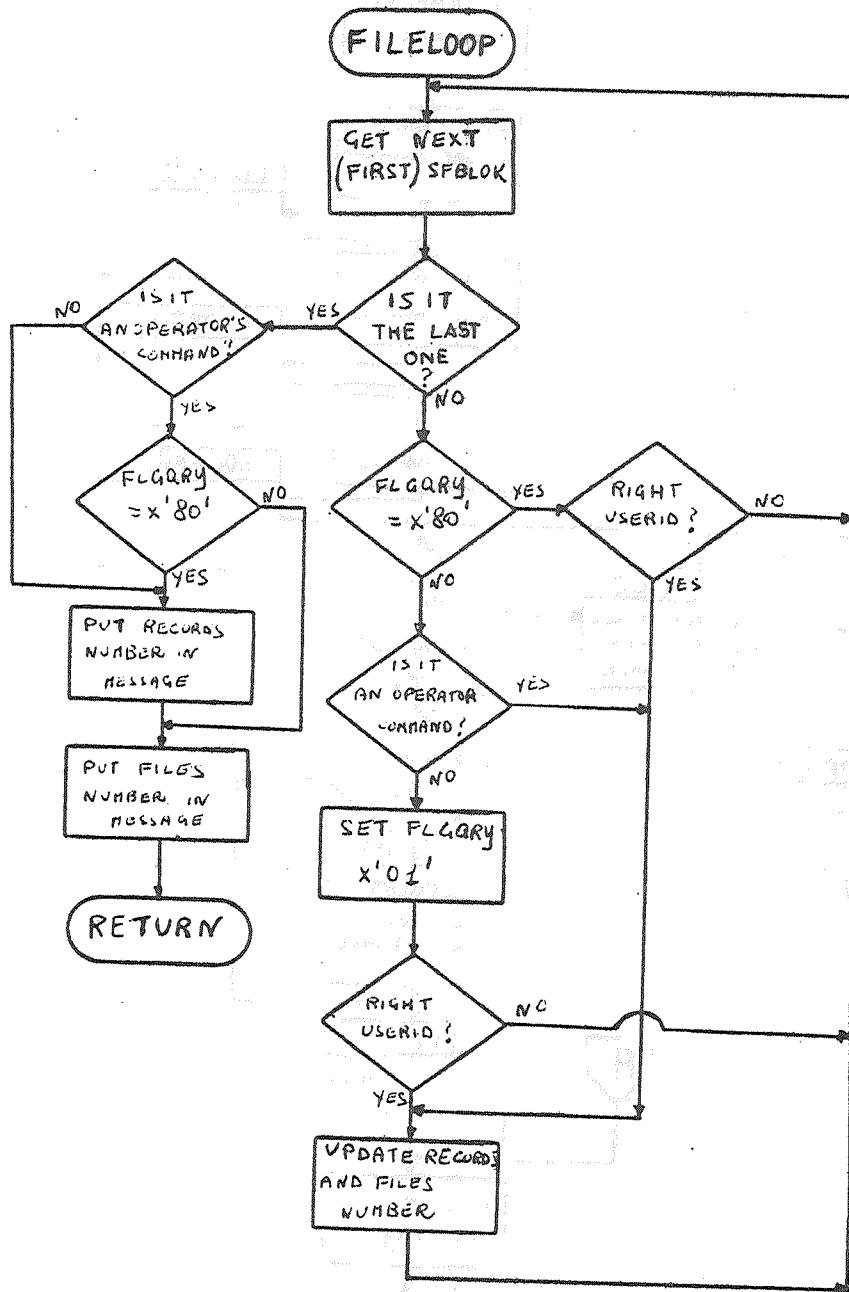


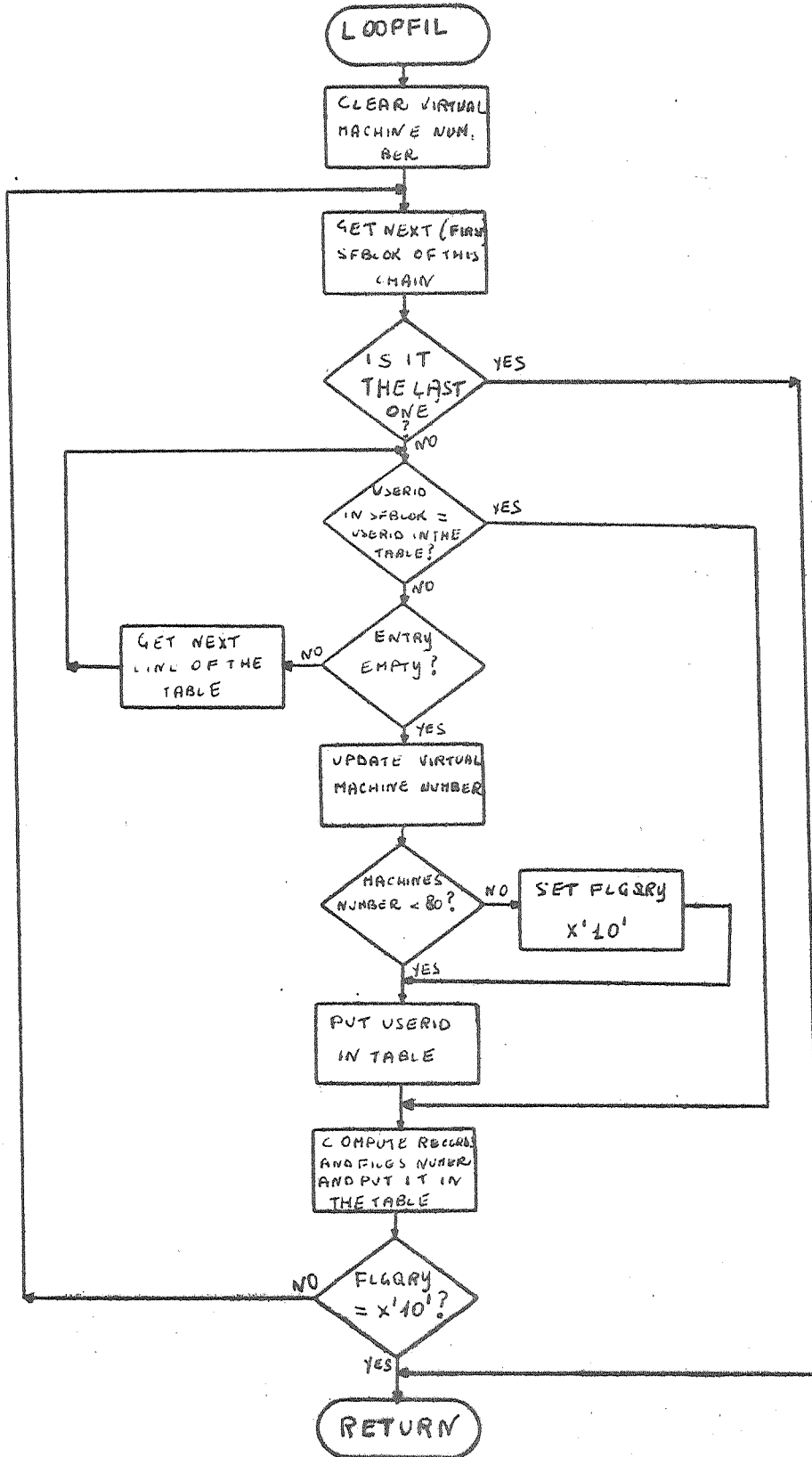












1.  $\frac{1}{x^2} = x^{-2}$   
 $\frac{d}{dx} x^{-2} = -2x^{-3} = -\frac{2}{x^3}$

2.  $\frac{1}{x^3} = x^{-3}$   
 $\frac{d}{dx} x^{-3} = -3x^{-4} = -\frac{3}{x^4}$

3.  $\frac{1}{x^4} = x^{-4}$   
 $\frac{d}{dx} x^{-4} = -4x^{-5} = -\frac{4}{x^5}$

4.  $\frac{1}{x^5} = x^{-5}$   
 $\frac{d}{dx} x^{-5} = -5x^{-6} = -\frac{5}{x^6}$

5.  $\frac{1}{x^6} = x^{-6}$   
 $\frac{d}{dx} x^{-6} = -6x^{-7} = -\frac{6}{x^7}$

6.  $\frac{1}{x^7} = x^{-7}$   
 $\frac{d}{dx} x^{-7} = -7x^{-8} = -\frac{7}{x^8}$

7.  $\frac{1}{x^8} = x^{-8}$   
 $\frac{d}{dx} x^{-8} = -8x^{-9} = -\frac{8}{x^9}$

8.  $\frac{1}{x^9} = x^{-9}$   
 $\frac{d}{dx} x^{-9} = -9x^{-10} = -\frac{9}{x^{10}}$