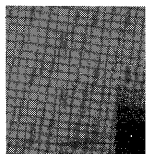
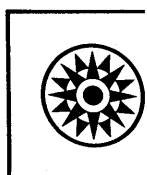
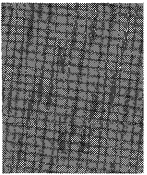
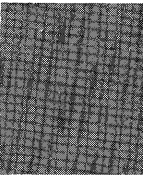
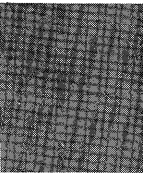
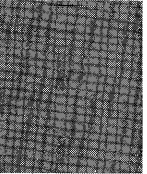


Systems Reference Library

IBM System/360 Operating System: Conversational Remote Job Entry Concepts and Facilities

This publication describes the basic concepts of Conversational Remote Job Entry (CRJE) and guides the CRJE user—system programmer, system manager, terminal user, central operator—in the use of its facilities.

Conversational Remote Job Entry provides Remote Job Entry capability for users at remote keyboard terminals attached by communication lines to an IBM System/360 Operating System that provides multiprogramming with a fixed or variable number of tasks.



Preface

This publication is designed to answer two basic questions concerning Conversational Remote Job Entry (CRJE): Why is CRJE? and What is CRJE?

The introduction answers the first question, explaining the needs that are satisfied through the facilities of CRJE.

The remainder of the book answers the second question, what CRJE is. The first section, "Conversational Processing," describes the devices required for operating under CRJE and explains the concept of conversational processing in general.

The second section, "CRJE System Personnel," points out the responsibilities of those who are involved in the overall operation of CRJE. These responsibilities are presented in subsections, which correspond to the different types of system personnel. This section may be read as applicable; i.e., if you are a central operator, you may not be concerned with the responsibilities of the system programmer or the system manager and would, therefore, not need to read the subsections designed primarily for them.

The third section, "System Concepts," describes two primary concepts of CRJE—data organization and job processing. The concepts introduced in this section are of particular interest to the terminal user; however, knowledge of these concepts is essential for anyone directly concerned with CRJE operation.

The last section of this book, "System Facilities," lists and describes the system functions available to the system manager, the central operator, and the terminal user. As in the second section concerning system personnel, you may read only that subsection that is directly applicable to you.

This publication includes two appendixes: "Appendix A: Publications," and "Appendix B: Glossary." The first appendix contains the name and a brief abstract of each of the publications that provide additional, more detailed information for the CRJE user. The second appendix defines terms introduced in CRJE or those terms that have special meanings in CRJE. (A more extensive glossary is found in the back of the publication, *IBM System/360 Operating System: Conversational Remote Job Entry Terminal User's Guide*, GC30-2014.)

First Edition (June 1970)

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Corresponding to the constantly increasing number of functions a computer can perform, there is an increasing number of people who require computing facilities. Many of these people may not require the services of a computer on a regular basis, or the volume of their computing operations may not be great enough to justify a large computer for their individual use. Yet, when the need arises, it is important that they get their jobs executed and get results with a minimum amount of turnaround time.

The result of these conditions is a growing demand for a remote job entry capability from low-speed, low-cost terminals linked by communication lines to one central computer. Thus, a centralized computing system could serve users in many different locations and could do the processing that would otherwise require a separate system at each remote site. (See Figure 1.)

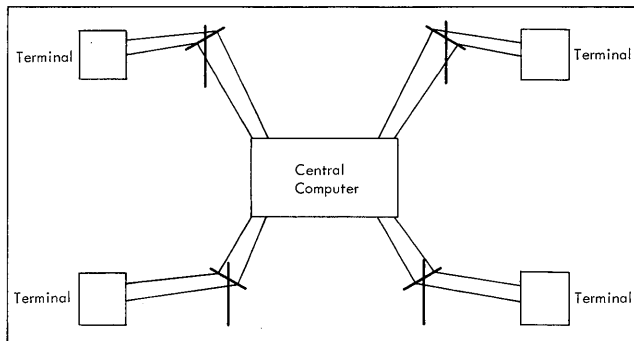


Figure 1. Central Computer Linked by Telephone Lines to Remote Terminals

The users of such a system need an efficient, easy-to-use method for preparing their jobs and submitting them for processing. On-line data entry is desirable because of the time saved by entering programs and data at a keyboard terminal without having to wait for keypunching. If users are to key in their own data, however, there must be simple procedures for correcting typing errors. A syntax checking facility is particularly desirable for PL/1 and FORTRAN users, so that many errors in syntax can be detected and corrected without the need for a costly and time-consuming compilation.

Users must be able to update programs and data used in processing. They must be able to make changes and corrections without having to reenter all the information. This requires a facility for storing programs and data within the central system. A user can then retrieve stored information for listing and updating.

A storage facility also makes it possible to share programs and data with other users, regardless of their physical locations. For example, a program that meets the requirements of several users can be stored so that users enter only the necessary data and submit the job for execution. If a user can share data, however, he must also be able to protect it from unauthorized access. He should be able to determine who is allowed access to his programs and data.

In addition to on-line entry and file update facilities, a terminal user needs a convenient means of submitting his programs and data for processing and of obtaining the output of these jobs. It is important that remotely submitted jobs be executed with as little delay as possible and that the results be available to the user as soon as execution is completed.

An installation may want to provide such computing services to remote users, but may not be able to dedicate a system solely to terminal-oriented use because a local workload must be maintained. This situation demands a system that can provide remote job entry, but in which remote jobs do not interfere with or degrade local work. At the same time, however, a terminal user should not be conscious of the fact that the system he is using is servicing many other users as well as processing both local and remote jobs.

IBM's Conversational Remote Job Entry (CRJE) satisfies the needs of both the terminal user and the installation. A facility of the IBM System/360 Operating System (OS), CRJE provides Remote Job Entry capability for users at remote keyboard terminals that are connected to an IBM System/360 via communication lines. Users can prepare and enter jobs for background processing under the operating system at the central installation. Remotely submitted jobs are scheduled, initiated, executed, and terminated under the control of the OS job management routines. Thus, a remote CRJE user has the same batch-computing facility that is available for a local user. By means of background processing of jobs submitted through CRJE, users have access to the full facilities of their installation's operating system.

Job input consists of programs and data that are conversationally created and maintained through the facilities of CRJE. Lines of program source statements, data, and job control language are collected within the central system as the user types them at a remote keyboard terminal. There is no need for keypunching, nor is there the waiting time for operator handling and card reading. Simple correction procedures make it easy to get data entered without typing errors. Also, syntax checking facilities for FORTRAN and PL/1 statements are provided.

Operating on-line with the system greatly reduces job turnaround time, since data is transmitted directly between the central processor and the terminal, with no intermediate devices such as card readers and printers. (See Figure 2.) To submit a job for execution, the user just selects the program, data, and job control statements to be entered into the OS input stream. As soon as the job is completed, the user can examine the output at any terminal.

Data entered from a terminal can also be saved at the central installation for subsequent use. Stored data can be retrieved easily for on-line display and modification, as well as be specified as part of job input to the operating system. A user can update his stored data by

inserting, replacing, deleting, and changing single lines or groups of lines. CRJE provides for protection against unauthorized access of stored data; it also provides a method for users to share data.

In addition to facilities for job preparation, job entry, retrieval of job output, and manipulation of programs and data, CRJE provides the terminal user with information about his data sets and the status of jobs he has submitted. There is also a message facility for two-way communication between terminal users and the operator of the central computer.

CRJE operates under the operating system providing multiprogramming with a variable number of tasks (MVT) or a fixed number of tasks (MFT). Operation under MVT requires an IBM System/360 Model 50, 65, 67(65 mode), 75, 85, or 91 with at least 393,216 bytes of main storage. Operation under MFT requires an IBM System/360 Model 40, 50, 65, 67(65 mode), 75, or 85, with at least 262,144 bytes of main storage. As a feature of the IBM System/360 Operating System that provides multiprogramming, CRJE can operate concurrently with batched jobs submitted locally as well as remotely. The flexibility of CRJE allows adaptability and extensibility of the system to meet the individual needs of an installation.

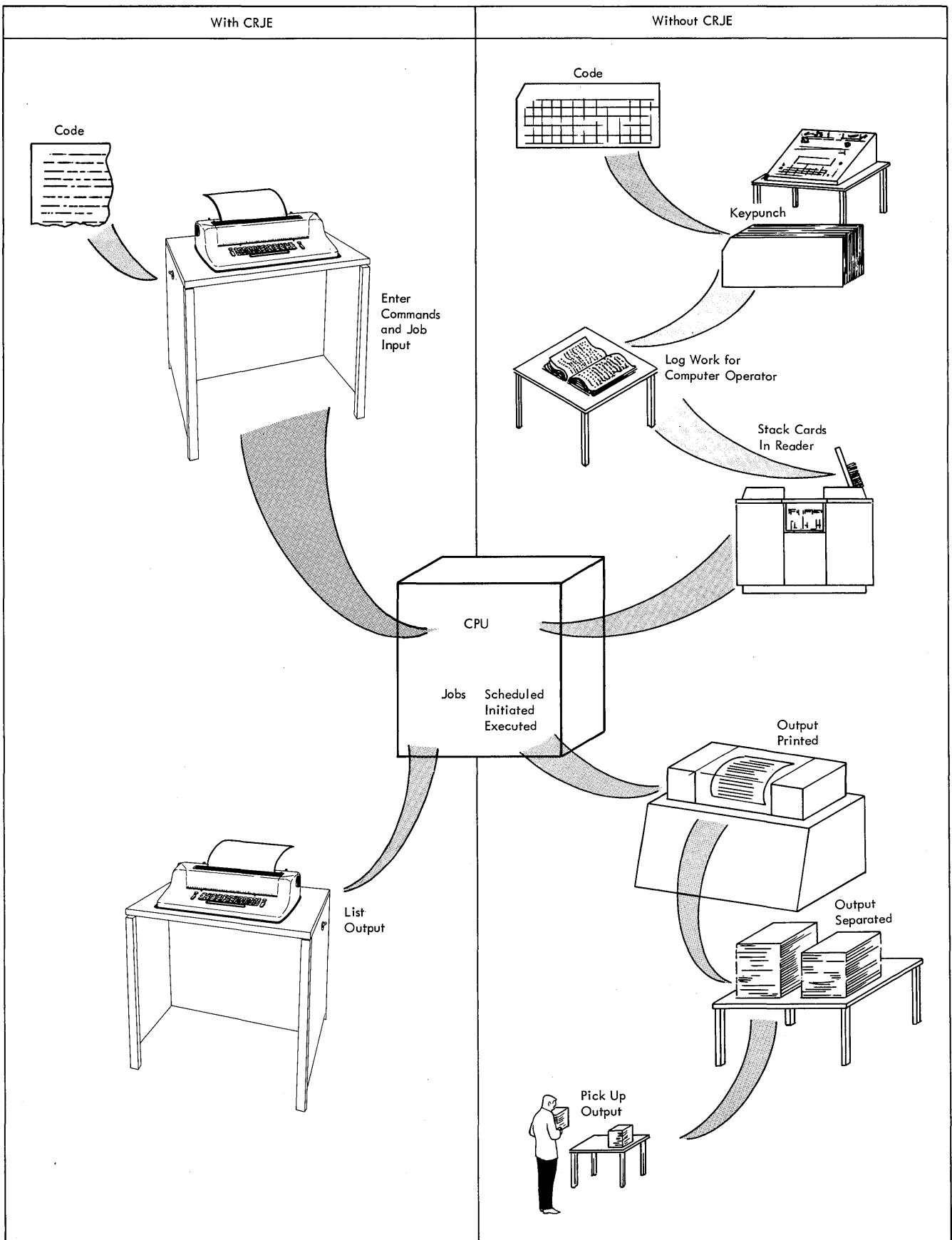


Figure 2. Reduced Overhead with CRJE

The remote terminals serviced by CRJE are typewriter-like devices. The keyboards serve as the input units to the system, and the printing mechanisms serve as output units. The terminals can be located at any distance from the central processor, the communication lines providing the necessary connection.

CRJE supports three types of terminals: the IBM 1050 Data Communications System with an IBM 1052 Printer-Keyboard, the IBM 2740 (Model 1) Communications Terminal, and the IBM 2741 Communications Terminal. The 1050 system is a multipurpose terminal in which a variety of devices, in addition to the 1052 Printer-Keyboard, can be attached to a control unit. The 2740 and 2741 are basically IBM SELECTRIC® typewriters with communications facilities, the 2741 being especially designed for conversational processing with a System/360. When not being used on-line, these terminals can be used as standard office typewriters. (See Figures 3, 4, and 5).



Figure 3. IBM 2741 Communications Terminal



Figure 4. IBM 2740 Model 1 Communications Terminal

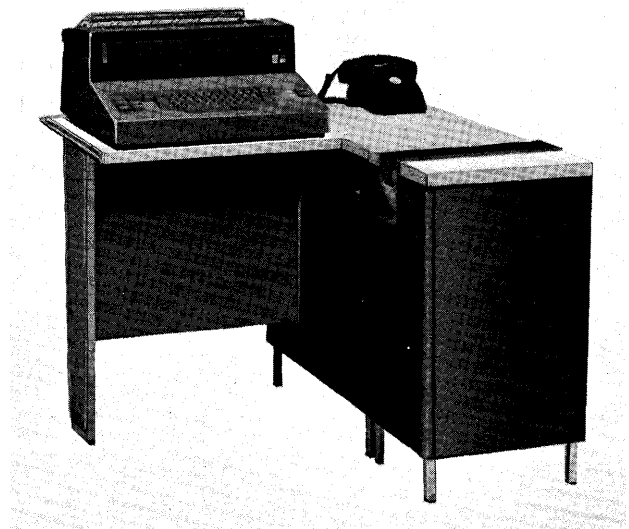


Figure 5. IBM 1050 Data Communications System

Conversational processing is on-line processing that consists of a dialog between the terminal user and the central system. Input from a user and response by the CRJE system alternate, as in an ordinary telephone conversation. While operating at a terminal, the user is in constant communication with the central system. He enters commands to request system actions or status information.

By the use of commands, the terminal user directs the activity of the central system. The user always initiates the dialog with the system, and normally, the conversation ends when the user chooses. The system processes each command as it is entered; the user enters another command only after the preceding one has completed. In processing a command, the system may prompt the user for information that was omitted or entered incorrectly. It may also accept lines of program and data input keyed in by the user.

A user's background jobs are executed while the user continues to operate at the terminal. When a user requests the execution of a job, CRJE submits the specified job stream to the operating system for processing. Execution of the job proceeds under the control of OS job management routines, while CRJE continues to accept other commands entered by the user. When the background job terminates, the user who submitted it is notified that it is complete and that the output is available. He can then list conversationally all or portions of the output created.

The time during which the system and a terminal user are engaged in a conversation is referred to as the user's session. During his session, a user is considered active; he is inactive while he is not working at a terminal. The term active may also refer to a terminal where there is a session in progress, as may the term inactive refer to a terminal where there is no session in progress. While a terminal is active, the communication line connecting it to the central processor is available for transmission of data to and from the central system. The line connection may be permanently established, or it may have to be established by dialing.

After a startup of the CRJE system, users can initiate sessions at will until there is a system closedown. A user initiates a session by logging on, i.e., entering his identification code and a password that identifies him as an authorized user of the system. He then proceeds with his session, which consists of the commands and data he enters and the system responses he receives. When the user has satisfied his present requirement for CRJE services, he logs off the system, thus ending his session.

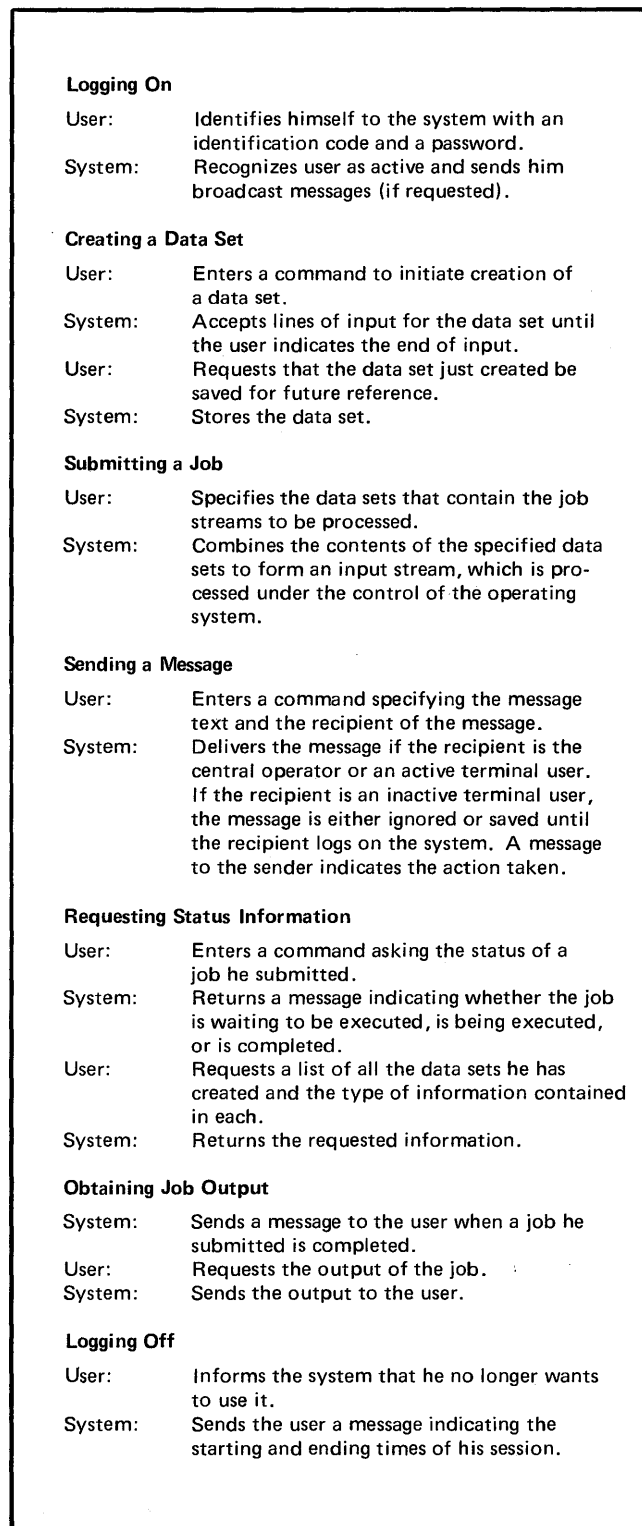


Figure 6. Session Dialog

Operation of a CRJE system involves people with various responsibilities at the central installation as well as the users at remote terminals. Planning for the system, generating the system, and maintaining it after it becomes operational are the responsibilities of a system manager and system programmer. The central operator is responsible for the operation of the central computer and its peripheral devices.

SYSTEM MANAGER

The system manager has general administrative responsibility for the operating system. In planning for CRJE, he must decide on the appropriate configuration for his system. He determines the number of users to be serviced by CRJE and the number of terminals that will accommodate these users. By estimating the degree of activity of the terminal users, the system manager can decide the amount of secondary storage that must be provided for users' permanent storage and the amount of main storage necessary to handle communication lines, remote jobs, and messages, and to provide optimum performance in servicing user requests.

There are also decisions the system manager must make about tailoring the CRJE system to meet the needs of the users at his particular installation. Some system facilities, such as PL/1 and FORTRAN syntax checkers, are optional and need be included only if required by terminal users. If desired, the facilities of the system can be easily extended. Defining these additional facilities and assigning system programmers to develop them are part of the system manager's job. Accounting procedures, which are established according to the installation's requirements, must also be defined by the manager.

The system manager is responsible for authorizing system use. When the system is designed, he decides who will be recognized as valid users. After the system is operational, he may authorize additional users and withdraw service to previously authorized users.

SYSTEM PROGRAMMER

The system programmer is responsible for implementing the decisions of the system manager. This involves generating an operating system and defining, generating, and initializing the CRJE system with selected

options, assignments, and installation-defined exit routines. The system programmer codes the macro instructions that define the system and codes the exit routines that the system manager deemed necessary for the installation. He also provides procedures in the OS procedure library that are necessary for execution of CRJE.

Once CRJE is operational, the system programmer guides the central operator in starting and restarting the system and in making system modifications that are accomplished by operator commands. If a user's storage requirements increase, the system programmer can allocate additional space if it is available.

One of the primary roles of the system programmer is to provide assistance to terminal users. He must insure that each user has the information necessary to operate with his particular installation—the optional facilities included, any additional system facilities provided, accounting information required, and installation assignments made. The system programmer can be especially valuable in helping users who have little programming experience. Job Control Language (JCL) statements required for frequently executed programs can be supplied by the system programmer and stored in the central system, where all users have access to them. If this information were supplied, the user would be concerned only with writing his program, without worrying about the details of writing JCL. A series of commands used in an often-repeated operation can also be stored so that terminal users need not worry about the details of the commands involved in performing the operation. In order to execute the commands, the user can simply specify the name under which they are stored.

CENTRAL OPERATOR

The central operator is responsible for running the operating system that provides Conversational Remote Job Entry. This includes operating the computer and its peripheral devices at the central installation and making sure the communication lines that link the remote terminals to the central processor are properly connected. By means of commands, the central operator starts and stops operation of CRJE and controls or modifies the CRJE system while it is running. The

information and instructions that the operator needs are provided by the system programmer.

The central operator is also responsible for providing terminal users with information about the system that might affect the users' operation. Such information might include the installation equipment configuration and its status, a scheduled closedown of CRJE, and the next scheduled startup of CRJE. The operator can supply this information by means of the message facility, which is available through use of central commands.

TERMINAL USER

Since the purpose of CRJE is to extend computing facilities to remote users, users do not have any responsibility for the operation of the system itself. A person who is authorized to use CRJE can operate at any of the terminals serviced by the system and need be

concerned only with the work he needs to do. The work done by various users of the same system is not necessarily related in any way.

A terminal user of CRJE can be anyone who requires the services of a computer. Programmers, doing systems programming or applications programming, have the same background processing facilities that would be available to them locally. An installation can provide standard procedures so that nonprofessional programmers, such as students and engineers, can take advantage of the computing facilities. A terminal user could even be someone just entering data that will be used by others.

The basic functions of CRJE can be easily understood by the new user, while more complex facilities are available for more experienced users. The new user is thus not faced with complicated instructions, and the experienced user is not restricted to a basic, inflexible set of procedures.

DATA ORGANIZATION

Each CRJE terminal user has a permanent library for storage of the data sets he creates conversationally. Active users share temporary storage (on disk) called the active area, for use in creating and manipulating data sets. In addition to data sets created and maintained through the facilities of CRJE, terminal users have access to certain data sets created through data management facilities of the operating system. These data sets are referred to as OS data sets, while those created conversationally and stored in user libraries are referred to as CRJE data sets.

User Libraries and CRJE Data Sets

Each user of the CRJE system has a user library in which he can store data sets he creates. User libraries reside on disk storage facilities at the central installation. They are allocated prior to CRJE operation and according to the storage requirements of the user and the amount of storage available in the system. Data sets in user libraries are not affected when user sessions are terminated or when the CRJE system is closed down.

A user library is a partitioned data set that consists of members, which are the CRJE data sets stored by the user, and a directory, which contains information about the members and where each is located. (See Figure 7.) The identification code of a user is a part of the name of his user library, and only that user can store data sets in his library. Each data set has a 1-8 character name, which is assigned by the user. The user may also assign a protection key to a data set in his library in order to prevent unauthorized access to it.

The CRJE data sets in a user library may consist of one or more sequential records, which are called lines since each record represents one line of input entered by a user at a remote terminal. A user is allowed up to 80 characters of input per line. A line number is associated with each line entered. The line numbers, which serve as identifiers when lines are listed or modified, can be maintained in the last eight positions of the line, in addition to the line numbers maintained internally by CRJE.

CRJE data sets may contain source language statements, Job Control Language (JCL) statements, data records, or any combination of these three. Source statements may be coded in any language supported by

the central operating system. In addition to compilers and assemblers provided by the operating system, syntax checkers may be provided by CRJE to detect errors in PL/1 and FORTRAN statements in CRJE data sets.

For special applications, a CRJE data set may consist of lines containing names of CRJE data sets (a data set list) or containing CRJE terminal commands (a command list). A data set list may be used to specify a combination of data sets which form a job entry. A command list may be used to execute a series of commands that perform an often-repeated function.

CRJE data sets can be shared on a read-only basis. Users may retrieve data sets from other users' libraries if sufficient information is provided, but a user can store data sets only in his own library. A user may protect a CRJE data set by assigning it a protection key when he saves it in his library. Other users have access to such a protected data set if they know the name, protection key, and owner's identification code. A data set without a protection key is accessible to any user who knows the data set name and the data set owner's identification (userid). In order to retrieve data sets from his own library, a user need only specify the data set name.

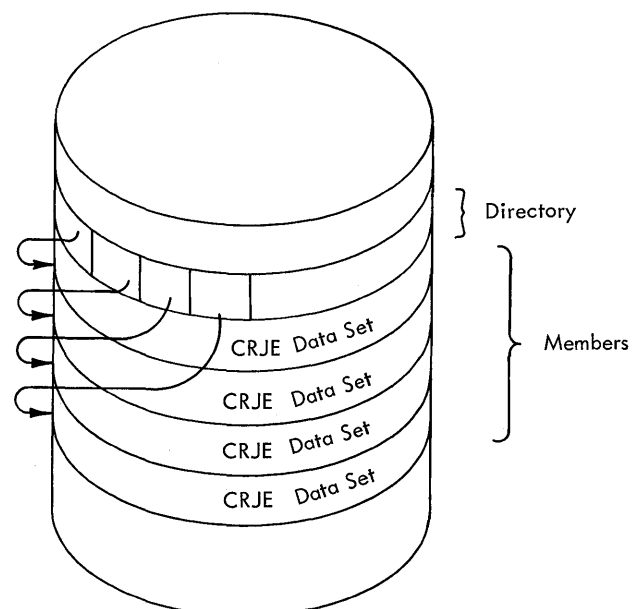


Figure 7. User Library

Active Area and Active Data Sets

The active area, a work area in direct access storage, is used for creating and manipulating data sets. The data set that a user is creating, updating, or listing is called his active data set. Lines of a data set being created are collected in an active data set. At any time during the creation of a data set, the user can make corrections to previously entered lines. The data set does not become a permanent CRJE data set until it is saved in the user's library.

In order to be listed, modified, or scanned for syntax errors, a CRJE data set must be copied into the active area to serve as the active data set. The user identifies the lines to be listed, modified, or scanned by specifying the line numbers associated with the lines. A modified data set in the active area does not replace the original, permanent copy in a user's library unless the user stores it with the same name as the original data set.

OS data sets, which are data sets other than those in CRJE user libraries, can also be copied into the active area where they can be listed. CRJE assigns line numbers to each record of an OS data set as it is copied into the active area so that the user can list lines selectively. OS data sets that are accessible to CRJE users are described in the following paragraph.

OS Data Sets

OS data sets are data sets created by background jobs using OS data management facilities. Although created independently of CRJE, OS data sets are accessible through CRJE if they satisfy certain conditions. They must be named data sets that are cataloged in the OS system catalog, they must be resident on a single volume of a direct-access storage device (DASD) that was mounted at the time CRJE operation started, and they must have either sequential or partitioned organization. A sequential data set or a member of a partitioned data set can be copied into the active area, where it can be examined by the user.

JOB PROCESSING

CRJE allows a user at a remote terminal to enter jobs into an input stream to be processed under the control of the operating system. At the request of a user, CRJE constructs the input stream by combining specified data sets. Once the input stream is constructed, all job handling is done by OS job management routines while CRJE continues to process commands entered by the terminal user. Remote jobs in the input stream are processed in the background in the same manner as

batched jobs entered from a local input unit, such as a card reader. Jobs are scheduled on an input work queue and are initiated when the required resources are available and all higher priority jobs have been handled.

Job Submission

When a user is ready to submit jobs for processing, all of the necessary input must have been collected within the central system. The user describes the input stream to be processed by specifying the data sets that contain the necessary job control statements, program source statements, and data. These data sets can be CRJE data sets in user libraries and the user's active data set, if one currently exists. The user may specify CRJE data sets in his own library, or he may specify those in another user library to which he has access. Job Control Language (JCL) statements may be supplied by the user, or they may be provided in another user library to which he has access. The JCL may invoke a procedure from the OS procedure library, which contains job control statements for applications used on a regular basis.

The user must specify data sets in the order in which their contents are to be entered into the input stream. He may specify a data set that contains just a list of the names of CRJE data sets that compose his job stream, in which case the contents of each data set in the list are entered into the input stream.

Once the input stream specified by the user is collected, CRJE no longer has control over the processing of the job. Under the control of the operating system, the input stream is read and the jobs scheduled on an input work queue. Jobs are selected for execution according to their position on the input work queue. CRJE can supply the user with information about the status of the job in the operating system or can cancel the job at the user's request, but there is no user interaction with background jobs.

When a conversationally submitted job is completed, a message indicating normal or abnormal termination is sent to the user who submitted the job. The user then knows that output is available for examination.

Job Output

The output data sets created by a user's background jobs can be assigned to a general class of system output (SYSOUT) or can be specifically described as OS data sets. The job control statements for each job describe the output data sets that will be created, as well as the ones that will be used during processing.

SYSOUT data sets can be directed to system output classes from which they will be written to devices at the central installation or to the system output class especially designated for output to be returned to CRJE terminal users. The output class used by CRJE is assigned when the CRJE system is assembled. Job output directed to this class can be requested by the terminal user who submitted the job. He simply specifies the name of the job in order to get all the job's output that was directed to the CRJE system output class. The user can obtain only one complete copy of the data sets in this output class.

Each data set in the CRJE system output class is deleted after it is transmitted to the user in its entirety. If the user interrupts the transmission of such a data set, he can skip the data set that was interrupted, resume the output listing where he left off or at the

beginning of the data set that was interrupted, or he can request the central operator to obtain the remaining output at the central installation.

A job can also produce OS data sets, which will be accessible to other terminal users and can be used by other background jobs.

A sequential data set or a member of a partitioned data set can be copied into the active area to serve as an active data set. In this process, line numbers are assigned by CRJE so that the user can selectively list the contents.

OS data sets can be obtained by any user knowing the fully qualified name of the data set. Multiple copies are available since these data sets are only deleted at the direction of a user. CRJE will delete an OS data set on command from a user if the first qualifier of the data set name is the user's identification code.

CRJE offers facilities for system administration, system operation, and terminal use. Administrative facilities are provided for the system manager and for the system programmer, who implements decisions made by the manager. Operating facilities are provided for the operator of the central computer. The operator may also be instrumental in carrying out decisions made by the system manager. The broadest range of facilities is, of course, provided for terminal users, for whom the system is designed.

SYSTEM MANAGER

The administrative facilities of CRJE are provided by means of system assembly options and operator commands. The system manager makes the major decisions about the characteristics of the generated system and any modifications to be made. The system programmer implements these decisions by coding CRJE macros and installation exit routines. These macros and exit routines are assembled to generate a CRJE system that is tailored to the installation's requirements. Significant system modifications made by means of operator commands are carried out by the central operator under the direction of the system manager or system programmer. The following functions are provided:

- Select optional facilities
- Add system facilities
- Provide installation accounting routines
- Make system assignments
- Make secondary storage assignments
- Authorize system use

Select Optional Facilities

Some system facilities need be included in a CRJE system only if they apply to the particular installation and if the system is large enough to contain them. There would certainly be no need to include the FORTRAN or PL/1 Syntax Checkers if there were no FORTRAN or PL/1 users. The syntax checkers themselves provide options as to the level and degree of checking performed. The more storage space that is available, the more complete the checking can be.

The BTAM On-Line Terminal Test, a communication line serviceability feature, is also optional. Not

including this facility saves main storage space, but also means that full system resources must be made available to the customer engineer for terminal maintenance when required.

Add System Facilities

The facilities provided users by the terminal commands furnished by CRJE can be extended during system specification by the addition of installation-supplied commands. An installation exit in CRJE allows the inclusion of processing routines for any additional commands an installation would like to provide for its users. Aliases for commands supplied by CRJE can also be assigned when the CRJE system is being specified. An alias might be an abbreviated form of a command, or it could be a different name entirely.

Provide Installation Accounting Routines

Besides the exit provided for the addition of terminal commands, CRJE has three other exits at which the installation can provide routines to tailor the system to its own requirements. Accounting procedures are established by the individual installation. The existing facilities provided by the System/360 Operating System can be used for job accounting, since remotely submitted jobs are processed in the standard batch environment. CRJE provides an exit at the point where a job is submitted for background processing so that an installation supplied routine can examine the JOB statement of each job submitted to insure that required parameters are supplied.

In addition to batch job accounting, CRJE allows accounting on a user-session basis by providing exits at session initiation (LOGON) and session termination (LOGOFF). Whatever accounting information an installation requires is supplied by the user in his LOGON command. This information is passed to the installation's LOGON exit routine to be processed. The LOGOFF exit routine can obtain the length of the user's session and can record appropriate information.

Make System Assignments

A CRJE system is also tailored to the requirements of an installation by means of various assignments and

restrictions made during the CRJE assembly. A system can be specified according to the number of users to be supported, the number of remote jobs that can be monitored simultaneously, and the number of messages that can be handled at one time.

CRJE can be adapted to the installation's operating system and configuration by assignments such as the output class for remote job output; which console is to receive CRJE messages if the central system has multiple consoles; and the number of lines of output to be sent to a terminal before the terminal user can interrupt it.

Make Secondary Storage Assignments

Secondary storage requirements may vary greatly depending upon how large a system is being used, how many users there are for the system, and how much storage space each user needs. The space for permanent storage of users' data sets is allocated on a user basis. Each user is allocated space according to his needs and is assured that the space will not be used by other users.

The active area, which is used for creating and editing data sets, is also assigned according to the installation's requirements. If the anticipated work load is heavy, a large amount of storage can be allocated, whereas an installation with a light work load need allocate only a minimum amount of storage.

CRJE provides an initialization program for the CRJE system data set, which contains internal control information such as a table of remote jobs, a table of valid users, and messages waiting for delivery. The initialization program is generated according to installation specifications, and the size of the data set is determined by such information as the number of users, remote jobs, and messages allowed.

Authorize System Use

Users who will have access to the CRJE system are specified when the CRJE system is assembled. Each user is assigned an identification code and a password, both of which must be specified whenever he initiates a user session.

A central operator command provides dynamic control of CRJE system access. Additional user assignments can be made, existing assignments can be deleted, and system access can be temporarily denied to all or specific users.

CENTRAL OPERATOR

In addition to the system operator commands provided by the version of the operating system being used

(MVT or MFT), there are operator commands provided by CRJE for use in maintaining and controlling the CRJE system. The operator of the central computer can:

- Start and stop CRJE operation
- Display system information
- Obtain remote job output
- Communicate with terminal users
- Control service to communication lines
- Control access to the system

Start and Stop CRJE Operation

Operation of CRJE is started by means of a command entered at the console of the central computer. System startup can mean resuming operations that were temporarily stopped by a system shutdown, or it can mean initializing the system without regard to any operations previously performed. Once the system is started, terminal users can initiate and terminate sessions at will.

System shutdown is also achieved by an operator command. When system operation is stopped, the sessions in progress are automatically terminated and the communication lines are no longer serviced. Jobs being processed under the control of the operating system are not affected by a CRJE shutdown.

Display System Information

The central operator can display system information about users, jobs, and communication lines. Any of the following information about users may be displayed: a list of all valid CRJE users with an indication of whether each is active, an indication of whether a particular user is active and how long he has been active, and the number of currently active users. The operator can also request notification whenever either all users or a particular user logs on and off the system.

In addition to the OS facilities provided for displaying information about jobs, CRJE allows the operator to list remotely submitted jobs that are in the operating system, with an indication of whether each is completed.

Error counts and the total transmission count for communication lines are automatically displayed when any one of the counts reaches a threshold value defined during the CRJE assembly. In addition, an operator command provides dynamic display of accumulative error counts and total transmission of all lines or for a particular line serviced by CRJE.

Obtain Remote Job Output

Remote job output originally designated as output to be returned to the terminal can be obtained at the central installation by entering an operator command. This facility might be used when output cannot be transmitted to a terminal, when undelivered output is occupying needed space on storage devices, or when a user specifically requests the operator to obtain the output.

Communicate With Terminal Users

The central operator can send messages to terminal users and can maintain the broadcast messages, which contain information of interest to all users. The operator can send a message to all active users or to a particular user. If a particular user is not currently active, the message can be retained for delivery to him when he next logs on.

The broadcast messages are a convenient means of supplying information about which users should be aware to do their work most effectively. They are generally sent to a user when he logs on, but there is also a terminal command that allows a user to request a copy of these messages at any time. The central operator maintains the broadcast messages by adding and deleting messages. He can also control the order in which the messages are sent to users.

Control Service to Communication Lines

The central operator can dynamically suspend and resume service to a communication line. This facility is particularly valuable if a line is temporarily inoperative. The line can be deactivated, or removed from use, until it again becomes available. Activating the line puts it back in use by CRJE.

Control Access to the System

A central command allows the operator to control access to the CRJE system by modifying the list of authorized users of the system and by restricting user session initiation. Under the direction of the system manager, the operator can dynamically make additions and deletions from the list of authorized terminal users. He can also temporarily prevent additional users from logging on the system. This capability is particularly useful in reducing a heavy system load and in preparing for system shutdown.

TERMINAL USERS

The CRJE system is designed to provide terminal users with an efficient, easy-to-use method of preparing and entering jobs for execution by the operating system. The user operating at a remote terminal accomplishes his work through the use of the terminal command language. He requests system action and information by entering commands that are interpreted and processed at the central system. The commands allow the user to perform the following functions:

- Enter programs and data on-line
- Store programs and data for future reference
- Protect and share data sets
- List lines of data sets
- Update and renumber stored data sets
- Have PL/1 and FORTRAN statements syntax-checked
- Submit jobs for processing
- Obtain job output
- Obtain status information
- Communicate with the central operator and other terminal users

Enter Programs and Data On-Line

The terminal user can key in lines of program source statements, data, and job control language statements, which are collected in data sets within the CRJE system. Tabulation facilities enable the user to format his input and output, and simple procedures allow easy correction of typing errors.

As PL/1 or FORTRAN source statements are entered, they can be checked for intra-statement syntax errors. Errors detected can be corrected immediately by changing only the line or lines affected.

CRJE provides automatic line numbering of data sets. Each line entered from the terminal is assigned a line number, which identifies the line for future reference. CRJE prompts the user for input by printing the line number to be assigned to the next line entered.

Store Programs and Data for Future Reference

A user can request that his programs and data be stored in his library at the central system for subsequent use. The information thus need be entered only once, after which it can be used in processing as often as desired. Future modifications can be made by indicating only the necessary changes. The unchanged lines never need to be reentered.

Protect and Share Data Sets

Stored data sets can be shared with other terminal users. Sharing is on a read-only basis; that is, only the user who saved a data set can make changes in it. Other users can list lines of the data set and can use the data set in job processing, but cannot make modifications in it.

Sharing is selective in that the identification code of the user who stored a data set must be supplied by another user wanting access to that data set. In addition, a user may assign a protection key to a data set when he saves it. This protection key must be supplied, along with the user identification, in order for anyone else to gain access to that data set.

List Lines of Data Sets

Lines of data sets can be listed by specifying the line numbers associated with them. A single line number may be specified, or two line numbers may be specified to indicate a range of lines. When a range is specified, those lines with line numbers greater than or equal to the first line and less than or equal to the last line are listed. The user can also request that the entire data set be listed. The lines can be listed with or without their assigned line numbers.

Update and Renumber Stored Data Sets

A terminal user can update data sets in his library by inserting, replacing, deleting, changing, and moving lines. He can also request that the lines in a data set be renumbered.

A user can add a single line or a group of lines to a data set. The lines he enters may replace existing lines or they may be inserted between existing lines, depending upon whether the line numbers indicated already exist. The user also has the protective facility of specifying insertion only or replacement only.

If only a few characters within a line need to be changed, the user can simply specify those characters along with the correct characters without having to reenter the entire line. A character string can be replaced throughout a range of lines as well as in a single line. Deletions may also apply to a single line or a group of lines.

Moving lines may be a matter of copying lines from one place to another within a data set, or it may mean inserting lines from one data set into another. In this case, lines are renumbered automatically to avoid duplicate line numbers. Renumbering can also be requested by a user.

Have PL/1 and FORTRAN Statements Syntax-Checked

A syntax checking facility is provided for PL/1 and FORTRAN users. As mentioned above, PL/1 and FORTRAN IV source statements can be automatically scanned for syntax errors as they are entered. The user can also request that one or more lines of source statements in a data set be scanned for syntax errors.

Diagnostics are performed on a single statement basis with no cross-checking between different statements. When errors are detected, the user can correct them by changing only the line or lines affected.

Submit Jobs for Processing

To submit a job for processing, a user simply specifies the data set or combination of data sets that contains the job control language statements, program source statements, and data to be entered into the job stream. The data sets specified may be ones the user himself created, they may have been supplied by the system programmer, or they may have been created by other terminal users. Remotely submitted jobs are executed in the background under the control of the operating system. Thus, the user can submit remotely any job that he would be able to submit for local batch processing. When a remotely submitted job is completed, the user who submitted it is notified so that he can obtain the output of it.

Obtain Job Output

Job output can be obtained at a remote terminal or at the central installation. The user determines the destination of the output when he submits a job. He can direct it to system output classes that correspond to devices at the central installation, or he can direct it to a system output class that contains output to be returned to CRJE terminal users. Output in the CRJE system output class can be obtained simply by specifying the name of the job that produced the output. This output is available to only the user who submitted the job, and only one copy can be obtained. If necessary, the central operator can also obtain output from the CRJE system output class.

If a user wishes to share job output with other users or wishes to obtain multiple copies of output, he may assign the output to a uniquely named data set, which must be cataloged in the OS system catalog. Such an OS data set is accessible to any user who knows the name of the data set.

CRJE allows a user to interrupt the transmission of output to his terminal. If the terminal is equipped with a special interrupt feature, the user can stop the output at any time. Otherwise, CRJE transmits the output in groups of lines, allowing the user to interrupt between groups.

Obtain Status Information

A CRJE user can request information about the status of jobs he has submitted and data sets he has created and stored in his user library. The status of a job indicates whether execution has begun, is in progress, or is completed. If a job is waiting to be executed, the user is notified of how many jobs are scheduled ahead of it.

The information a user can request about his data sets includes their size, whether or not they have

protection keys, when they were created, the last time they were edited, and how many times they were used. The user can inquire about a particular data set, or he can request a list of all his data sets and the status of each.

Communicate with the Central Operator and Other Terminal Users

A terminal user can send messages to the central operator or to another terminal user. If the central system is configured with multiple consoles, the user may specify the console to which the message is to be sent. When sending a message to another terminal user, a user may specify immediate delivery only, or he may specify that if the recipient is inactive, the message should be delivered to him when he next logs on the system.

This publication, *CRJE Concepts and Facilities*, provides introductory information for anyone connected with CRJE—managers, system programmers, operators, and terminal users. Additional information can be found in the *CRJE Terminal User's Guide*, the *CRJE System Programmer's Guide*, and various OS system publications. A brief description of the information contained in each of these publications follows.

IBM SYSTEM/360 OPERATING SYSTEM: CRJE TERMINAL USER'S GUIDE, GC30-2014

This publication is a guide for the new CRJE user as well as the experienced user. It contains information about how to operate the terminals supported by CRJE and how to use the terminal command language to direct the functions of CRJE. The commands are described in detail, and examples illustrate how they are used. Terminal messages are documented with explanations and appropriate system and user responses.

The terminal user's guide is the only publication a user needs in order to work at a terminal. In addition, however, the installation must provide its users with certain details about their particular system, such as installation exit routines, accounting procedures, optional facilities included, extended facilities available, and installation assignments.

The system programmer should also be familiar with this publication, since he must understand how the system is used in order to maintain it effectively.

IBM SYSTEM/360 OPERATING SYSTEM: CRJE SYSTEM PROGRAMMER'S GUIDE, GC30-2016

This manual contains a description of the CRJE operating environment and tells how the system is gener-

ated, expanded, and maintained. It gives the machine configuration—the features both required and supported for remote terminals, and the device requirements and storage estimates for the central system. A section on the generation of a CRJE system explains how to include CRJE in the operating system and how to allocate and initialize system data sets. The assembly macros and installation exits are described in detail, and an example of the required cataloged procedure for CRJE execution is given. Operator commands and central installation messages are included. Performance guidelines are also provided in this publication.

IBM SYSTEM/360 OPERATING SYSTEM: OPERATOR'S GUIDE, GC28-6540

This guide to running the operating system contains a section on the operation of CRJE. The facilities provided for the CRJE central operator are presented, and the commands for controlling and maintaining the CRJE system are described in detail.

IBM SYSTEM/360 OPERATING SYSTEM: MESSAGES AND CODES, GC28-6631

Messages generated by CRJE to be sent to the central operator or to terminal users are documented in this publication. Listed in alphabetic order, the messages are presented with explanations, system actions taken, and appropriate user responses.

active area: a work area in direct access storage used for creating and manipulating data sets.

active data set: the data set that a user is creating, updating or listing.

CRJE data set: a data set that is created via the facilities of CRJE and is stored in a user's library.

OS data set: a data set that is created via background jobs using OS data management facilities. It must be named, cataloged, resident on a direct-access storage device, and have either partitioned or sequential organization.

session: the period of time a user is active at a terminal.

syntax-checking: analyzing statements in a language (PL/1 or FORTRAN) to be sure that the structure of the expressions is correct.

user library: a partitioned data set that consists of members, which are the CRJE data sets stored by the user, and a directory, which contains information about the members and where each is located.

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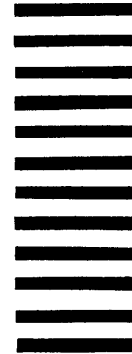
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