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IBM System/370 Model 158 Channel Characteristics

IBM

Preface

This publication is intended as a reference source for the systems programmer who wishes to calculate System/370 Model 158 channel loading, and who must evaluate system configurations for the most efficient channel operation.

For more general information about the Model 158, see the *IBM System/370 Model 158 Functional Characteristics,* GA22-7011.

The first section outlines the basic channel characteristics of the Model 158, explaining channel operations for both the byte multiplexer channel and the block multiplexer channel.

The second section explains the concepts of concurrent I/O operation and covers various methods of channel programming for efficient operation.

The third and fourth sections introduce methods for calculating whether a channel and device configuration will operate in a satisfactory manner.

The fifth section describes a procedure for calculating channel interference with the CPU.

The appendix contains tables used in calculating the channel load. It also contains samples of the *Byte Multiplexer Channel Worksheet,* and the *IBM 2703 Worksheet.*

Publications pertaining to the System/370 Model 158 may be found in the *IBM System/370 Bibliography,* GC20-0001.

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Changes are continually made to the information herein; before using this publication in connection with the operation of IBM systems, refer to the latest *IBM System/370 Bibliography,* GC20-0001, for editions that are applicable and current.

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GENERAL CHANNEL INFORMATION

IBM System/370 channels transfer data between main storage and I/O devices under control of a channel program executed independently of the CPU program. The Model 158 CPU (the IBM 3158 Processing Unit Model 1 or 3) is free to resume the CPU program after initiating an I/O operation.

Model 158 channels may run concurrently, within the data transfer rate and channel programming conventions specified in this manual.

A major feature of the channels is their common I/O interface connection to all System/370 input/output control units. The I/O interface provides for attachment of a variety of I/O devices to a channel.

At the end of an I/O operation, the channel signals an I/O interruption request to the CPU. If not disallowed, an I/O interruption occurs that places the CPU under control of the I/O new PSW. When I/O interruptions are disallowed, interruption requests are queued. Until honored, an I/O interruption condition is called a pending I/O interruption.

At the end of an I/O operation, a channel has information concerning the success of the operation, or has detailed information about any lack of success. This information is available to the CPU program.

Each System/370 channel has facilities for performing the following functions:

Accepting an I/O instruction from the CPU
Addressing the device specified by an I/O instruction
Fetching the channel program from main storage
Decoding the channel command words (CCW's) that make up the channel program
Testing each CCW for validity
Executing CCW functions
Placing control signals on the I/O interface
Accepting control-response signals from the I/O interface
Transferring data between an I/O device and main storage
Checking parity of bytes transferred
Counting the number of bytes transferred
Accepting status information from I/O devices
Maintaining channel-status information
Signaling interruption requests to the CPU
Sequencing interruption requests from I/O devices
Sending status information to location 64 (decimal) when an interruption occurs
Sending status information to location 64 (decimal) upon CPU request

CHANNEL CONTROL

IBM System/370 channels provide a common input/output interface to all System/360 and System/370 control units. All control units are governed by six basic channel commands and a common set of five CPU instructions. The instructions are:

Start I/O
Test Channel
Test I/O
Halt I/O
Halt Device

All I/O instructions set the PSW condition code; and, under certain conditions, all instructions except test channel may cause a channel status word (CSW) to be stored. A test channel instruction elicits information about the addressed channel; a test I/O instruction elicits information about a channel and a particular I/O device. Halt I/O terminates any operation on the addressed channel, subchannel, and I/O device. Halt device terminates only operations associated with the addressed I/O device. Only start I/O uses channel command words (CCW's).

A start I/O instruction initiates execution of one or more I/O operations. It specifies a channel, a subchannel, a control unit, and an I/O device. It causes the channel to fetch the channel address word (CAW) from location 72. The CAW contains the protection key and the address of the first channel command word (CCW) for the operation. The channel fetches and executes one or more CCW's, beginning with the first CCW specified by the CAW.

Six channel commands are used:

Read
Write
Read Backward
Control
Sense
Transfer in Channel

The first three are self-explanatory. Control commands specify such operations as set tape density, rewind tape, advance paper in a printer, or sound an audible alarm.

A sense command brings information from a control unit into main storage concerning unusual conditions detected during the last I/O operation and detailed status about the device.

A transfer in channel (TIC) command specifies the location in main storage from which the next CCW in the channel program is to be fetched. A TIC may not specify another TIC. Also, the CAW may not address a TIC.

Each CCW specifies the channel operation to be performed; and for data transfer operations, specifies contiguous locations in main storage to be used. One or more CCW's make up a channel program that directs a channel operation.

Command retry is a channel-control unit procedure that can cause a command to be retried without requiring an I/O interruption. Retry is initiated by the control unit. When the command being executed encounters a retriable error, the control unit presents retry status to the channel. If conditions permit, a normal device reselection occurs to reissue the previous command; if retry is not possible, any chaining is terminated and an I/O interruption follows.

Channels and Subchannels

System/370 channels maintain the following channel control information for each I/O device selected:

Protection key
Data address
Identity of operation specified by command code
CCW flags
Byte count
Channel status
Address of next CCW

On both byte and block multiplexer channels, the listed information must be maintained for each subchannel in operation. Storage for this information is provided by special channel storage that is not directly addressable. Each subchannel has provision in channel storage for unit control word (UCW) information. When a particular subchannel is selected by a start I/O instruction and a channel program is initiated, the UCW locations for the subchannel are loaded with the information necessary for operation of the subchannel.

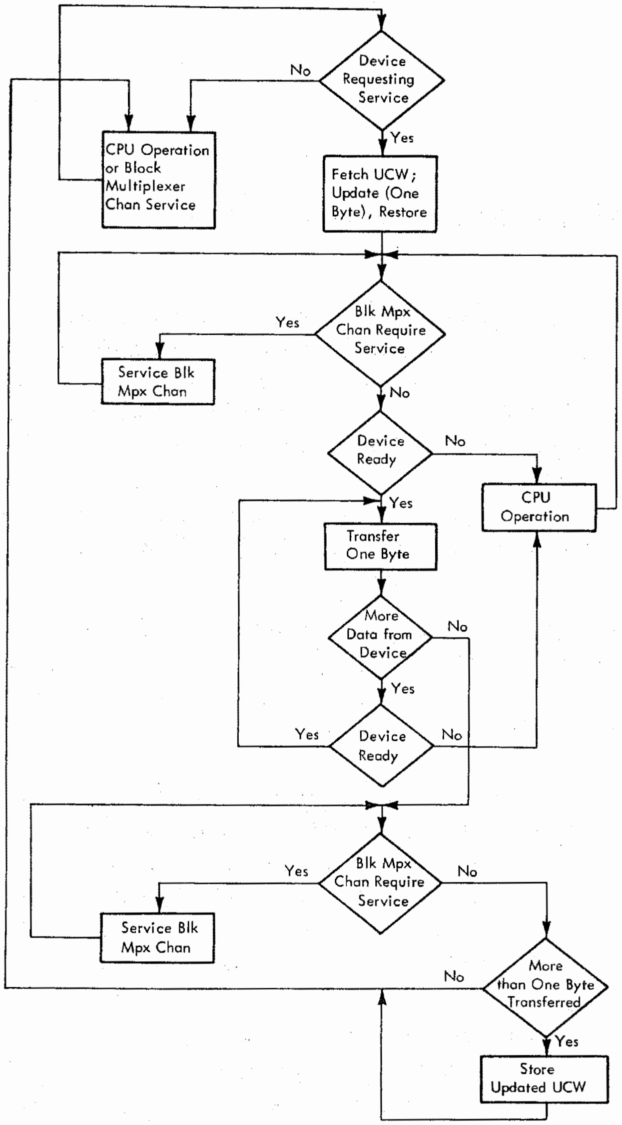
At each cessation of activity in a subchannel, its UCW contains updated information, and the channel is available for operation of another subchannel. The sharing of facilities by the byte multiplexer channel and the CPU is shown in Figure 1.

Chaining

A single CCW may specify contiguous locations in main storage for a data transfer operation, or successive CCW's may be chained together to specify a set of noncontiguous storage areas. Chaining to the next CCW is caused by the presence of a flag bit in a CCW.

In data chaining, the address and count information in a new CCW is used; the command code field is ignored unless a TIC is specified.

Entire CCW's, including their command code fields, may also be chained together for use in a sequence of channel operations. Such coupling is called command chaining, and it is specified by a different flag bit in a CCW.



Note: During byte multiplexer operation, the block multiplexer channels are scanned for higher priority data service requirements as shown. The CPU is allowed to absorb available time due to delays in device responses.

Figure 1. Equipment Sharing by Model 158 CPU and Byte Multiplexer Channel

Data chaining has no effect on a device, as long as the channel has sufficient time to perform both data chaining and data transfer for the device.

In this manual, when a device is said to data chain, it means that the channel program for the device specifies data chaining.

Fetching Channel Command Words

The channel must fetch a new CCW when a CCW specifies data chaining, command chaining, or transfer in channel (TIC). The extra control activity caused by these operations takes time and diminishes the capability of the channel to do other work.

A data chaining fetch operation usually occurs while a channel also has a data transfer load from the same device. The time required to fetch the new CCW necessarily limits the interval of time available for successive data transfers through the channel. An absence of data chaining ordinarily permits a channel to operate with a faster I/O device.

Data Chaining in Gaps

For direct access storage devices, such as an IBM 3330 Disk Storage or an IBM 2305 Fixed Head Storage Model 2, formatting write commands causes the control unit to create gaps between count, key, and data fields on the recording track. Read and write commands that address more than one of the fields may specify data chaining to define separate areas in main storage for the fields.

The gaps on a track have significance to channel programming considerations for direct access storage devices. The channel does not transfer data during the time a gap is created or passes under the read/write head, and this time is sufficient for a Model 158 to perform a command chaining or data chaining operation.

Command chaining ordinarily occurs only during gap time, but data chaining may occur during gap time or while data is being transferred. A data chaining operation occurring during gap time has a lesser impact on channel facilities than when data transfers also occur. If a channel program for a direct access storage device calls for data chaining only during gap time, the overall load of the device on channel facilities is significantly less.

When a direct access device is said to data chain in a gap, the reference is to a gap other than a gap following a data field. The latter gap causes a device end indication and command chaining is used in such a gap if the transfer of more information is desired. A device end condition occurring in the absence of a CCW specifying command chaining results in termination of the operation. When command chaining continues the operation, the status information available at the end of the operation relates to the last operation in the chain.

During a read operation, an attempt to data chain in a gap following a data field causes an incorrect-length indication in the channel status byte.

Late Command Chaining

Operation of direct access devices, such as disk storage, requires the use of command chaining. Between certain operations, such as searching for a record identification key and reading a data field on a direct access storage device, the control unit has a fixed time interval during which it must receive and execute a new command. If activity on other channel(s) causes too much delay in initiation of the operation specified by the new command, the channel program is terminated and an I/O interruption condition occurs. Certain I/O devices can cause a command retry operation without requiring an I/O interruption.

Storage Addressing

During a data chaining operation, the beginning and ending byte addresses and the minimum number of bytes transferred are factors in the maximum data rates that different System/370 and System/360 channels can sustain. If the storage width of larger models and the possibility of using faster I/O devices are kept in mind when writing channel programs for smaller models, better performance will be obtained when the programs are run on larger models or with faster I/O devices.

For example, a tape operation at a 30 kb/s (kilobytes per second) data rate may data chain with a byte count of 1 on a System/360 Model 30 with one selector channel, but the same tape operation cannot be performed at 90 kb/s on a Model 158. In this instance, the use of a larger count for data chaining would permit the Model 158 to execute the channel program at 90 kb/s. Similarly, better performance can be obtained on the Model 158 when data chained blocks (records) begin on fullword, doubleword, or quadword boundaries.

CHANNEL IMPLEMENTATION

The Model 158 has two types of channels. A byte multiplexer channel and two block multiplexer channels are standard; as many as three block multiplexer channels and a second byte multiplexer channel (which takes the place of one block multiplexer channel) are optional. All channels on the Model 158 are integrated with the 3158 Processing Unit and share part of the CPU facilities. Each channel may attach as many as eight control units and can address as many as 256 I/O devices. Control units are connected to all channels through a standardized I/O interface.

Block Multiplexer Channel

Each block multiplexer channel provides a path for moving data between storage and a selected I/O device. It has storage for control information and data buffering for multiple subchannels. Data moves to or from an I/O device one byte at a time, but it is buffered to a width of 16 bytes for communication with storage. Block multiplexer channels can operate concurrently with each other and with the CPU.

Burst Mode is defined as operation over the I/O interface in which the device and the channel remain connected for a relatively long period of time in terms of system operation.

Byte Mode is defined as byte-interleaved operation over the I/O interface in which the channel and any one device remain connected for a relatively short period of time, typically long enough to transfer one byte or a small number of bytes.

Multiplexing refers to the channel and device capability of disconnecting and reconnecting during an operation over the I/O interface. The block multiplexer channel operates in burst mode and has multiplexing capability between blocks of data; the byte multiplexer channel operates either in burst mode or in byte mode with multiplexing capability between bytes, groups of bytes, or blocks.

Byte Multiplexer Channel

A byte multiplexer channel has a single data path that may be monopolized by one I/O device (burst mode) or shared by many I/O devices (byte mode). The design of a control unit predetermines whether its operation on the byte multiplexer channel is in burst or byte mode. In either case, data transfer between storage and an I/O device is controlled one byte at a time. Byte multiplexer channel operation may overlap block multiplexer channel and CPU operations.

When multiple I/O devices concurrently share byte multiplexer channel facilities, the operations are in byte mode. Each device in operation is selected, one at a time, for transfer of a byte or a group of bytes to or from main storage. Bytes from multiple devices are interleaved and routed to or from the desired locations in main storage. Therefore, the byte multiplexer channel data path is used by one device for transfer of one or a group of bytes, and then another devices uses the same data path. The sharing of the data path makes each device appear to the programmer as if it has a data path of its own. This leads to calling a device's share of the data path a subchannel.

Integrated Storage Control (ISC)

The Model 158 integrated storage control (ISC) feature provides the capability of attaching up to eight 3333 Model 1 drives. Additional 3330 Model 1's can be attached to provide a maximum of sixty-four drives. The ISC executes IBM DASD-type commands and is program compatible with the 3830/3330 facility in the areas of data format, channel commands, permissible command sequences, and error recovery procedures.

The ISC contains two data and control paths, each capable of attaching up to thirty-two drives (see Figure 2). The two paths are logically independent, with completely overlapped operation, and each can attach to separate block multiplexer channels.

A two-channel switch feature is available which provides for the attachment of an additional block multiplexer channel or integrated system channel to each data and control path. (See Figure 2.)

SUBCHANNELS AND UNIT CONTROL WORDS

The channel facilities required to sustain a single I/O operation are termed a subchannel. Subchannels may be either nonshared or shared. A nonshared subchannel has the facilities to operate only one I/O device; a shared subchannel provides facilities to operate one of an attached set of I/O devices.

The initiation of multiple I/O operations with logic-controlled channel multiprogramming requires that the subchannels be provided channel storage to record the addresses, count, and status and control information associated with the I/O operation. In the Model 158, the storage for a single set of such information is called a unit control word (UCW). UCW's are stored in normally unaddressable auxiliary storage of 16K bytes, referred to as 'bump' storage. 4K bytes are used for the first byte multiplexer channel and an additional 4K bytes for the second byte multiplexer channel, if installed. 8K bytes are used for the block multiplexer channels.

Byte Multiplexer Channel UCW Assignment

Each byte multiplexer channel has its own set of device addresses and its own set of subchannel numbers. This is true for both Models 1 and 3 of the 3158. However, the models differ in a number of respects in UCW assignment for the byte multiplexer channel. These differences are discussed in the following paragraphs.

UCW Assignment in the 3158-1

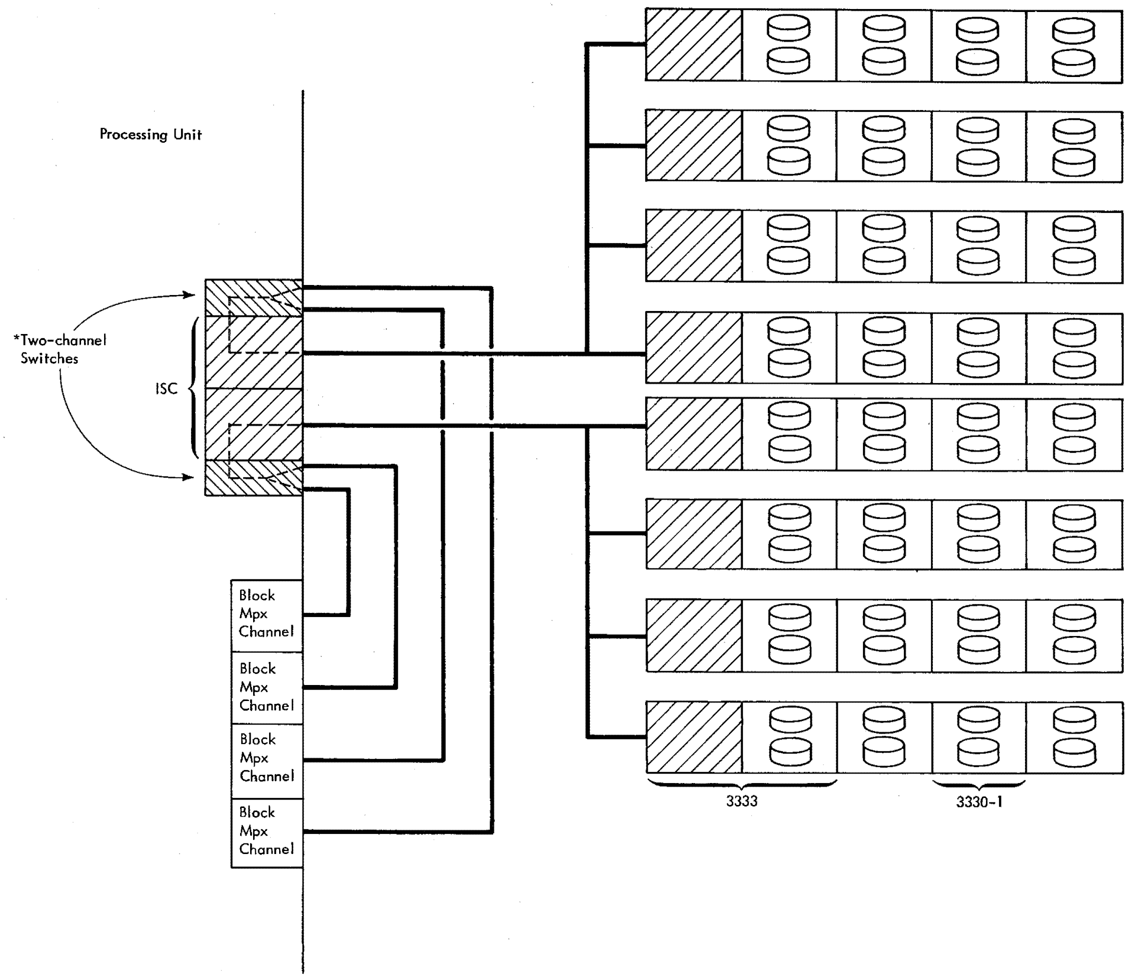
At installation time, the service engineer may independently wire the first byte multiplexer channel (channel 0) and the second byte multiplexer channel (if installed) either to allow or to inhibit the use of shared subchannels.

When the channel is wired to allow sharing, each device whose eight-bit address has a 1 in the high-order bit position is assigned to a shared subchannel. Each shared subchannel is associated with a block of 16 contiguous device addresses of the form X0 through XF. This arrangement provides eight shared subchannels. The shared subchannels use the same UCW's as the first eight nonshared subchannels. Because only one control unit should be used with a shared subchannel, the following device addresses are usually mutually exclusive:

80-8F and 00
90-9F and 01
A0-AF and 02
B0-BF and 03
C0-CF and 04
D0-DF and 05
E0-EF and 06
F0-FF and 07

As an example of an exception, the IBM 2848 Model 2 or 22 with the IBM 1053 Printer Model 4 attached requires 17 device addresses, all of which share one UCW.

When the channel is wired to inhibit sharing (nonsharing option), each device is assigned to a unique subchannel. A byte multiplexer channel wired for the nonsharing option has as many as 256 subchannels (Figure 3), numbered 00



*The two-channel switches may be connected to channels on the host CPU or on another CPU.

Figure 2. Integrated Storage Controls and Two-Channel Switches (Maximum Configuration)

	Byte Multiplexer Subchannels						Block Multiplexer Subchannels	
3158-1	Channel 0 Nonsharing Option **	Channel 0 Sharing Option **		Channel 4 * Nonsharing Option **	Channel 4 * Sharing Option**			
		Nonshared	Shared		Nonshared	Shared	Nonshared	Shared
	256	120	8	256	120	8	480	16

	Byte Multiplexer Subchannels Per Channel 0 or 4		Block Multiplexer Subchannels		
3158-3	Without Sharing	With Sharing	Without Sharing	With Sharing	
				Shared	Nonshared
	256	256 nonshared less 16 or 32 for each subchannel configured for sharing	480* or 736	32* or 40	480* or 736, less 1 for each shared subchannel

*True only when channel 4 is installed as the optional second byte multiplexer channel.

**The sharing or nonsharing option is wired by service personnel at installation time to the user's specification.

Figure 3. Available Subchannels

through FF. Each device is assigned a subchannel number that is the same as the device address.

UCW Assignment in the 3158-3

Plugcard positions are provided to assign shared subchannels to control-unit addresses. During system installation or reconfiguration, service personnel may plug a position on the plugcard for each attached control unit either to allow or inhibit a shared subchannel. Plugcard positions are provided to specify either 16 or 32 devices to be attached to any individual shared subchannel. When the control-unit position on the plugcard in the channel is plugged to allow sharing, all devices attached to that control unit are assigned to the same subchannel. If the 32-device option is plugged, the control-unit address assigned must be even-numbered, and the next higher odd-numbered control unit address is not usable.

Each shared subchannel is associated with a block of 16 or 32 contiguous device addresses in the form X0 through XF (for 16 addresses) or X0 through (X+1)F (for 32 addresses).

Because only one control unit can be used with a shared subchannel, the following device addresses are mutually exclusive, if sharing 32 devices.

00-0F and 10-1F
20-2F and 30-3F
40-4F and 50-5F
60-6F and 70-7F
80-8F and 90-9F
A0-AF and B0-BF
C0-CF and D0-DF
E0-EF and F0-FF

When the control-unit position on the plugcard is not plugged to allow sharing, each device is assigned to a unique subchannel. A byte multiplexer channel with no sharing enabled has 256 available subchannels (Figure 3), numbered 00 through FF.

Block Multiplexer Channel UCW Assignment

Models 1 and 3 of the 3158 differ in a variety of respects in UCW assignment for the block multiplexer channel. These differences are discussed in the following paragraphs.

UCW Assignment in the 3158-1

Block multiplexer channels assign devices to UCW's as needed. Sixteen of the UCW's available to the block multiplexer channels are reserved for shared subchannels; the remaining UCW's are used for nonshared subchannels. Sixteen plugcard positions are provided to assign the channel number and the device address set of up to 16 shared subchannels. These positions are wired at installation time. Each shared subchannel refers to a block of 16 contiguous device addresses of the form X0 through XF, and no more than one control unit should be attached to each shared subchannel.

During the execution of a Start I/O addressed to a device not specified on one of the plugcard positions, a block multiplexer channel in block multiplex mode checks to see if a UCW is already assigned. If a UCW is not assigned and the device is successfully selected, the channel assigns nonshared UCW's to a block of eight contiguous device addresses of the form X0 through X7, or X8 through XF. These UCW's remain assigned until a system reset occurs. For example, the assignment of a nonshared UCW to device 163 (channel 1, device 63) causes the assignment of UCW's to I/O addresses 160 through 167. When a nonshared subchannel operation is initiated after all available UCW's are assigned, the block multiplexer channel's registers are dedicated to that operation; multiprogramming on the channel is suppressed from the Start I/O initiation until the CSW is stored for the operation. In effect, the block multiplexer channel acts as a selector channel.

UCW Assignment in the 3158-3

Block multiplexer channels assign devices to unshared UCW's as needed. Shared UCW's are assigned during initial microprogram load (IMPL). There are as many as eight shared UCW's for each installed block multiplexer channel. Fewer may be specified, depending on customer requirements.

Assignment of the configuration is made by service personnel during system installation. This assignment can be easily changed if the system is reconfigured.

During installation or reconfiguration, the following parameters must be specified for each shared subchannel:

1. 16 or 32 devices installed per individual control unit.
2. Mode of operation (selector or block multiplex, for each control unit).

Each shared subchannel refers to a block of 16 or 32 contiguous device addresses of the form X0 through XF (for 16 addresses) or X0 through (X+1)F (for 32 addresses). Only one control unit can be attached to each shared subchannel.

A Start I/O instruction, executed by a block multiplexer channel, causes the subchannel to be tested to determine (1) if a UCW is assigned to the device, (2) if the UCW is shared, and (3) the mode of operation (selector or block multiplex). All UCW's not assigned at IMPL time are nonshared and permit the channel to operate only in block multiplex mode. If a UCW is not previously assigned and the device is successfully selected, the system assigns nonshared UCW's to a block of eight contiguous device addresses of the form X0 through X7, or X8 through XF. These UCW's remain assigned until a system reset occurs. For example, the assignment of a nonshared UCW to device

163 (channel 1, control unit 6, device 3) causes the assignment of UCW's to I/O addresses 160 through 167. When all nonshared UCW's are assigned, the next Start I/O operation to a device without an assigned UCW causes a "floating UCW" for that channel to be assigned. One floating UCW is reserved for each block multiplexer channel.

Modes of Operation

The block multiplexer channel has three modes of operation:

1. When operating in block multiplex mode with a nonshared subchannel that has a UCW assigned, the channel follows all block multiplex rules. (These rules are in *IBM System/370 Principles of Operation,* GA22-7000.)
2. When operating in block multiplex mode with a shared subchannel, the channel follows block multiplex rules but does not disconnect during command chaining. However, when terminating status is presented and the CPU is not enabled for interruptions from this channel, the channel disconnects until the status for the shared subchannel can be presented.
3. When not operating in block multiplex mode, or when operating with a nonshared subchannel for which a UCW cannot be assigned (because the UCW pool is exhausted), the block multiplexer channel of a 3158 Model 1 acts as a selector channel.

In a 3158-3, however, the block multiplexer channel operates as a selector channel only if it is specified, at the time of installation or reconfiguration, to operate in that way.

Block multiplexer channel UCW availability is shown in Figure 3.

INDIRECT DATA ADDRESSING

Channels do not implement dynamic address translation. CCW's in virtual storage must be translated by the control program before execution. To allow the designation of contiguous areas of virtual storage to be mapped into noncontiguous areas of real storage, indirect data addressing (IDA) is provided. For further information concerning IDA, see *IBM System/370 Principles of Operation,* GA22-7000.

CHANNEL PRIORITY

Priority for allocation of Model 158 CPU facilities is in the following order, for normal operation:

Machine check interruption handling
Block multiplexer channel data transfer
Block multiplexer channel data chaining
Block multiplexer channel command chaining
Byte multiplexer channel operations
Second byte multiplexer channel operations (if implemented)
CPU operations

Block multiplexer channels receive data handling priority in numeric order, with highest priority for channel 1.

I/O interruption priority is in order of channel number, with the highest priority for channel 0 and the lowest for channel 5. This priority is unchanged whether channel 4 is a byte multiplexer or a block multiplexer channel.

Channel Available Interruption

The Model 158 implements the channel available interruption on block multiplexer channels 1 through 5. The channel available interruption is not implemented on byte multiplexer channel 0 or on the second byte multiplexer channel (channel 4), if installed.

Each I/O device in operation places a load on its channel facilities. The magnitude of a load depends on a device's channel programming and its data transfer rate. In this manual, numeric factors are used to relate the loads caused by operation of I/O devices to the channel's abilities to sustain concurrent operation of the devices.

One or more numeric factors are specified for each I/O device and channel available with a Model 158. The numeric factors are presented in tables in the appendix to this manual and are used in arithmetic procedures for determining whether the operations of specific Model 158 input/output configurations are satisfactory.

Several procedures are provided for evaluating a configuration of I/O devices for concurrent operation on Model 158 channels. Use of the basic procedures will suffice for most configurations in determining whether operation is satisfactory; more detailed procedures are used only for configurations that appear to exceed Model 158 input/output capabilities.

Worst Case Loads

The evaluation factors and procedures allow for a worst case situation – when the most demanding devices in the configuration all make their heaviest demands on Model 158 I/O capabilities at the same time. Such a situation may not occur frequently, but it is the situation that the evaluation procedures place under test. If a particular configuration fails to pass testing, one or more devices may be expected to incur overrun or loss of performance.

Overrun

Overrun occurs when a channel does not accept or transfer data within required time limits. This data loss may occur when the total channel activity initiated by the program exceeds channel capabilities. Depending on the device, it may halt operation, or it may continue transferring data until the end of the block is reached.

An overrun may cause a unit check indication to be presented to the channel and stored in the CSW. Chaining, if any, is suppressed and an I/O interruption condition is generated at the end of the operation. Certain control units, however, may initiate a command retry sequence without storing a CSW or requiring an I/O interruption.

Loss of Performance

Overrun occurs only on unbuffered I/O devices. Buffered devices are not subject to overrun. Instead, when buffer service is not provided within required time limits, the device merely waits for channel service. While it is waiting, the device is said to incur a loss of performance.

Conventions for Satisfactory Channel Programs

Execution of a channel program causes a load on channel and system I/O facilities. Some I/O devices require execution of a chain of commands, preparatory to transfer of a data block. However, the impact of the load caused by a channel program is not a simple function of the number of commands used: the sequence in which particular types of commands appear in a channel program is also a factor.

A type of command particularly significant to sequencing considerations is a control command that is executed at electronic speeds and that does not cause any mechanical motion. The command is executed as an immediate operation and provides device end in the initial status byte. When command chaining is specified in such an immediate operation, channel facilities are not disengaged from the channel program until the chain ends or a command causing mechanical motion or data transfer is executed. Therefore, when immediate operations with device end in the initial status byte are chained together, fetching and execution of the CCW's may cause a heavy load on channel facilities. This load may cause excessive delay in channel service to one or more devices in the I/O configuration, with resultant overrun or loss of performance. For example, a chain of no-op commands can contribute heavily to channel loading. Thus, a programming convenience may cause a severe overrun situation for concurrently operating devices.

Data Chaining Considerations

A System/370 user is free to specify data chaining in channel programs, although a channel is able to transfer data at a faster rate, without overrun, when data chaining is not specified. The channel evaluation procedures and tables in this manual provide guidance in gauging the effects of data chaining operations.

Relationship of Conventions and Evaluation Procedures

The evaluation procedures are premised on channel programs having command sequences that provide efficient operation of I/O devices and avoid placing unnecessary loads on channel facilities. Channel programming conventions have been established to help I/O programmers avoid overrun situations.

Observance of channel programming conventions is fundamental to the selection of an I/O configuration that will permit concurrent operation of I/O devices in a satisfactory manner. The channel programming conventions described below are integral to the channel evaluation procedures. An evaluation yielding an indication of satisfactory channel performance is not dependable when channel programs written in violation of the conventions are used.

Scope of Conventions

1. The conventions relate to the sequence in which certain types of commands may be executed, not to their sequence in main storage.
2. The conventions define four classes of commands and the sequence in which they may be used.
3. The command sequences provided by the conventions are different for different types of devices. Sequences are provided for these devices:

DASD – 2303, 2305, 2311, 2314, 2321, 3330
Tape unit – 2400 series, 2420, 3410, 3420
Card units – 1442, 2501, 2520, 2540, 3505, 3525
Printers – 1403, 1442, 3211
Console Printer – 3213
Communication adapters – 2701, 2702, 2703, 3705

4. The conventions relate to all the commands in a chain including the CCW addressed by the CAW and the terminating CCW that does not specify any chaining.
5. The conventions do not relate to commands addressed by the CAW that does not specify any chaining.
6. The conventions relate only to the avoidance of overrun; they do not define invalid command sequences that are rejected by a channel, such as TIC to TIC, or that are rejected by a control unit. CCW sequences causing command reject are specified in the I/O device manuals.

Note that item 4 is of particular interest to I/O programmers working on segments of a single channel program; the rules still apply when one segment is chained to another segment.

The channel programming conventions in this manual are recommended to System/370 users, particularly in a multiprogramming environment where a programmer is not aware of the overall load on channel facilities. Where a programmer controls or has knowledge of all I/O activity, he may establish somewhat less restrictive channel programming conventions of his own which may be particularly suited to his application and configuration.

Classes of Commands

The conventions establish four classes of commands. Commands that always cause mechanical motion are in one class. The other three classes encompass commands that are always executed at electronic speeds, plus commands that are sometimes executed at electronic speeds. An example of the latter is rewind, which is executed at electronic speeds when tape is already at load point. The three classes of commands having electronic-speed properties differ in the length of time required for their execution.

The conventions for the different devices specify classifications for the specific commands pertinent to each device.

The conventions define the four classifications by the sequence in which they may precede or follow other commands:

Class A Commands: These commands may be chained in any order, without restriction. Class A commands always cause mechanical motion.

Class B Commands: Only one Class B command may be chained between two Class A commands:

→A→B→A. = permissible command chaining sequence
→A→B→B→A. = command chaining sequence excluded by conventions

A Class B command may be substituted for a Class C or Class D command.

Class C Commands: A Class C command may appear only once in a channel program, and then only as the first command in a channel program; therefore, a Class C command may appear only in the location specified by the CAW:

CAW → C → A→B. = permissible program
CAW → A →C→A. = program excluded by conventions

A Class B command may be substituted for a Class C command:

CAW→B→A→B→A→B. = permissible program

Class D Commands: A Class D command may appear only as the last command in a channel program; it may not specify any chaining:

CAW→X→X→D. = permissible program
CAW→X→D→A. = program excluded by conventions

A Class B command may be substituted for a Class D command.

Some devices have conventions that exclude specific sequences of commands not excluded by the classifications above.

Some devices have conventions that allow a specific command sequence to be substituted for a single command of a specified class.

Command Classifications for I/O Devices

The following rules define classifications for specific commands used with a particular device. The bit pattern for each command code byte is specified to provide positive identification of commands.

Commands not classified may not specify any chaining and may be placed only in the location specified by the CAW. Each such command thus constitutes an entire channel program in which it is the only command. The sense command is used in this manner for all devices.

Direct Access Storage Devices: These command classifications are valid for all DASD devices.

Class A commands (any order):

Read	XXXX XX10	
Write Search Erase	XXXX XX01	
Space Record	0000 1111	
Recalibrate	0001 0011	(Class A on 2311 only)
NoOp	0000 0011	(NoOp may be used only when preceded by a formatting write: 0001 XX01 or 0000 0001)

Class B commands (not more than one between Class A commands):

TIC	XXXX	1000
Seek	0000 000X	0111 1011
Set Sector	0010	0011

These command chains have the properties of a single Class B command:

$$\text{TIC} \rightarrow \text{Seek} \qquad \text{XXXX} \quad 1000 \rightarrow \left\{\begin{matrix} 0000 & 0111 \\ 000\text{X} & 1011 \end{matrix}\right.$$

$$\text{Seek} \rightarrow \text{TIC} \qquad \left.\begin{matrix} 0000 & 0111 \\ 000\text{X} & 1011 \end{matrix}\right\} \rightarrow \text{XXXX} \quad 1000$$

$$\text{TIC} \rightarrow \text{Seek} \rightarrow \text{Set ∡} \qquad \text{XXXX} \quad 1000 \rightarrow \left\{\begin{matrix} 0000 & 0111 \\ 000\text{X} & 1011 \end{matrix}\right. \rightarrow 0010 \quad 0011$$

$$\text{Seek} \rightarrow \text{Set ∡} \rightarrow \text{TIC} \qquad \left\{\begin{matrix} 0000 & 0111 \\ 000\text{X} & 1011 \end{matrix}\right\} \rightarrow 0010 \quad 0011 \rightarrow \text{XXXX} \quad 1000$$

Class C commands (first CCW in program): These command chains have the properties of a single Class C command:

$$\text{Seek} \rightarrow \text{Set File Mask} \rightarrow \text{TIC} \qquad \left.\begin{matrix} 0000 & 0111 \\ 000\text{X} & 1011 \end{matrix}\right\} \rightarrow 0001 \quad 1111 \rightarrow \text{XXXX} \quad 1000$$

Class D commands (last CCW in program):

NoOp	0000	0011	(except when preceded by a formatting write)
Restore	0001	0111	(NoOp on other than 2311)

Excluded chains:

$$\text{Search} \rightarrow \text{TIC} \rightarrow \text{Write} \qquad \left.\begin{matrix} \text{X011} & 0001 \\ \text{X010} & 1001 \end{matrix}\right\} \rightarrow \text{XXXX} \quad 1000 \rightarrow 0000 \quad \text{X101}$$

Data chaining may propagate through a TIC command for gap-only data-chaining, as described in "Data Chaining in Gaps" under "Channel Characteristics."

2400 Series, 2420, 3410, and 3420 Tape Units:

Read	XXXX	XX10
Write	XXXX	XX01
Read backward	XXXX	1100
Forward space	0011	X111
Backspace	0010	X111
Write tape mark	0001	1111
Erase gap	0001	0111

Class B commands (not more than one between Class A commands):

TIC	XXXX	1000

Class C commands (first CCW in program):

Set Mode	XXXX	X011

This command chain has the properties of a single Class C command:

Set Mode → TIC XXXX X011 → XXXX 1000

Class D commands (last CCW in program):

Rewind	0000	0111
Rewind and Unload	0000	1111
NoOp	0000	0011

Mixed Mode Seven-Track Tape Operations: A routine may be used to select a tape unit, set its density mode, and then TIC to a desired channel program:

$$\text{SIO} \rightarrow \left.\begin{matrix} \text{Set Mode} \\ \text{TIC} \end{matrix}\right\} \begin{matrix} \text{Class C} \\ \text{sequence} \end{matrix}$$

The conventions require the CCW addressed by the TIC to be Class A.

If the tape applications involve mixed mode seven-track operations, the programmer may make provision for placing the proper set mode command in the location addressed by the CAW before SIO is issued, or the programmer may begin each channel program addressed by the TIC with an appropriate set mode command. This additional set mode command violates the convention for Class C commands and causes an additional load on channel facilities.

Card Units (1442, 2501, 2520, 2540, 3505, 3525):

Class A commands (any order):

Read	XXXX	XX10
Write	XXXX	XX01

Class B commands (not more than one between Class A commands):

TIC	XXXX	1000

Class C commands (first CCW in program):

Control	XXXX	XX11

Class D commands (last CCW in program):

Control	XXXX	XX11

Printers (1403, 1443, 3211):

Class A commands (any order):

Write	XXXX	XX01

Class B command (not more than one between Class A commands):

TIC	XXXX	1000

Class C commands (first CCW in program):

Control	XXXX	XX11

Class D commands (last CCW in program):

Control	0000	0011

Communication Adapters (2701, 2702): Data chaining with or without TIC can be used for these adapters.

Class A commands (any order):

Write Dial Break Diagnostic write	XXXX	XX01
Read Prepare Inhibit Search Diagnostic read	XXXX	XX10

Class B commands:

Not applicable

Class C commands (first CCW in program):

Control*	XXXX	XX11

Class D commands (last CCW in program):

Control*	XXXX	XX11

* For a communications network of switch-type terminals, these two control commands are Class A:

Disable	0010	1111
Enable	0010	0111

Evaluating Heavily Loaded Channels

When evaluating the performance of a system susceptible to channel overload conditions, consideration should be given to the relative ease of restarting an interrupted I/O operation. For example, an overrun on a communication line coupling two CPU's is handled more readily than a read overrun on a card read punch. Preferential priority may be given to devices that require manual intervention in response to an overrun condition. When operating under systems which support block multiplexing, it may prove advantageous to attach the 3211, 1403, and 2540 to a block multiplexer channel because of the greater efficiency of burst mode operations. These devices disconnect from the channel during the relatively long mechanical portion of their cycle. This minimizes CPU microcode cycles per data transfer, and transfers 16 times more data to storage.

Some circumstances may make it desirable to place devices with heavy load factors on the same block multiplexer channel rather than on separate block multiplexer channels, to reduce the channel load on the system.

Evaluations should not ignore the characteristics of IBM Programming Systems packages:

OS/VS1
OS/VS2
VM/370
DOS/VS
OS/360
DOS/360

These programs attempt to execute any start I/O instruction for which the channel and device are available.

Block multiplexer channel operations resulting in overrun cause degradation of the total system because of the time required for error recovery procedures.

OVERRUN EVALUATION CONSIDERATIONS

When more than one channel is running concurrently, the channels compete for use of the system's resources. If any channel is delayed in its bid for the shared resources because the resources are being used by other channels, the channel being delayed may overrun. The use of data chaining with TIC increases the time that a channel needs the shared resources; this may, in turn, reduce the maximum data rate that can be sustained on the channel and may diminish the capabilities of lower priority channels. The procedure in "Testing for Overrun" uses arithmetic formulas to express the effect of this contention.

The block multiplexer equations pertaining to data chaining do not represent the worst possible case from the standpoint of overrun, but are based on reasonable assumptions which take into account the frequency and coincidence of certain worst case conditions. For example, although the channels normally have higher priority than the CPU for the use of storage facilities, in certain unusual situations the CPU may monopolize the main storage facilities for an abnormally long period of time. If this happens when a channel is attempting to data chain, overrun may result. However, this coincidence of events is considered to be highly unlikely and is not treated in the generalized chaining capability algorithms.

When data chaining in extended control mode, overrun may be observed if successive data-chained segments are aligned as follows: fewer than 16 bytes are aligned past a page boundary at the end of the first segment, and fewer than 16 bytes are aligned before a page boundary at the beginning of the second segment.

OVERRUN TEST EXCEPTION

A channel program for direct access storage devices, such as an IBM 2311 Disk Storage Drive, must specify command chaining, and it may, of course, specify data chaining operations. The time it takes a gap on a track to pass a read-write head on one of these devices is sufficient for the channel to perform a data chaining operation. Gap time occurs in such operations as "write count, key, and data," where the gap time occurs between writing the count and the key, and between writing the key and the data.

If the program causes data chaining to occur only during gap time, the data chaining does not reduce the maximum data rate that can be sustained on that channel. It may, however, reduce the capabilities of lower priority channels that are also data chaining.

COMMAND RETRY

In systems that have disk storage and/or fixed-head storage facilities with retry capabilities (with a maximum of two facilities on each of the two highest priority channels) operating on more than three channels, simultaneous command chaining on four or more channels may cause late command chaining on the lower priority channels. In this event, the channel and control unit cooperate to reissue the failing command to repeat the operation after one revolution of the disk. Because late command chaining occurs infrequently, system performance is not likely to be affected significantly.

Because of the command chaining requirement of 3330 Disk Storage devices, it is suggested that configurations including both 3330 Disk Storage devices and 3420 Magnetic Tape Units Model 8, place the 3330's on higher priority channels than the 3420 Model 8's.

TESTING FOR OVERRUN

To determine the maximum individual block multiplexer channel capability under various operating conditions, see Table 10 in the appendix. Check to see that no device operating under the conditions in the left column of Table 10 exceeds the maximum data rate specified in the right column. This applies to any device on any block multiplexer channel.

To ensure that no overrun occurs because of channels running concurrently, perform the following procedure:

1. Determine p for each device on each block multiplexer channel by using the following formulas, as appropriate, with M equal to the data transfer rate (in megabytes/sec) of the device (Table 9):
   a. If the device is not data chaining, but is only transferring data:
      $p = 9.4 \times M$
   b. If the device is data chaining, use case i or ii:
      L = the smallest number of bytes specified as count for any command having the data chaining flag on.
      C = 64 if no TIC is to be executed between data chained commands.
      C = 80 if a TIC is to be executed between data chained commands.

Case i: If $L \geqslant 16$

$$p = 11.5 \text{ x} \frac{M}{L} \text{x} ((13 \text{ x} \frac{L+32}{16}) + C)$$

Case ii: If $L < 16$

$$p = 11.5 \text{ x } \frac{M}{L} \text{ x} (26 + C)$$

2. For each block multiplexer channel n, select pn equal to the largest of the p values for the devices attached to channel n.

3. Add the pn values for all the block multiplexer channels. If the sum is less than 100 ($p1 + p2 + p3 + \ldots + pn \leqslant 100$), and if no data chaining occurs on any channel, the system will operate with no overrun and the procedure is finished. If, however, the sum is greater than 100, reconfigure and repeat steps 1-3. If data chaining occurs on any channel, continue the procedure.

4. Set n = 1 and perform steps 5-9.

5. Check block multiplexer channel n. If no devices are data chaining, increase n by 1 and repeat. When a channel is found with devices data chaining (except when data chaining occurs only during gap time), check the devices that are data chaining. From Table 9, select the R factor for the data chaining device with the highest p and call it Rn.

6. Determine Tn using case i or ii, whichever is applicable:

Case i: If Ln, where Ln = the smallest number of bytes specified as count for any command having the data chaining flag on, is greater than 23,

$$Tn = 24 \text{ x } Rn$$

Case ii: If Ln is 23 or less,

$$Tn = Ln \text{ x } Rn$$

7. For each channel j, where j = 1 through n−1, select the appropriate case and calculate tj:

Lj = the smallest number of bytes specified as count for a command that is data chained on channel j.

Cj = 64 if no TIC is executed on channel j between data chained commands.

C_j = 80 if a TIC is executed on channel j between data chained commands.

Rj = is selected from R factors in Table 9 for the device on channel j with the highest p value.

Case i: If the device with the highest p value on channel j is not data chaining:

$$tj = 0.8 \text{ x} \frac{Tn}{Rj}$$

Case ii: If the device with the highest p value on channel j is data chaining with chained counts > 16, including the case when data chaining occurs only during gap time:

$$tj = 0.8 \text{ x } \frac{Tn}{Rj} + 13 + Cj$$

Case iii: If the device with the highest p value on channel j is data chaining with counts ≤ 16, including the case when data chaining occurs only during gap time:

$$tj = \frac{Tn}{Lj \text{ x } Rj} \text{ x } (26 + Cj)$$

where

$$tj\ (min) = 26 + Cj$$

8. Determine the validity of the formula

$$t1 + t2 + \ldots + t(n-1) + K + Cn \leqslant Tn$$

where

$K = 73$ for $L > 23$

$K = 88$ for $L \leqslant 23$

Cn = 64 if no TIC is executed on channel n between data chained commands.

Cn = 80 if a TIC is executed on channel n between data chained commands.

If the formula is valid, channel n will not overrun. If the formula is not valid, channel n will overrun whenever the combination of conditions as chosen in step 7 occurs.

9. Increase n by 1 and repeat steps 5-9 until all channels have been treated.

Example of Block Multiplexer Procedure

Configuration

Channel 1:	2305 Fixed Head Storage Model 2, no data chaining	1.5 mb/sec
Channel 2:	3330 Disk Storage, no data chaining	0.806 mb/sec
Channel 3:	3330 Disk Storage, no data chaining	0.806 mb/sec
Channel 4:	2420 Magnetic Tape Unit Model 7, data chaining 80-byte records. No TIC	0.320 mb/sec
Channel 5:	2420 Magnetic Tape Unit Model 7, no data chaining	0.320 mb/sec

Step 1

Channel 1: p (2305) = 9.4 x 1.5 = 14.1 = p1

Channel 2: p (3330) = 9.4 x 0.8 = 7.5 = p2

Channel 3: p (3330) = 9.4 x 0.8 = 7.5 = p3

Channel 4: $p\ (2420) = \text{Case i} \Rightarrow 11.5 \text{ x} \frac{.32}{80} ((13\text{x } \frac{112}{16}) + 64) = 7.1 = p4$

Channel 5: p (2420) = 9.4 x 0.32 = 3.0 = p5

Steps 2 and 3

$p1 + p2 + p3 + p4 + p5 \leqslant 100$

$14.1 + 7.5 + 7.5 + 7.1 + 3.0 = 39.2 < 100$

Steps 4 and 5

R factor for 2420 on channel 4 is 27

Step 6

Channel 4, Case i: T4 = 24 x 27.0 = 648

Step 7

Channel 1, Case i: $t1 = 0.8 \times \frac{648}{6} = 86$

Channel 2, Case i: $t2 = 0.8 \times \frac{648}{11} = 47$

Channel 3, Case i: $t3 = t2 = 47$

Step 8

$t1 + t2 + t3 + K + C4 \leqslant T4$

$86 + 47 + 47 + 73 + 64 = 317$

$317 < 648$

This configuration will operate without overrun.

TESTING FOR OVERRUN WITH MULTIPROCESSING

To determine the maximum individual block multiplexer channel capability under various operating conditions, see Table 10 in the appendix. Check to see that no device operating under the conditions in the left column of Table 10 exceeds the maximum data rate specified in the right column. This applies to any device on any block multiplexer channel.

To ensure that no overrun occurs because of channels running concurrently, perform the following procedure:

1. Determine p for each device on each block multiplexer channel by using the following formulas, as appropriate, with M equal to the data transfer rate (in megabytes/sec) of the device (Table 9):
   a. If the device is not data chaining, but is only transferring data:
      $p = 17.3 \times M$
   b. If the device is data chaining, use case i or ii:
      L = the smallest number of bytes specified as count for any command having the data chaining flag on.
      C = 75 if no TIC is to be executed between data chained commands.
      C = 102 if a TIC is to be executed between data chained commands.
      Case i: If $L \geqslant 16$

$$p = 11.5 \times \frac{M}{L} \times ((24 \times \frac{L + 32}{16}) + C)$$

      Case ii: If $L < 16$

$$p = 11.5 \times \frac{M}{L} \times (48 + C)$$

2. For each block multiplexer channel n, select pn equal to the largest of the p values for the devices attached to channel n.

3. Add the pn values for all the block multiplexer channels. If the sum is less than 100 ($p1 + p2 + p3 + ... + pn < 100$), and if no data chaining occurs on any channel, the system will operate with no overrun and the procedure is finished. If, however, the sum is greater than 100, reconfigure and repeat steps 1-3. If data chaining occurs on any channel, continue the procedure.

4. Set n = 1 and perform steps 5-9.

5. Check block multiplexer channel n. If no devices are data chaining, increase n by 1 and repeat. When a channel is found with devices data chaining (except when data chaining occurs only during gap time), check the devices that are data chaining. From Table 9, select the R factor for the data chaining device with the highest p and call it Rn.

6. Determine Tn using case i or ii, whichever is applicable:

Case i: If Ln, where Ln = the smallest number of bytes specified as count for any command having the data chaining flag on, is greater than 23.

$Tn = 24 \times Rn$

Case ii: If Ln is 23 or less,

$Tn = Ln \times Rn$

7. For each channel j, where j = 1 through N–1, select the appropriate case and calculate tj;

Lj = the smallest number of bytes specified as count for a command that is data chained on channel j.

Cj = 75 if no TIC is executed on channel j between data chained commands.

Cj = 102 if a TIC is executed on channel j between data chained commands.

Rj = is selected from R factors in Table 9 for the device on channel j with the highest p value.

Case i: If the device with the highest p value on channel j is not data chaining:

$$tj = 1.5 \times \frac{Tn}{Rj}$$

Case ii: If the device with the highest p value on channel j is data chaining with chained counts > 16, including the case when data chaining occurs only during gap time:

$$tj = 1.5 \times \frac{Tn}{Rj} + 24 + Cj$$

Case iii: If the device with the highest p value on channel j is data chaining with counts $\leqslant 16$, including the case when data chaining occurs only during gap time:

$$tj = \frac{Tn}{Lj \times Rj} \times 48 + Cj$$

where

$tj\,(min) = 48 + Cj$

8. Determine the validity of the formula

$$t1 + t2 + \ldots + t(n\text{-}1) + K + Cn \leqslant Tn$$

where

$K = 73$ for $L > 23$
$K = 88$ for $L \leqslant 23$

$Cn = 75$ if no TIC is executed on channel n between data chained commands.

$Cn = 102$ if a TIC is executed on channel n between data chained commands.

If the formula is valid, channel n will not overrun. If the formula is not valid, channel n will overrun whenever the combination of conditions as chosen in step 7 occurs.

9. Increase n by 1 and repeat steps 5-9 until all channels have been treated.

CHANNEL-TO-CHANNEL ADAPTER

The System/370 Model 158 operates at maximum efficiency when the channel-to-channel adapter (CTCA) is connected to the lowest-priority (highest numbered) block multiplexer channel. If any overrunable devices are attached to the byte multiplexer channel, the suppress data function should be operable on the channel to which the CTCA is attached.

There is a possibility of device overrun on byte multiplexer channel 0 (or 4) when the CTCA is on a block multiplexer channel. The suppress data function allows the byte multiplexer channel to suppress data transfer on the block multiplexer channel by bringing up suppress-out in the block multiplexer channel. Only buffered devices on the block multiplexer channel will have data suppressed.

The rate at which data is transferred through the CTCA depends upon the characteristics of the CTCA itself, the characteristics of the two channels to which it is attached, and the length of cable between the CTCA and the channels. The data transfer rate cannot be higher than that permitted by the more limited of the two channels. The limit established by a Model 158 block multiplexer channel connected through a CTCA to a System/370 block multiplexer channel by 100 feet of external cable is 1.3 megabytes per second. The maximum data rate allowed by a System/370 selector channel connected through a CTCA to a Model 158 block multiplexer channel by 100 feet of external cable is 0.4 megabyte per second.

The byte multiplexer channel on the Model 158 can handle a burst mode I/O device with a data rate not greater than 100 kilobytes per second. If byte mode devices are in operation when a burst mode operation is initiated on the byte multiplexer channel, they will overrun or lose performance when their ability to wait for channel service is exceeded.

BYTE MODE CONSIDERATIONS

Concurrent operation of I/O devices on a byte multiplexer channel is governed by several variables, including the following:

1. Devices vary in data transfer rates.
2. Devices have buffers varying in capacity from 1 byte to 132 bytes.
3. Devices vary in the number and type of CCW's needed for their operation.
4. Combinations of devices on the block multiplexer channels vary in the interference they cause.
5. The large number of I/O devices available for use on a byte multiplexer channel may be combined in many different ways.
6. Devices in a particular configuration may be physically connected in many different priority sequences.

Procedures using a worksheet and factor tables can be used to determine whether a byte multiplexer channel configuration will run concurrently in a satisfactory manner.

Device Load

A numeric factor has been computed for each byte mode device to represent its load on channel facilities. It is called a device load. The factors are listed in Table 1 in the appendix.

Other factors are listed in Table 1 for use in considering the impact of higher priority devices on lower priority devices.

Device Wait Time

After a byte mode device requests channel service, it has a fixed length of time that it can wait for service. If the channel provides service within this length of time, the device operates satisfactorily. If, however, the channel does not service the device within the device's wait time, either of two things happens: if the device is not susceptible to overrun, it continues waiting; if it is, it loses data and subsequently causes an I/O interruption condition. For example, when an IBM 1403 Printer on an overloaded byte multiplexer channel fails to receive data within its particular wait time, it merely waits until service is provided by the byte multiplexer channel. The delay does not cause an interruption condition; nor is a new start I/O instruction required for selecting the 1403. The only effect is a slight reduction in performance. If an IBM 1442 Card Read Punch read operation does not receive data service within its wait time, however, overrun occurs.

Wait time factors for byte mode devices are listed in Table 1.

Device Priority on Byte Multiplexer Channel

The priority of devices on a byte multiplexer channel is determined at the time of installation by the sequence in which they are connected to the channel. The cabling facilities provide considerable flexibility in the physical location and logical position of I/O devices.

Devices may have the priority sequence in which they are attached to the cable (select-out line priority) or the device most remote from the channel may be connected to have highest priority and the device nearest the channel connected to have lowest priority (select-in line priority).

Each device on the byte multiplexer channel cable may be connected (for selection) either to the select-out line, or to the select-in line. Thus, one or the other of the lines is specified in establishing priority for a desired physical layout of devices.

Because the second byte multiplexer channel (channel 4, when installed) has lower priority than the first byte multiplexer channel (channel 0), all the devices attached to the second byte multiplexer channel receive lower priority service.

Priority assignments and machine room layout should be established during the physical planning phase of an installation so that cables for the I/O devices may be properly specified.

A major consideration in assigning priority to multiplex mode devices is their susceptibility to overrun. Devices are identified in this manual as being in one of three classes:

Class 1: Devices subject to overrun, such as the IBM 2501 Card Reader.

Class 2: Devices that require channel service to be in synchronization with their mechanical operations. For example, the IBM 2540 Card Read Punch has a fixed mechanical cycle. Delay in channel service for such devices usually occasions additional delay due to synchronization lag.

Class 3: Devices that do not require synchronized channel service, such as an IBM 2260 Display Station with a 2848 Display Control. An IBM 1443 Printer is another device that does not require synchronized channel service; it can begin printing as soon as its buffer is full and line spacing is completed. Any loss of performance by devices in this class is limited to that caused by channel delay in providing service.

Devices in the first class have a need for the highest priority. The devices in the last two classes may operate with reduced performance on an overloaded channel but are not subject to overrun; their control units have data buffers or an ability to wait for channel service. Devices in the second class, however, should have higher priority than those in the third class.

Within each class, devices are assigned decreasing priority in the order of their increasing wait time factors; smaller wait time factors should have higher priority. Wait time factors are listed in Table 1.

When devices that operate only in burst mode, such as magnetic tape or disk storage devices, are attached to the byte multiplexer channel, they should have lower priority than byte mode devices. Low priority devices take longer to respond to selection than do higher priority devices; a burst mode device need be selected only once for an operation, but a byte mode device must be selected for the transfer of each byte, or a short burst, of data. Because the second byte multiplexer channel has lower priority than the first byte multiplexer channel, devices should be attached to the two byte multiplexer channels in descending priority as if they were attached to a single byte multiplexer channel.

The control unit determines whether a device operates on the byte multiplexer channel in burst mode or in byte mode.

Some devices, such as the IBM 2821 Control Unit, may operate on a byte multiplexer channel in either burst mode or in byte mode, as determined by the setting of a manual switch on the control unit's maintenance panel. Such devices are assigned priority on the byte multiplexer channel according to the mode of operation selected.

A byte multiplexer channel can transfer data most rapidly in burst mode. Where an application uses only class 2 or 3 devices that have the mode choice, improved byte multiplexer channel efficiency may be obtained by operating the devices in burst mode.

Table 1 specifies whether a device operates in burst mode or in byte mode.

Interference from Priority Devices

The byte multiplexer channel sustains concurrent operations in byte mode by servicing one device at a time.

The operating devices compete for service, and the byte multiplexer channel services them in the order of their priority.

Devices on the block multiplexer channels or higher priority devices on the byte multiplexer channel may force a lower priority byte mode device to wait for channel service. The former are called priority devices, and the latter is called a waiting device.

When a priority device forces a waiting device to wait for channel service, the priority device is said to interfere with the lower priority device.

When there is more than one priority device, each of the priority devices may generate interference. All such interference must be considered in determining whether the waiting device will receive channel service before its wait time is exceeded.

The test procedures for concurrent operation of byte mode devices assume that a waiting device has made its request for channel service at the worst possible time, that is, when the priority devices will cause maximum interference during the waiting device's wait time.

The channel ordinarily works its way through the interference, and the waiting device is unaffected by the wait. If, however, heavy interference forces the waiting device to wait past its particular wait time, it will be subject to overrun.

Priority Loads

To evaluate the effect of priority device interference on a waiting device, a numeric priority load is computed.

Three factors are considered in determining a priority load:

1. The control load caused by execution of CCW's, including chaining and transfer in channel operations.
2. The priority device's data transfer load.
3. The wait time of the device being evaluated.

Note that since a priority load is a function of wait time, a fixed priority load cannot be established for a priority device; the priority load caused by a priority device must be computed as a function of a particular waiting device's wait time.

Ranges of Wait Times

The relationship between the interference generated by a priority device (expressed as "priority load") and various wait times is shown in Figure 4. The abscissa relates to device wait times. The short wait time shown results in a heavy priority load; the longer wait time falls in a part of the curve showing much less priority load. This curve shows that the impact of a priority device on a waiting device is more intense for a waiting device with a short wait time than it is for a device with a long wait time.

Two factors, called A and B, are provided in this manual, which relate each device's priority load curve to different wait times. The priority load curve was considered in segments related to different time intervals, and an A and a B factor were computed for each curve segment. These factors are used to compute the priority load for a waiting

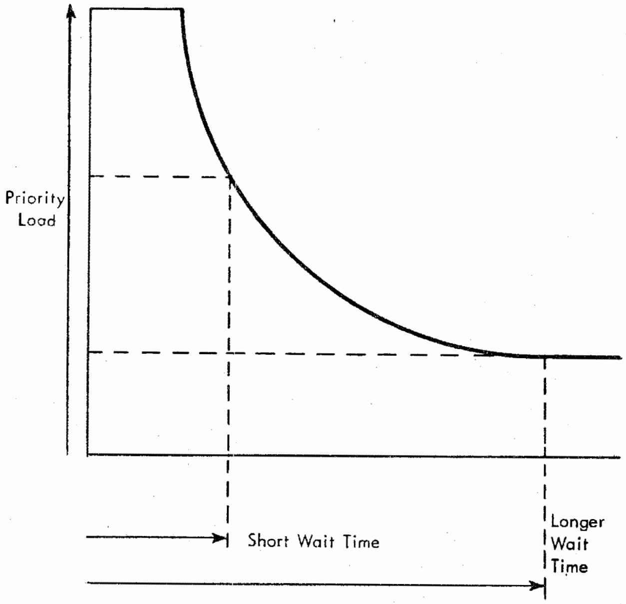


Figure 4. Priority Load Curve

device having a wait time that falls within the range of the interval established for the curve segment.

Multiple A and B Factors: Table 1 lists the A and B factors for each Model 158 class 1 input/output device.

Some devices have only one set of A and B factors. Other devices have more than one set. Each set has an associated priority time factor that represents the beginning of the time interval over which the A and B factors are effective.

Priority Time Factors: The priority time factors in Table 1 are used in the evaluation procedure to identify the A and B factors to be used.

As each waiting device is evaluated on a byte multiplexer channel worksheet, its wait time is used to select a set of A and B factors for each priority device.

Each set of A and B factors in Table 1 has a priority time factor next to it that specifies the beginning of a time interval significant to that set of A and B factors. The range extends from the priority time factor specified for that set to the priority time factor specified for the next set, if any. The end of the last interval is assumed to be unbounded. For example, a device may have three sets of A and B values which describe the priority load function over three contiguous intervals. Figure 5 shows the priority time factors and A and B factors as they appear in Table 1 for an IBM 1442 Card Read Punch Model N1 Reading EBCDIC.

Priority Load Formula

The A and B factors and wait time factors in Table 1 are provided for use in a formula that yields the priority load which occurs when a priority device interferes with a waiting device.

The sum of the B factor and the quotient obtained by dividing the A factor by the wait time factor of the waiting device is the priority load. The arithmetic looks like this:

A/wait time + B = priority load

Previous Load

A waiting byte mode device may be forced to wait for channel facilities, not only by devices with higher priority, but also by a device with lower priority that is in operation when the waiting device requests channel facilities. This interference is called a "previous load" and must be added to the priority load caused by priority devices. Previous load factors are provided in Table 1.

Load Sum

Several load factors relating to byte mode operations have been described:

Device load (contributed by waiting device)
Priority load (contributed by each priority device)
Previous load (contributed by a lower priority device)

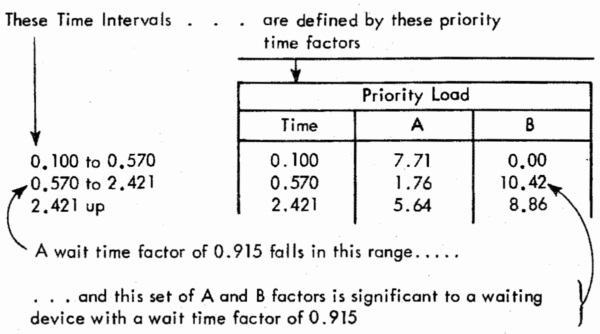
These loads are added together to form a load sum for each waiting device. The load sum represents the total load on system channel facilities under a worst case condition when:

1. All priority devices are causing maximum priority loads.
2. Any lower priority device, already in operation, is making maximum demands on channel facilities (previous load).
3. The waiting device places its maximum device load on channel facilities.

A step-by-step procedure for computing load sums is given in "Byte Mode Evaluation Procedure."

Byte Mode Channel Load Limit

A numeric factor of 100 has been established as the byte mode channel load limit. If a load sum exceeds 100, overrun is indicated during worst case situations.



Priority Load		
Time	A	B
0.100	7.71	0.00
0.570	1.76	10.42
2.421	5.64	8.86

Figure 5. Use of Priority Time Factors

BYTE MODE EVALUATION PROCEDURE

The following step-by-step procedure is used with a *Byte Multiplexer Channel Worksheet,* shown in Figure 6. (Figures 6-14 are part of the appendix; they are at the end of the manual so they can be removed easily for reference.)

Most of the steps call for an entry to be made on the worksheet. Each circled number shown on the worksheet in Figure 7 refers to the numbered step in the following procedure. For example, a circled number 1 is shown at the top of the worksheet in each of the two spaces that receive the entries called for by step 1. As an additional aid in seeing where entries are made on a worksheet, see Figure 8, which shows a worksheet that has been completed for a configuration specified in "Worksheet Example."

The following procedure assumes that the block multiplexer channel configuration has already been defined and evaluated (see "Block Multiplexer Channel Loading").

1. Enter the system identification and the date.
2. Identify for each operating block multiplexer channel the device that has the greatest p value. (See "Block Multiplexer Channel Loading.")
3. For the devices entered in step 2, enter the "time, A, B" sets listed under "Block Multiplexer Channel Priority Load" in Table 1.
4. Arrange the byte mode devices proposed for simultaneous operation in sequence by priority class (1, 2, and 3). Within the priority classes, arrange the devices according to increasing wait time. The device with the smallest wait time appears first (receives highest priority). An exception to this rule is made for the 2703, a class 1 device, which should follow all other class 1 devices in priority, regardless of the wait time. Class 1 devices that have an inseparable class 2 component should be arranged according to class 1 wait time (examples of such devices are 1442 and 2520-B1). Then enter the devices in class 1 on the worksheet in the sequence just established. The devices on the second byte multiplexer channel (if installed) follow those attached to the first byte multiplexer channel. Note that class 2 and 3 devices do not overrun; therefore, it is not necessary to include these devices in the overrun evaluation. In certain worst-case situations, it is possible to delay these devices, but overrun will not occur. Since the frequency of occurrence of the worst-case peak-load circumstance is application-dependent, the loss of performance caused by these delays is not predictable by this procedure.
5. For the first device entered in step 4, enter the wait time from Table 1; the "time, A, B" sets listed under "Byte Multiplexer Channel Priority Load"; the previous load; and device load. If the device is a 2703, the information does not appear in Table 1. The quantities to be placed on the worksheet should be calculated using the information found in "IBM 2703 Considerations." Perform such calculations at this time, using the 2703 Worksheet (Figure 10).

If the device is a 3705 Communications Controller operating under the emulation program, overrun evaluation requires a special procedure which can be found under "IBM 3705 Considerations."

If the device is one of the following class 2 or class 3 devices, no information is given in Table 1 because these devices do not overrun.

1017
1018
1403
1442-N2
1443
2150
2250
2260
2495
2520-B2
2520-B3
2540
2671
2715
3211
3277
3505
3525
3850 (on byte multiplexer channels)

6. Repeat step 5 for each remaining device entered in step 4.

The following steps can be performed without referring to the tables. All the needed information is now recorded on the worksheet.

7. Compare the wait time factor of the first waiting device being evaluated to the time factors of the priority device for the first block multiplexer channel; enter the set of A and B factors that relate to the time interval that includes the wait time (that is, the set that is on the same line with the largest time factor that is less than the wait time factor). For multiprocessing (MP) systems, enter 1.5 times the B factor selected.
8. Repeat step 7 with the time factors of the priority devices listed for the other block multiplexer channels in step 2.
9. For the second and each other waiting device on the byte multiplexer channel, compare its wait time to the time factors given for each of the block multiplexer channel priority devices (steps 7 and 8) and also for each of the byte multiplexer channel devices with higher priority; enter the appropriate set of A and B factors (that is, the set that is on the same line with the largest time factor that is less than the wait time). For multiprocessing (MP) systems, enter 1.5 times the B factor selected.
10. For each byte multiplexer channel waiting device, add the selected A factors and enter the A sum.
11. Divide A sum by the wait time factor for the device and enter the quotient. For multiprocessing (MP) systems, enter 1.5 times the quotient into the worksheet.
12. For each byte multiplexer channel waiting device, add the B values, the quotient found in step 11, the device load, and the previous load, and enter this sum as the load sum. The load sum must be less than or equal to 100 for satisfactory operation of the waiting device.

Worksheet Example

Channel 1 Channel 2	3330 Disk Storage, no data chaining
Channel 3 Channel 4 Channel 5	2420 Magnetic Tape Unit Model 7 (320 kb/sec), no data chaining
Byte multiplexer channel	2501 Card Reader Model B2, reading EBCDIC 1288 Optical Page Reader, reading formatted alphameric

The completed byte multiplexer channel worksheet for the given configuration is shown in Figure 8; it shows satisfactory operation for all byte mode devices; **no load sum exceeds 100.**

IBM 2702 Considerations

The IBM 2702 Transmission Control may connect a variety of communication terminals to a byte multiplexer channel; 1-15 or 1-31 terminal lines may be connected.

The 2702 uses delay lines for storage of data and control information. The information circulates in the delay lines and may be accessed for transfer to or from the byte multiplexer channel or to or from a terminal.

When priority devices force a 2702 to wait for channel service, additional delay may occur in the 2702 because of time required for synchronization with the delay line. Such additional delay exists only for the 2702 and does not affect other devices on the byte multiplexer channel.

A bit of information takes a certain length of time to go once around a delay line. A 2702 with a capacity for 15 terminal lines takes 0.480 millisecond per revolution, and a 31-line 2702 has a delay line revolution time of 0.992 millisecond. The number of communications lines attached to a 2702 has a direct bearing on how long it can wait for channel service. Maximum wait time exists when only one communications line is used. Each additional line in operation reduces the time a 2702 can wait for channel service.

In addition, the data transfer speed of a terminal affects 2702 wait time; a high-speed line cannot wait for channel service as long as a lower-speed line. Therefore, the wait time factors specified in Table 1 vary with the type of terminal control and number of lines available. The factors shown in Table 1 for the 2702 are for all lines operating at the same speed.

Worksheet Example with Two 2702's

The following Model 158 I/O configuration is evaluated:

Block multiplexer channel 1	2305 Fixed Head Storage Model 2, no data chaining
Block multiplexer channel 2 Block multiplexer channel 3	3330 Disk Storage, no data chaining
Block multiplexer channel 4 Block multiplexer channel 5	2401 Magnetic Tape Unit Model 5 (120 kb/sec), no data chaining
Byte multiplexer channel	2702 Transmission Control, fifteen 1030's (Terminal Control II) at 600 bps, no autopolling 2702 Transmission Control, thirty-one 1050's (Terminal Control I) at 134.5 bps, no autopolling

The completed worksheet for this configuration is shown in Figure 9.

Priority Load Factors for 2702

An IBM 2702 Transmission Control may have terminal lines attached that all operate at the same speed. Where this is the case, the priority load A and B factors listed in Table 1 (for the type of terminal control and the number of lines attached) are used for the byte mode evaluation.

An IBM 2702 may have a configuration of terminal lines that operate at different speeds. Where this is the case, the priority load factors in Table 1 for the highest speed line may be used; the A and B factors used are those listed for the number of lines attached. When these factors are used, the slower speed lines receive undue weight; but if their use does not cause any load sum to exceed 100, satisfactory operation is indicated, and the disparity in line speeds may be ignored.

If the use of the factors indicates unsatisfactory byte multiplexer channel operation, a more accurate assessment of the situation may be made:

1. Retain the first set of "time, A, B" factors already entered on the byte multiplexer channel worksheet for the priority 2702 and also retain the time factor from the second set.
2. Compute a new second set of "A, B" factors to replace the second set already entered.

New load sums are then computed. Any new load sum that is less than or equal to 100 indicates satisfactory operation for the load sum device.

Each new second set of "A, B" factors is computed as specified in steps 1-3. An example computation is shown immediately following step 5.

1. Select from Table 2 a *b* factor for each type of terminal. Multiply each selected *b* factor by the number of terminal lines having that *b* factor, and add the products. The sum of the products is the *new B factor.*
2. Subtract the new B factor from the B factor specified in the first set of "A, B" factors already entered; then multiply the remainder by the time factor retained from the second set.
3. Add the A factor specified in the first set of "A, B" factors already entered to the product found in step 2. The sum is the *new A factor.*
4. Substitute the "A, B" factors just determined in place of the second set of "A, B" factors previously entered on the byte multiplexer channel worksheet for the priority 2702.
5. Repeat steps 1-5 for any remaining 2702 priority devices and then consider the new "A, B" factors in computing new load sums for the devices previously found to have excessive load sums.

A new second set of "A, B" factors can be computed for a 2702 with a mix of line speeds as shown in the following example:

Consider a 15-line 2702 to which is attached:
One 1030 line (Terminal Control II) at 600 bps
Ten 1050 lines (Terminal Control I) at 134.5 bps

Step 1. From Table 2:
1030: 1 x 0.092 = 0.092
1050: 10 x 0.021 = 0.210 +
New B factor = 0.302

Step 2. From first set: B = 5.330
From step 1: new B = 0.302 -
5.028
From second set: t = 7.2 x
36.20

Step 3. From first set: 2.58
From step 2: 36.20 +
New A factor 38.78

Step 4. Previous priority load factors (from Table 1):

TIME	A	B
0.100	2.58	5.33
7.20	31.0	1.38

New priority load factors:

TIME	A	B
0.100	2.58	5.33
7.20	38.78	0.302

IBM 2703 Considerations

The IBM 2703 Transmission Control requires special computation of device load, previous load, and priority load. These values cannot be taken directly from Table 1 for use in the byte mode evaluation procedure.

The priority of the 2703 should be lower than any other class 1 device. However, the order of multiple 2703's is unimportant since lower priority devices can obtain service between successive 2703 requests. A second 2703 of lower priority can be serviced as often as the first.

Using the *2703 Worksheet* (Figure 10) and Tables 3 and 4, enter the descriptive information for each base on the 2703. Calculate the other parameters as indicated and determine the properties of the critical base to be used in the appropriate load computation procedure.

Procedure for One 2703 per System

1. Compute the device load for critical base using the following formula:

$$\text{Device Load} = \frac{3.29 \text{ x Ne (for critical base)}}{\text{T}-\text{k}}$$

where k=0.015 x Ne (for critical base) except when a buffered device or another 2703 is operating simultaneously on the byte multiplexer channel; in that case, k=0.

2. Compute the total previous load for all lower priority devices. Note that only class 2 or class 3 devices should be attached with lower priority than the 2703. For each of these devices, select the x and y values from Table 11. Compute the previous load using the following formula:

$$\text{Previous Load} = \left(\frac{\Sigma x}{T} + \Sigma y\right) \text{ x } 100$$

up to a maximum equal to the device load calculated in step 1.

3. Enter the wait time T, device load, and previous load factors into the byte multiplexer worksheet and continue with step 6 of the "Byte Mode Evaluation Procedure."

Procedure for Two 2703's per System

1. Compute the device load for the critical base on each 2703 using the following formula:

$$\text{Device Load} = \frac{3.29 \text{ x Ne (for critical base)}}{\text{T}}$$

2. Calculate the priority load of the first 2703 on the second 2703 using the following formula:

$$\text{Priority Load (first 2703)} = \frac{3.29 \text{ x Ne(max) (first 2703)}}{\text{T (second 2703)}}$$

up to a maximum equal to the device load of the second 2703 as computed in step 1.

3. Calculate previous load for each 2703.

For the first 2703:

Total Previous Load = Previous Load (second 2703) + Previous Load (Other)

where

$$\text{Previous Load (second 2703)} = \frac{3.29 \text{ x Ne(max) (second 2703)}}{\text{T (first 2703)}}$$

and

$$\text{Previous Load (other)} = \left(\frac{\Sigma x}{\text{T (first 2703)}} + \Sigma y\right) \text{ x } 100$$

where x and y are selected from Table 11 for all devices of a priority lower than the lower priority 2703.

Note that the maximum Total Previous Load cannot exceed the device load of the first 2703 as calculated in step 1.

For the second 2703:

$$\text{Previous Load} = \left(\frac{\Sigma x}{\text{T (second 2703)}} + \Sigma y\right) \text{ x } 100$$

where x and y are selected from Table 11 for all devices of a priority lower than the lower priority 2703, but where

Previous Load + Priority Load (from step 2 above)

cannot exceed the device load of the second 2703 as computed in step 1.

4. For each 2703, enter the device load and previous load into the appropriate column on the byte multiplexer worksheet. Enter the priority load of the first 2703 on the second 2703 (as calculated in step 2 above) as B factor, 0.0 as A factor, and 0.100 as Time factor in the appropriate columns at the left side of the worksheet. Continue with step 6 of the "Byte Mode Evaluation Procedure."

Procedure for More Than Two 2703's per System

When more than two 2703's are attached to the system, they may be evaluated as successive pairs. The procedure for the first pair is the same as the procedure for two 2703's. The third 2703 does not obtain service until one of the first pair has completed service of its Ne(max) lines. The remaining lines of the other 2703 then alternate with the third 2703. The last 2703 in the series is loaded by all pairs of 2703's having higher priority. Its priority load is computed using the formula:

$$\text{Priority Load} = \frac{3.29 \text{ x Nt}}{\text{T (for last 2703)}}$$

where Nt is the total number of higher priority lines that may be serviced before the last 2703 is able to complete its service requirement. An illustration of how Nt is computed follows:

Configuration of four 2703's

	Ne(max)	Nt
#1	184	0
#2	112	112
#3	72	(2 x 112) + (184 - 112) = 296
#4	72	(2 x 112) + (2 x (184 - 112)) + (72 - (184 - 112)) = 368

Example 1 (One 2703)

Configuration

Block Multiplexer Channel 1
2305-2 Fixed Head Storage

Block Multiplexer Channel 2
3330 Disk Storage

Byte Multiplexer Channel 0
2501-B1 Card Reader reading EBCDIC
2703 Base A – Terminal Control Type I, 88 lines of 1050
Base B – Terminal Control Type II, 24 lines of 1030
Base C -- Synchronous Terminal Control Type 1A with Autopolling, 24 lines at 2,400 bps
2540 Card Read/Punch reading EBCDIC in 1-byte mode
1403-N1 Printer in 1-byte mode

The block multiplex Time, A, and B factors are entered into the byte multiplexer channel worksheet as in step 3 of the "Byte Mode Evaluation Procedure." The critical base is found to be Base C by filling out the 2703 worksheet as in Figure 11.

Using the procedure for one 2703:

1. Device Load

$$= \frac{3.29 \text{ x Ne (Base C)}}{\text{T} - 0.0}$$

$$= \frac{3.29 \text{ x } 54}{6}$$

$$= 29.61$$

2. For 2540 x=2.42 and y=0
and 1403 x=4.47 and y=0

$$\text{Previous Load} = \left(\frac{\Sigma x}{T} + \Sigma y\right) \text{ x } 100$$

$$= \left(\frac{2.42 + 4.47}{6} + 0\right) \text{ x } 100$$

$$= 115$$

but the maximum previous load equals the device load; therefore,

Previous Load = 29.61

3. The T value is entered as the wait time for the 2703. Device load and previous load are entered in the column for the 2703 (Figure 12).

The rest of the byte mode evaluation procedure shows that this configuration will operate with no overrun (Figure 12).

Example 2 (Two 2703's)

Configuration

Block Multiplexer Channel 1
3330 Disk Storage

Block Multiplexer Channel 2
3330 Disk Storage

Block Multiplexer Channel 3
3330 Disk Storage
Byte Multiplexer Channel 0
2703 Base A – Terminal Control Type I, 88 lines of 1050
Base B – Terminal Control Type II, 24 lines of 1030
Base C – Synchronous Terminal Control Type 1A with Autopolling, 24 lines at 2,400 bps
2703 Base A – Terminal Control Type I, 32 lines of 1050
Base B – Terminal Control Type II, 24 lines of 1030
Base C – Synchronous Terminal Control Type 1B 6-bit with Autopolling, 16 lines at 2,400 bps
1403-N1 Printer in 4-byte mode
1403-N1 Printer in 4-byte mode

The block multiplexer Time, A, and B factors are entered into the byte multiplexer channel worksheet. The critical base for the first 2703 is found as in example 1. The critical base of the second 2703 is found to be Base C by filling out a 2703 worksheet as shown in Figure 13. The configuration is found to be in the correct priority sequence since Te(min) for the first 2703 is smaller than Te(min) for the second 2703.

Using the procedure for two 2703's:

1. For the first 2703, Device Load

$$= \frac{3.29 \text{ x Ne(C)}}{\text{T}}$$

$$= \frac{3.29 \text{ x } 54}{6}$$

$$= 29.61$$

For the second 2703,

$$\text{Device Load} = \frac{3.29 \times \text{Ne(C)}}{\text{T}} = \frac{3.29 \times 28}{4.1} = 22.5$$

2. For the second 2703:

$$\begin{array}{l} \text{Priority Load} \\ \text{(of first 2703)} \end{array} = \frac{3.29 \times \text{Ne(max) (first 2703)}}{\text{T (second 2703)}} = \frac{3.29 \times 184}{4.1} = 147.6$$

but the maximum priority load is equal to the device load of the second 2703; therefore,

Priority Load (of first 2703) = 22.5

3. For the first 2703:

Total Previous Load = Previous Load (second 2703) + Previous Load (two 1403's)

$$\begin{array}{l} \text{Previous Load} \\ \text{(second 2703)} \end{array} = \frac{3.29 \times \text{Ne(max) (second 2703)}}{\text{T (first 2703)}} = \frac{3.29 \times 112}{6} = 61.41$$

For 1403-N1 in 4-byte mode x=2.32 and y=0

$$\begin{array}{l} \text{Previous Load} \\ \text{(two 1403's)} \end{array} = \left(\frac{\Sigma \text{x}}{\text{T (first 2703)}} + \Sigma \text{y}\right) \times 100 = \left(\frac{2.32 + 2.32}{6} + 0\right) \times 100 = 77$$

but the maximum total previous load for the first 2703 is equal to device load of the first as calculated in step 1.

Therefore,

Total Previous Load = 29.61

For the second 2703:

$$\text{Previous Load} = \left(\frac{\Sigma \text{x}}{\text{T (second 2703)}} + \Sigma \text{y}\right) \times 100$$

for 1403-N1 in 4-byte mode x=2.32 and y=0

as in step 3 above

Previous Load = 77

but

Previous Load + Priority Load (first 2703) $\leqslant$ Device Load (second 2703)

Therefore,

Previous Load $\leqslant$ Device Load (second 2703) – Priority Load (first 2703)

Previous Load = 22.5 - 22.5 = 0

4. The device load and previous load for each 2703 are entered into the appropriate column. The priority load of the first 2703 on the second 2703 is entered as the B factor of the byte multiplexer device 1 on the left side of the byte multiplexer worksheet. The time and A factors are 0.100 and 0.0, respectively.

The byte multiplex mode procedure is used to finish the evaluation as in Figure 14. It shows that no overrun will occur on this configuration.

IBM 3704 and 3705 Considerations

For proper operation, the network of teleprocessing lines attached to an IBM 3704 or 3705 Communications Controller operating with a type I channel adapter in emulation mode must adhere to the performance feasibility requirements and priority arrangements specified in the *IBM 3704 and 3705 Communications Controller Emulation Program Storage and Performance Reference Manual,* GC30-3005.

In order to determine the channel load parameters for a 3704 or 3705, a loading factor (L) must be derived which represents the internal utilization of the communications controller.

In a 3704 or 3705, *subchannel service priority* refers to the internal priority in servicing data accumulated for the teleprocessing (TP) lines. These subchannel priorities are assigned at emulation program generation time. When two subchannel priorities are used, separate loading factors should be calculated for each priority. Ln is the loading factor calculated for normal priority lines, and Lh is the loading factor calculated for high priority lines.

In the following algorithms, the factor U is the peak load line utilization (the part of the time an average line is receiving or sending data, or control or polling information in the sustained peak load situation), expressed as a decimal.

Loading Factor for Type I Scanner

The loading factor (L) for the Communication Scanner Type I is calculated as follows:

L = C x U x TBPS + N x 0.0002

where

C = 0.000038 (for 3705) or 0.000044 (for 3704).

TBPS = the sum of the line speeds in bits per second of all attached lines.

N = the total number of lines attached to the scanner.

The constant C is the average time in seconds per bit for all processing in the communications controller.

Loading Factor for Type II Scanner

The loading factor for the Communication Scanner Type II is calculated as follows:

$L = U \times (EBSC + ABSC + SS) + N \times 0.0002$

where

N = the total number of lines attached to the scanner.

EBSC = 0.000064 (for 3705) or 0.000074 (for 3704) multiplied by the sum of the line speeds (in characters per second) of all attached binary synchronous lines which use EBCDIC code.

$EBSC = 0.000064 \times \Sigma\, n[I] cs[I]$ for 3705, and
$0.000074 \times \Sigma\, n[I] cs[I]$ for 3704

where

n[I] = the number of lines of speed I
cs[I] = line speed in characters per second for speed I

ABSC is like EBSC for ASCII code.

$ABSC = 0.000068 \times \Sigma\, n[I] cs[I]$ for 3705, and
$0.000078 \times \Sigma\, n[I] cs[I]$ for 3704

SS is like EBSC for start-stop lines

$SS = 0.000074 \times \Sigma\, n[I] cs[I]$ for 3705, and
$0.000083 \times \Sigma\, n[I] cs[I]$ for 3704

Normal Channel Priority Procedure for 3704 and 3705

Use the following procedure for extracting wait time, device load, previous load, and priority load from Tables 5 and 6.

1. Calculate communication controller loading, using the formulas described under the 'Loading Factor' headings.
2. Using the calculated L value and the highest speed line as arguments, enter Table 5 for Type I Scanner or Table 6 for Type II Scanner. Select wait time, device load, previous load and priority load factors and enter them into the appropriate byte multiplexer worksheet.

Note: For the 3704, decrease wait time by 10 percent and increase device load, previous load, and priority load factor A by 10 percent.

3. Continue with the byte mode evaluation procedure. (See Figures 15 and 16.)

Example 1

Configuration Using a 3705

Four 2400-bps (EBCDIC-BSC) lines; line utilization = 70%
Ten 134.5-bps (start-stop) lines; line utilization = 70%
Scanner = Type I
One priority arrangement

1. $L = 0.000038 \times 0.7 \times [(4 \times 2{,}400) + (10 \times 134.5)] + 14 \times 0.0002$
   $= 0.000038 \times 0.7 \times (9{,}600 + 1{,}345) + 0.0028$
   $= 0.29 + 0.0028$
   $= 0.29$, rounded to 0.3
2. Using Table 5 with bps = 2400 and L = 0.3
   Wait time = 2.03
   Device load = 2.0
   Previous load = 2.0
   Priority load:

Time	*A*	*B*
0.100	0	40
0.200	$8 - \frac{CPS}{5000}$	$\frac{CPS}{1000}$

where

$CPS = (4 \times 300) + (10 \times 14.8)$
$= 1{,}200 + 148 = 1{,}348$

Therefore:

$$A = 8 - \frac{CPS}{5{,}000} = 8 - \frac{1{,}348}{5{,}000} = 8 - 0.27 = 7.73$$

$B = CPS/1000 = 1{,}348/1{,}000 = 1.35$

The results of these calculations are used in Figure 15.

Example 2

Configuration Using a 3704

The configuration is the same as for Example 1, except that a 3704 is used instead of a 3705.

1. $L = 0.000044 \times 0.7 \times [(4 \times 2{,}400) + (10 \times 134.5)] + 14.0 \times 0.0002$
   $= 0.000031 \times (9{,}600 + 1{,}345) + 0.0028$
   $= 0.34 + 0.0028$
   $= 0.34$, rounded to 0.3
2. Decrease the 3705 wait time by 10 percent and increase the 3705 device load, previous load, and priority load factor A by 10 percent.

Wait time = 2.03 – 0.10(2.03) = 1.83
Device load = 2.0 + 0.10(2.0) = 2.2
Previous load = 2.0 + 0.10(2.0) = 2.2
Priority load:
For time = 0.200, A = 7.73 + 0.10(7.73) = 8.50

The results of these calculations are used in Figure 16.

High Channel Priority Procedure for 3704 and 3705

Use the following procedure to determine the wait time, device load, previous load, and priority load of configurations containing high speed lines (⩾ 19,200 bps). When two subchannel service priorities are involved, determine the load factors for each of the two priorities.

1. Split the total line configuration according to subchannel priority into two parts: high priority and normal priority.
2. Calculate the test value and loading factors for each of two priorities: Lh for high priority and Ln for normal priority.
3. Using the high speed line configuration (lines ⩾ 19,200 bps) and the loading factor Ln of the normal priority, determine the wait time from Table 7.

4. Using the loading factor for both the high (Lh) and the normal (Ln) priorities, and the highest speed lines in normal priority, determine the wait time from Table 8. (Skip this step if Ln = 0).

5. Using the lower of the wait times determined in steps 3 and 4 above, select the device load, previous load and priority load factors from the corresponding Table 7 or 8 and enter them into the appropriate multiplexer worksheet along with the wait time.

6. Continue with the byte mode evaluation procedure. (See Figures 15 and 16.)

Example 3

Configuration Using a 3705

Three 19,200-bps (EBCDIC-BSC) lines; line utilization = 90%
Twenty 1200-bps (EBCDIC-BSC) lines; line utilization = 80%
Scanner = Type II

This configuration requires the use of both channel priorities (see *IBM 3704 and 3705 Communications Controller Emulation Program Storage and Performance Reference Manual,* GC30-3005).

1. High priority = Three 19,200-bps lines
   Normal priority = Twenty 1200-bps lines
2. Calculate the loading factor for both priorities:
   Lh = 0.000064 x 0.9 x 3 x 2400 + 3 x 0.0002
   = 0.415
   Ln = 0.000064 x 0.8 x 20 x 150 + 20 x 0.0002
   = 0.154
3. Enter Table 7 with Ln = 0.2
   Wait time = 0.33
4. Enter Table 8 with Lh = 0.4 and Ln = 0.2
   Wait time = 0.44

5. The wait time determined in step 3 is smaller than the wait time determined in step 4. Therefore, from Table 7, select device load, previous load, and priority load for step 3 and enter them into the appropriate multiplexer worksheet.

Wait time = 0.33
Device load = 12.1
Previous load = 12.1
Priority load:

Time	*A*	*B*
0.100	0	40
0.200	$8 - \frac{\text{CPS}}{5{,}000}$	$\frac{\text{CPS}}{1{,}000}$

where
CPS = (3 x 2,400) + (20 x 150)
= 7,200 + 3,000 = 10,200

Therefore:

$$A = 8 - \frac{\text{CPS}}{5{,}000} = 8 - \frac{10{,}200}{5{,}000} = 8 - 2.04 = 5.96$$

$$B = \frac{\text{CPS}}{1{,}000} = \frac{10{,}200}{1{,}000} = 10.20$$

The results of these calculations are used in Figure 15.

Example 4

Configuration Using a 3704

The configuration is the same as for Example 3, except that a 3704 is used instead of a 3705.

1. High priority = Three 19,200-bps lines
   Normal priority = Twenty 1200-bps lines
2. Calculate the loading factor for both priorities:
   Lh = 0.000074 x 0.9 x 3 x 2400 + 3 x 0.0002
   = 0.48, rounded to 0.5
   = 0.000074 x 0.8 x 20 x 150 + 20 x 0.0002
   = 0.18, rounded to 0.2
3. Enter Table 7 with Ln = 0.2
   Wait time = 0.33
4. Enter Table 8 with Lh = 0.5 and Ln = 0.2
   Wait time = 0.30

5. The wait time determined in step 4 is smaller than the wait time determined in step 3. Therefore, from Table 8 select the device load, previous load, and priority load for step 4.

Wait time = 0.30
Device load = 13.3
Priority load = 13.3
Priority load factor A:
For time = 0.200, A = 8 – CPS/5,000
where
CPS = (3 x 2,400) + (20 x 150)
= 7,200 + 3,000 = 10,200
Therefore, A = 8 – 10,200/5,000 = 5.96

6. Now calculate the 3704 equivalent of these values by decreasing the wait time by 10 percent and increasing the device load, previous load, and priority load factor A by 10 percent. This results in the following:

Wait time = 0.27
Device load = 14.6
Previous load = 14.6
Priority load factor A = 6.56

The results of these calculations are used in Figure 16.

A channel operation on the Model 158 interferes with CPU use of main storage whenever the channel requests access to main storage. Additional CPU interference is generated because the channels use some CPU facilities.

The amount of CPU interference caused by an I/O device over a period of time depends on the data transfer rate of the device and on channel programming. Table 12 lists the factors used to compute channel interference with the CPU on the Model 158.

When an application requires concurrent operation of I/O devices, it must first be determined that the devices will operate without overrun. This is done as described in the channel loading sections of this manual.

COMPUTING AVAILABLE CPU TIME

After an indication of satisfactory operation has been found, establish the time span of the I/O operation pertinent to the application. In order to establish the time span, analyze the procedure, examining record lengths, data transfer rates, gap times, device operating cycle times, and so on.

To arrive at the portion of this time span that is available for CPU operations, calculate interference with the CPU during the I/O time span caused by execution of CCW's, data transfers, I/O interruptions, and so on. Subtract the total interference time (in milliseconds) from the I/O time span. The result is the time (in milliseconds) available for CPU operations.

Dividing the available CPU time by the time span and multiplying by 100 gives the percentage of available CPU time for the application considered:

$$\frac{\text{available CPU time}}{\text{time span}} \times 100 = \%\ \text{available CPU time}$$

Available CPU Time Example

With Command Chaining

Assume a tape-to-printer operation for a Model 158 using an IBM 2403 Magnetic Tape Unit and Control Model 2 (800 bytes per inch, data conversion feature not in operation) on a block multiplexer channel, and IBM 1403 Printer Model N1 in 1-byte mode (1,100 lines per minute, print cycle 54.5 milliseconds) on a byte multiplexer channel. Read 1,000-byte blocks of data on tape, data chained without TIC, into ten scattered 100-byte blocks of main storage that lie on word boundaries; the printer is programmed for command chaining (one start I/O and nine chained commands for each ten lines of print).

Available CPU time is computed in three steps:

1. Establish the I/O time span.
2. Compute channel interference with CPU.
3. Subtract total interference time from the time span to find available CPU time.

The information necessary to execute step 2 is found in Table 12.

Step 1–Establish Time Span: The time needed to read this 1,000-byte tape record block (24.7 ms) is listed on the tape timing card, *IBM System/360 Magnetic Tape Record Characteristics for IBM 2400 Series Magnetic Tape Units,* GX22-6837. It can also be computed by using the formula on the same card:

Model 2–ms per record block = 8.0 + 0.0167N
N = Number of bytes in record block

The time required to print ten lines is ten times the 1403-N1 print cycle time:

10 x 54.5 ms = 545 milliseconds (time required to print ten lines)

Because the tape and printer operations will be overlapped, the longer printer time of 545 ms is the time span pertinent to the application.

Step 2–Compute Channel Interference with CPU: Tape transfer interference time is equal to the block multiplexer channel byte data transfer interference factor (Table 12) multiplied by the number of bytes in the tape block.

1,000 x 0.094 = 94 microseconds (tape interference)

Tape data chaining interference time is equal to the block multiplexer channel data chaining interference factor (Table 12) multiplied by the number of data chaining operations per record block.

9 x 7.4 us = 66.6 microseconds (tape data chaining interference)

Printer transfer interference time is equal to the multiplexer channel byte data transfer interference factor (Table 12) multiplied by the number of characters per print line times the number of print lines handled during the time span:

100 x 10.0 us x 10 = 10,000 microseconds (printer transfer interference)

Printer command chaining interference time is equal to the byte multiplexer channel command chaining interference factor (Table 12) multiplied by the number of chained commands per time span:

9 x 14 us = 126 microseconds (printer command chaining interference)

Adding the channel end and device end interruption factors (Table 11) to the totals already computed, the total interference time is as follows:

Tape	*Microseconds*
Data transfer interference	94.0
Data chaining interference	66.6
Channel end interruption	25.3
Printer	
Data transfer interference	10,000.0
Command chaining interference	126.0
Channel end interruption (alone)	25.3
Device end interruption (alone)	44.1
Total interference time	10,381.3

Step 3–Compute Available CPU Time in Milliseconds: Subtract the total interference time from the time span.

545 ms – 10.4 ms = 534.6 milliseconds (available CPU time)

To express available CPU time as a percentage, divide it by the time span and multiply by 100.

$\frac{334.6}{545} \times 100 = 98\%$ (percentage available CPU time)

Without Command Chaining

To point out the efficiency of command chaining as a programming method, assume the same operation with the printer programmed for a start I/O for each line of print (no command chaining and each line of print requires a channel end and a device end). Printer channel control interference for the two methods is as follows.

Without Command Chaining	*Microseconds*
Channel end (alone) 10 x 25.3 us	253.0
Device end (alone) 10 x 44.1 us	441.0
Printer control interference without command chaining	694.0
With Command Chaining	
Command chaining interference	126.0
Channel end (alone)	25.3
Device end (alone)	44.1
Printer control interference using command chaining	195.4

694.0 – 195.4 = 498 microseconds (additional CPU interference caused by using start I/O for each line of print)

Table 1. IBM System/370 Model 158 Channel Evaluation Factors (Part 1 of 18)

Input/Output Device	*Key*	*Nominal Data Rate (kb/sec)*	*Cycle Time (ms)*	*Byte Multiplexer Channel*					
				Wait Time (ms)	*Device Load*	*Previous Load*	*Priority Load*		
							Time	*A*	*B*
1255 Magnetic Character Reader	1M	1.54	Var	0.65	5.65	15.38	0.100	13.20	0.00
							1.704	2.96	5.90
1287 Optical Reader*									
1428/ASCSOCR font	1M	2.50	Var	0.4	10.10	25.00	0.100	22.49	0.00
							2.000	3.49	9.50
1428/ASCSOCR font with blank detection	1M	2.50	Var	0.2	20.20	50.00	0.100	22.49	0.00
							1.045	1.39	20.20
1428/ASCSOCR font with imprinting	1M	0.50	Var	2.0	2.02	5.00	0.100	21.95	2.38
7B1/Gothic font	1M	0.40	Var	2.5	1.62	4.00	0.100	22.06	1.92
Numeric handwritten characters	1M	0.33	Var	3.0	1.35	3.33	0.100	22.13	1.60
Handwritten with blank detection	1M	0.33	Var	1.5	2.69	6.67	0.100	21.81	3.01
Mark read 10 position	1M	1.00	Var	2.0	2.02	5.00	0.100	21.95	2.41
Mark read 12 position	1M	0.86	Var	2.3	1.76	4.35	0.100	22.02	2.10
Roll form	1M	2.50	Var	0.4	10.10	25.00	0.100	6.79	0.00
							1.980	1.69	10.10
Roll form with separate mark line command	1M	2.50	Var	0.4	10.10	25.00	0.100	13.58	0.00
							1.177	1.69	10.10
Roll form with blank detection	1M	2.50	Var	0.2	20.20	50.00	0.100	6.79	0.00
							0.267	1.39	20.20
Roll form with blank detection and separate mark line command	1M	2.50	Var	0.2	20.20	50.00	0.100	13.58	0.00
							0.604	1.39	20.20
1288 Optical Page Reader*									
Formatted alphameric	1M	1.00	Var	1.00	1.82	10.00	0.100	10.66	0.00
							1.000	8.44	2.22
Unformatted alphameric	1M	0.67	Var	1.00	1.82	10.00	0.100	10.66	0.00
							1.000	8.49	2.17
Handwritten/Gothic	1M	0.67	Var	2.50	0.73	3.20	0.100	10.56	0.91
Mark Read 1	1M	1.00	Var	1.00	1.82	10.00	0.100	10.66	0.00
							1.000	8.45	2.21
2	1M	0.56	Var	1.77	1.03	4.52	0.100	10.66	0.00
							1.000	9.41	1.25
3	1M	0.39	Var	2.54	0.72	3.15	0.100	10.66	0.00
							1.000	9.79	0.87
4	1M	0.30	Var	3.31	0.55	2.42	0.100	10.66	0.00
							1.000	9.99	0.67
5	1M	0.49	Var	4.08	0.45	1.96	0.100	10.66	0.00
							1.000	10.12	0.54
6	1M	0.41	Var	4.85	0.38	1.65	0.100	10.66	0.00
							1.000	10.20	0.46
7	1M	0.36	Var	5.62	0.32	1.42	0.100	10.66	0.00
							1.000	10.27	0.39
8	1M	0.31	Var	6.39	0.28	1.25	0.100	10.66	0.00
							1.000	10.31	0.35
9	1M	0.28	Var	7.16	0.25	1.12	0.100	10.66	0.00
							1.000	10.35	0.31
10	1M	0.25	Var	7.93	0.23	1.01	0.100	10.66	0.00
							1.000	10.38	0.28
11	1M	0.23	Var	8.70	0.21	0.92	0.100	10.66	0.00
							1.000	10.41	0.25
12	1M	0.21	Var	9.47	0.19	0.84	0.100	10.66	0.00
							1.000	10.43	0.23

Key:
1: Device subject to overrun; highest priority required.
2: Device requires synchronized channel service; not subject to overrun; second highest priority required.
3: Device does not require synchronized channel service; not subject to overrun; lowest priority.

M: Byte mode on byte multiplexer channel.
B: Burst mode on byte multiplexer channel.
Var = Variable

* When either a 1287 or 1288 reader is attached to the block multiplexer channel, use the following channel priority figures:

Time	*A*	*B*
0.100	1.59	0.00

Table1. IBM System/370 Model 158 Channel Evaluation Factors (Part 2 of 18)

				Byte Multiplexer Channel					
		Nominal Data Rate (kb/sec)	*Cycle Time (ms)*	*Wait Time (ms)*	*Device Load*	*Previous Load*	*Priority Load*		
Input/Output Device	*Key*						*Time*	*A*	*B*
1419 Magnetic Character Reader									
Single Address Adapter 1,600 documents/min	1M	2.10	32.3	0.655	8.60	10.00	0.100	13.02	0.00
							1.325	1.29	8.84
Single Address Adapter with Batch Numbering feature	1M	2.10	32.3	0.655	8.60	10.00	0.100	25.78	0.00
							1.081	15.62	9.48
Dual Address Adapter without Expanded Capability Feature	1M	2.10	32.3	0.655	8.60	10.00	0.100	19.39	0.00
							1.856	3.35	8.64
Dual Address Adapter with Expanded Capability Feature* relative to other devices in system	1M	2.10	32.3	0.655	8.60	10.00	0.100	0.00	100.00
							0.288	28.88	0.00
							0.666	25.12	8.64
Relative to other 1419's in system							0.100	3.35	8.64
1442 Card Read Punch Model N1									
Reading EBCDIC	1M	0.53	150	0.800	10.42	12.50	0.100	7.71	0.00
							0.570	1.76	10.42
							2.421	5.64	8.86
Reading Card Image	1M	1.07	150	0.800	16.75	12.50	0.100	7.71	0.00
							0.222	3.98	16.75
							2.460	6.11	13.86
Punching EBCDIC	2M	0.12	656	11.000	0.79	0.91	0.100	7.71	0.00
							0.373	3.12	12.30
							2.437	7.92	10.37
Punching Card Image	2M	0.24	656	11.000	1.27	0.91	0.100	7.92	0.00
							0.173	4.50	19.80
							2.459	13.62	16.20
2501 Card Reader Model B1									
Reading EBCDIC	1M	0.80	100	0.915	8.85	10.92	0.100	8.51	0.00
							0.762	1.84	8.85
Reading Card Image	1M	1.60	100	0.915	12.61	10.92	0.100	8.51	0.00
							0.482	2.44	12.61
2501 Card Reader Model B2									
Reading EBCDIC	1M	1.33	60	0.915	8.85	10.92	0.100	8.51	0.00
							0.762	1.84	8.85
Reading Card Image	1M	2.67	60	0.915	12.61	10.92	0.100	8.51	0.00
							0.482	2.44	12.61

Key: 1: Device subject to overrun; highest priority required.
2: Device requires synchronized channel service; not subject to overrun; second highest priority required.
3: Device does not require synchronized channel service; not subject to overrun; lowest priority.
M: Byte mode on byte multiplexer channel.
B: Burst mode on byte multiplexer channel.

* When 1419's are the only class 1 devices (see key), they should be cabled physically last but logically first (highest priority). If there are other class 1 devices on the system, device priority should be established in order of increasing wait time.

Table 1. IBM System/370 Model 158 Channel Evaluation Factors (Part 3 of 18)

				Byte Multiplexer Channel					
		Nominal Data Rate	*Cycle Time*	*Wait Time*	*Device*	*Previous*	*Priority Load*		
Input/Output Device	*Key*	*(kb/sec)*	*(ms)*	*(ms)*	*Load*	*Load*	*Time*	*A*	*B*
2520 Card Read Punch Model B1									
Reading EBCDIC	1M	0.67	120	1.020	8.13	9.80	0.100	16.76	0.00
							1.859	1.96	7.96
							43.241	216.88	3.04
Reading Card Image	1M	1.33	120	1.020	11.59	9.80	0.100	16.76	0.00
							1.250	2.57	11.35
							43.241	310.82	4.26
Punching EBCDIC	2M	0.67	120	9.000	28.74	1.11	0.100	0.00	100.00
							2.587	253.10	2.16
Punching Column Binary	2M	1.33	120	9.000	56.08	1.11	0.100	0.00	100.00
							5.047	483.45	4.21
Reading and Punching EBCDIC	1/2M	1.33	120	*	*	*	0.100	0.00	100.00
							2.628	262.76	0.00
							32.468	4.84	7.96
							43.241	128.14	5.09
Reading and Punching Card Image	1/2 M	2.67	120	*	*	*	0.100	0.00	100.00
							5.088	508.96	0.00
							43.290	146.75	8.36
Console Devices**	3M	Var	Var	1.500	1.90	6.60	0.100	2.58	0.00

Key: 1: Device subject to overrun; highest priority required.
2: Device requires synchronized channel service; not subject to overrun; second highest priority required.
3: Device does not require synchronized channel service; not subject to overrun; lowest priority.
M: Byte mode on byte multiplexer channel.
B: Burst mode on byte multiplexer channel.

* Punching and reading should be evaluated separately by using the wait times, device loads, and previous loads listed for the independent operations.

Var: Variable

** The console devices are evaluated as one unit. These devices may be plugged either first or last on the byte multiplexer channel. When plugged in first priority, they offer priority load on all other devices.

Table 1. IBM System/370 Model 158 Channel Evaluation Factors (Part 4 of 18)

2701 Data Adapter Unit	*Bit Rate (bps)*	*Data Rate (cps)*	*Wait Time (ms)*	*Device Load*	*Previous Load*	*Priority Load*		
						Time	*A*	*B*
IBM Terminal Control I	134.5	14.8	63.200	0.02	0.13	0.100	4.16	0.00
	600	66.7	14.200	0.10	0.56	0.100	4.16	0.10
IBM Terminal Control II	600	60	14.200	0.10	0.56	0.100	4.16	0.10
IBM Terminal Control III	1,200	120	8.300	0.18	0.96	0.100	4.15	0.20
	2,400	240	4.200	0.35	1.90	0.100	4.15	0.40
IBM Telegraph Adapter	75	8.33	113.300	0.01	0.07	0.100	4.16	0.00
Telegraph Adapter								
Type I	45.5	6	141.300	0.01	0.06	0.100	4.16	0.00
	56.9	7.5	113.200	0.01	0.07	0.100	4.16	0.00
	74.2	10	86.900	0.02	0.09	0.100	4.16	0.00
Type II	110	10	85.800	0.02	0.09	0.100	4.16	0.00
World Trade TTY	50	6.6	128.700	0.01	0.06	0.100	4.16	0.00
	75	10	85.800	0.02	0.09	0.100	4.16	0.00
Synchronous Data Adapter								
Type I	1,200	150	5.800	0.26	1.38	0.100	4.15	0.20
	2,000	250	3.500	0.43	2.29	0.100	4.14	0.40
	2,400	300	2.900	0.51	2.76	0.100	4.14	0.50
	19,200	2,400	0.360	4.14	22.22	0.100	4.16	0.00
						0.360	2.87	3.58
	40,800	5,100	0.170	8.76	47.06	0.100	4.16	0.00
						0.200	2,87	7.60
Type II								
Eight-bit code	600	75	25.800	0.09	0.31	0.100	4.88	0.17
(no autopolling)	1,200	150	12.900	0.17	0.62	0.100	4.87	0.33
	2,000	250	7.700	0.29	1.04	0.100	4.86	0.55
	2,400	300	6.400	0.35	1.25	0.100	4.86	0.67
	4,800	600	3.200	0.69	2.50	0.100	4.82	1.33
	19,200	2,400	0.810	2.74	9.88	0.100	4.75	2.92
						0.810	2.79	5.33
	40,800	5,100	0.380	5.84	21.05	0.100	4.56	6.71
						0.380	2.81	11.32
	50,000	6,250	0.310	7.16	25.81	0.100	4.47	8.51
						0.310	2.81	13.88
	230,400	28,800	0.067	31.30	>100			
Six-bit code	600	100	19.200	0.12	0.42	0.100	4.88	0.22
(no autopolling)	1,200	200	9.600	0.23	0.83	0.100	4.87	0.44
	2,000	333	5.700	0.39	1.40	0.100	4.85	0.74
	2,400	400	4.800	0.46	1.67	0.100	4.85	0.89
	19,200	3,200	0.600	3.70	13.33	0.100	4.69	4.03
						0.600	2.85	7.10
	40,800	6,800	0.280	7.93	28.57	0.100	4.42	9.60
						0.280	2.88	15.10
	50,000	8,333	0.230	9.65	34.78	0.100	4.29	12.25
						0.230	2.85	18.50
	230,400	38,400	0.050	44.00	>100			
Eight-bit code	600	75	14.200	0.16	0.56	0.100	4.88	0.17
(with autopolling)	1,200	150	7.100	0.33	1.13	0.100	4.87	0.31
	2,000	250	4.200	0.53	2.38	0.100	4.86	0.55
	2,400	300	3.500	0.63	2.29	0.100	4.86	0.67
Six-bit code	4,800	600	1.800	1.23	4.44	0.100	4.82	1.33
(with autopolling)	600	100	10.800	0.21	0.74	0.100	4.88	0.22
	1,200	200	5.400	0.41	1.48	0.100	4.87	0.44
	2,000	333	3.200	0.69	2.50	0.100	4.85	0.74
	2,400	400	2.700	0.82	2.96	0.100	4.85	0.89
7770 Audio Response Unit								
8 lines	*	12	9.02	0.28	1.12	0.100	4.465	2.927
16 lines	*	12	4.50	0.56	2.24	0.100	4.465	2.927
24 lines	*	12	2.99	0.84	3.36	0.100	4.465	2.927
32 lines	*	12	1.48	1.70	6.80	0.100	4.465	2.927
40 lines	*	12	1.48	1.70	6.80	0.100	4.465	2.927
48 lines	*	12	1.48	1.70	6.80	0.100	4.465	2.927

* Parallel - Tone

Table 1. IBM System/370 Model 158 Channel Evaluation Factors (Part 5 of 18)

				Block Multiplexer Channel Priority															
				No Data Chaining				*Data Chaining***											
								Count ≤ 16			*Count ≤ 32*			*Count ≤ 64*			*Count ≤ 128*		
Input/Output Device		*Key*	*Nominal Data Rate (kb/sec)*	*Gap Time (ms)*	*Time*	*A*	*B*	*Time*	*A*	*B*	*Time*	*A*	*B*	*Time*	*A*	*B*	*Time*	*A*	*B*
2400 Series Magnetic Tape Units																			
Model	*Density (bytes/inch)*																		
1	200	1B	7.5	20.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
	556	1B	20.8	20.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								1.001	0.00	1.6									
	800	1B	30.0	16.0*	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								0.694	0.00	2.3	1.237	0.00	1.3						
2	200	1B	15.00	10.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								1.389	0.00	1.1									
	556	1B	41.7	10.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								0.500	0.00	3.2	0.890	0.00	1.8	1.461	0.00	1.1			
	800	1B	60.0	8.0*	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								0.347	0.00	4.6	0.618	0.00	2.6	1.015	0.00	1.6			
3	200	1B	22.5	6.7	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								0.926	0.00	1.7									
	556	1B	62.5	6.7	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								0.333	0.00	4.8	0.594	0.00	2.7	0.975	0.00	1.6	1.435	0.00	1.1
	800	1B	90.0	5.3*	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								0.231	0.00	6.9	0.412	0.00	3.9	0.677	0.00	2.3	0.996	0.00	1.6
4	800	1B	30.0	16.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								0.694	0.00	2.3	1.237	0.00	1.3						
	1600	1B	60.0	16.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								0.347	0.00	4.6	0.618	0.00	2.6	1.015	0.00	1.6			
5	800	1B	60.0	8.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								0.347	0.00	4.6	0.618	0.00	2.6	1.015	0.00	1.6			
	1600	1+	120.0	8.0	0.100	1.59	0.0	0.100	0.00	9.1	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
					1.415	0.00	1.1				0.309	0.00	5.1	0.508	0.00	3.1	0.747	0.00	2.1
6	800	1B	90.0	5.3	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								0.231	0.00	6.9	0.412	0.00	3.9	0.677	0.00	2.3	0.996	0.00	1.6
	1600	1+	180.0	5.3	0.100	1.59	0.0	0.100	0.00	13.7	0.100	0.00	7.7	0.100	1.59	0.0	0.100	1.59	0.0
					0.944	0.00	1.7							0.338	0.00	4.7	0.498	0.00	3.2
2415 Models 1-6		1B	15.0	32.0x	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								1.389	0.00	1.1									
2415 Models 4-5-6		1B	30.0	32.0x	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								0.694	0.00	2.3	1.237	0.00	1.3						
2420 Model 5		1+	160.0	6.0	0.100	1.59	0.0	0.100	0.00	12.2	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
					1.062	0.00	1.5				0.232	0.00	6.8	0.381	0.00	4.2	0.560	0.00	2.8
2420 Model 7		1+	320.0	3.0	0.100	1.59	0.0	0.100	0.00	24.4	0.100	0.00	13.7	0.100	0.00	8.3	0.100	1.59	0.0
					0.531	0.00	3.0										0.280	0.00	5.7
3410 Model 1		1B	20.0	48.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								1.042	0.00	1.5									
3410 Model 2		1B	40.0	24.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								0.521	0.00	3.1	0.928	0.00	1.7	1.523	0.00	1.0			
3410 Model 3		1B	80.0	12.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
								0.260	0.00	6.1	0.464	0.00	3.4	0.761	0.00	2.1	1.121	0.00	1.4
3420 Series Magnetic Tape Units																			
Model	*Density (bytes/inch)*																		
3	556/800	1B	60.0	8.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
	1600							0.347	0.00	4.6	0.618	0.00	2.6	1.015	0.00	1.6	1.494	0.00	1.1
	1600	1+	120.0	8.0	0.100	1.59	0.0	0.100	0.00	9.1	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
					1.415	0.00	1.1				0.309	0.00	5.1	0.508	0.00	3.1	0.747	0.00	2.1
4	1600	1+	120.0	8.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
					1.415	0.00	1.1	0.174	0.00	9.1	0.309	0.00	5.1	0.508	0.00	3.1	0.747	0.00	2.1
	6250	1+	469.0	4.0	0.100	1.59	0.0	0.100	0.0	35.8	0.100	0.0	20.1	0.100	1.59	0.0	0.100	1.59	0.0
					0.361	0.00	4.4							0.130	0.00	12.3	0.191	0.00	8.3
5	556/800	1+	100.0	4.8	0.100	1.59	0.0	0.100	0.00	7.6	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
											0.371	0.00	4.3	0.609	0.00	2.6	0.897	0.00	1.8
	1600	1+	200.0	4.8	0.100	1.59	0.0	0.100	0.00	15.2	0.100	0.00	8.6	0.100	1.59	0.0	0.100	1.59	0.0
					0.849	0.00	1.9							0.305	0.00	5.2	0.448	0.00	3.5
6	1600	1+	200.0	4.8	0.100	1.59	0.0	0.100	0.00	15.2	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
					0.849	0.00	1.9				0.186	0.00	8.6	0.305	0.00	5.2	0.448	0.00	3.5
	6250	1+	781.0	2.4	0.100	1.59	0.0	0.100	0.00	59.4	0.100	0.00	33.4	0.100	0.00	20.3	0.100	1.59	0.0
					0.218	0.00	7.3										0.115	0.00	13.8
7	556	1+	112.0	3.0	0.100	1.59	0.0	0.100	0.00	8.5	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
					1.516	0.00	1.1				0.331	0.00	4.3	0.544	0.00	2.9	0.801	0.00	2.0
	800	1+	160.0	3.0	0.100	1.59	0.0	0.100	0.00	12.2	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
					1.062	0.00	1.5				0.232	0.00	6.8	0.381	0.00	4.2	0.560	0.00	2.8
	1600	1+	320.0	3.0	0.100	1.59	0.0	0.100	0.00	24.4	0.100	0.00	13.7	0.100	0.00	8.3	0.100	1.59	0.0
					0.531	0.00	3.0										0.280	0.00	5.7
8	1600	1+	320.0	3.0	0.100	1.59	0.0	0.100	0.00	24.4	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
					0.531	0.00	3.0				0.116	0.00	13.7	0.190	0.00	8.3	0.280	0.00	5.7
	6250	1+	1250.0	1.5	0.100	1.59	0.0	0.100	0.00	95.2	0.100	0.00	53.5	0.100	0.00	32.6	0.100	0.00	22.1
					0.136	0.00	11.7												

* Nine-track gap time.
** For counts greater than 128, use the values for the case of no data chaining.
x Using the seven-track compatibility feature, the gap time is 38.6 ms.
Note: 2415 and 3410 densities cause negligible difference in the priority load factors.

Key:
1 Device subject to overrun; highest priority required.
B Burst mode on byte multiplexer channel.
\+ Block multiplexer channel only.

Table 1. IBM System/370 Model 158 Channel Evaluation Factors (Part 6 of 18)

Input/Output Device	Key	Nominal Data Rate	Rotation Time (ms)	No Data Chaining			Data Chaining – No TIC*											
							Count = 16			Count = 32			Count = 64			Count = 28		
				Time	A	B	Time	A	B	Time	A	B	Time	A	B	Time	A	B
2250 Display Unit Model 3	3	526.0	¢	0.100	1.59	0.0	0.100	0.00	34.0	0.100	0.00	19.5	0.100	0.00	12.2	0.100	0.00	8.6
				0.323	0.00	4.9												
2303 Drum Storage	1+	303.8	17.5	0.100	1.59	0.0	0.100	0.00	19.7	0.100	0.00	11.3	0.100	0.00	7.0	0.100	1.59	0.0
				0.559	0.00	2.8										0.321	0.00	4.9
2305 Fixed Head Storage	1+	1500.0	10.0	0.100	0.00	14.0	†											
2311 Disk Storage Drive	1+	156.0	25.0	0.100	1.59	0.0	0.100	0.00	10.1	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
				1.089	0.00	1.5				0.275	0.00	5.9	0.439	0.00	3.6	0.626	0.00	2.5
2314 A or B Direct Access Storage Facility	1+	312.0	25.0	0.100	1.59	0.0	0.100	0.00	20.2	0.100	0.00	11.6	0.100	0.00	7.2	0.100	1.59	0.0
				0.544	0.00	2.9										0.313	0.00	5.1
2321 Data Cell Drive	1B	54.7	50.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
				2.898	0.00	0.6	0.419	0.00	3.8	0.732	0.00	2.2	1.168	0.00	1.4	1.665	0.00	1.0
3330 Disk Storage	1+	806.0	16.7	0.100	0.00	7.5	0.100	0.00	52.1	0.100	0.00	29.8	0.100	0.00	18.7	0.100	0.00	13.1
3270 Information Display System	3	680	¢	0.100	1.3	0.0	0.100	0.00	44.0	0.100	0.00	25.2	0.100	0.00	15.9	0.100	0.00	11.0
				0.204	0.00	6.4												
3340 or 3344 Direct Access Storage Facility	1+	885	20.2	0.100	0.00	8.3	0.100	0.00	57.6	0.100	0.00	33.0	0.100	0.00	20.8	0.100	0.00	14.4
3350 Direct Access Storage	1+	1.198	16.7	0.100	0.00	11.3	0.100	0.00	77.4	0.100	0.00	43.3	0.100	0.00	27.1	0.100	0.00	19.0
3850 Mass Storage System (see 3330)																		
							Data Chaining with TIC*											
2250 Display Unit Model 3							0.100	0.00	40.1	0.100	0.00	22.5	0.100	0.00	13.7	0.100	0.00	9.31
2303 Drum Storage	1+						0.100	0.00	23.2	0.100	0.00	13.0	0.100	0.00	7.9	0.100	1.59	0.0
																0.295	0.00	5.4
2305 Fixed Head Storage	1+						†											
2311 Disk Storage Drive	1+						0.100	0.00	11.9	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
										0.238	0.00	6.7	0.390	0.00	4.1	0.575	0.00	2.8
2314 A or B Direct Access Storage Facility	1+						0.100	0.00	23.8	0.100	0.00	13.3	0.100	0.00	8.1	0.100	1.59	0.0
																0.287	0.00	5.5
2321 Data Cell Drive	1B						0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0	0.100	1.59	0.0
							0.355	0.00	4.5	0.633	0.00	2.5	1.039	0.00	1.5	1.530	0.00	1.0
3330 Disk Storage	1+						0.100	0.00	61.4	0.100	0.00	34.5	0.100	0.00	21.0	0.100	0.00	14.3
3270 Information Display System	1+						0.100	0.00	51.9	0.100	0.00	29.3	0.100	0.00	17.8	0.100	0.00	12.1
3340 or 3344 Direct Access Storage Facility	1+						0.100	0.00	67.8	0.100	0.00	38.3	0.100	0.00	23.2	0.100	0.00	15.8
3350 Direct Access Storage	1+						0.100	0.00	91.2	0.100	0.00	50.0	0.100	0.00	30.5	0.100	0.00	20.7
3850 Mass Storage System (see 3330)																		

Key:
1 Device subject to overrun; highest priority required.
3 Device does not require synchronized channel service; not subject to overrun; burst priority.
B Burst mode on byte multiplexer channel.
\+ Block multiplexer channel only.

* For counts greater than 128, use the values for the case of no data chaining.
¢ Not applicable.
† Data chaining is not recommended. See *IBM System/360 Component Description: 2835 Storage Control and 2305 Fixed Head Storage Module*, GA26-1589.

Table 1. IBM System/370 Model 158 Channel Evaluation Factors (Part 7 of 18)

2702 Transmission Control, Terminal Control I 75 bps
With Autopolling

15-Line Maximum						*No. of Lines Available*	*31-Line Maximum*					
Wait Time	*Device Load*	*Previous Load*	*Priority Load*				*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
			Time	*A*	*B*					*Time*	*A*	*B*
116.00	0.024	0.086	0.100	2.64	3.170	1	116.00	0.024	0.086	0.100	2.69	1.510
			0.495	4.20	0.012					1.010	4.20	0.012
58.10	0.047	0.172	0.100	2.58	5.330	2	57.50	0.047	0.174	0.100	2.66	2.670
			0.630	4.12	2.890					1.140	4.05	1.450
			1.490	8.38	0.024					3.020	8.35	0.024
38.40	0.071	0.261	0.100	2.58	5.330	3	38.70	0.071	0.259	0.100	2.66	2.670
			1.180	5.46	2.890					2.200	5.35	1.450
			2.480	12.50	0.036					5.040	12.40	0.036
28.80	0.095	0.347	0.100	2.58	5.330	4	28.80	0.095	0.348	0.100	2.66	2.670
			1.730	6.81	2.890					3.270	6.64	1.450
			3.470	16.70	0.048					7.050	16.50	0.048
23.00	0.119	0.434	0.100	2.58	5.330	5	22.80	0.120	0.439	0.100	2.66	2.670
			2.280	8.15	2.890					4.330	7.94	1.450
			4.460	20.80	0.060					9.070	20.50	0.060
19.20	0.142	0.521	0.100	2.58	5.330	6	18.80	0.145	0.531	0.100	2.66	2.670
			2.830	9.49	2.890					5.390	9.24	1.450
			5.450	24.90	0.072					11.100	24.50	0.072
16.30	0.167	0.613	0.100	2.58	5.330	7	15.90	0.172	0.631	0.100	2.66	2.670
			3.380	10.80	2.890					6.450	10.50	1.450
			6.450	28.90	0.084					13.100	28.40	0.084
14.40	0.190	0.695	0.100	2.58	5.330	8	13.90	0.197	0.721	0.100	2.66	2.670
			3.930	12.20	2.890					7.510	11.80	1.450
			7.440	33.00	0.096					15.100	32.20	0.096
12.50	0.219	0.802	0.100	2.58	5.330	9	12.90	0.212	0.776	0.100	2.66	2.670
			4.480	13.50	2.890					8.580	13.10	1.450
			8.430	37.00	0.108					17.100	36.00	0.108
11.50	0.237	0.869	0.100	2.58	5.330	10	10.90	0.251	0.918	0.100	2.66	2.670
			5.030	14.90	2.890					9.640	14.40	1.450
			9.420	41.00	0.120					19.200	39.80	0.120
10.50	0.259	0.948	0.100	2.58	5.330	11	9.90	0.276	1.010	0.100	2.66	2.670
			5.580	16.20	2.890					10.700	15.70	1.450
			10.400	44.90	0.132					21.200	43.50	0.132
9.58	0.285	1.040	0.100	2.58	5.330	12	8.91	0.306	1.120	0.100	2.66	2.670
			6.130	17.50	2.890					11.800	17.00	1.450
			11.400	48.90	0.144					23.200	47.20	0.144
8.62	0.317	1.160	0.100	2.58	5.330	13	8.91	0.306	1.120	0.100	2.66	2.670
			6.680	18.90	2.890					12.800	18.30	1.450
			12.400	52.80	0.156					25.200	50.80	0.156
8.14	0.335	1.230	0.100	2.58	5.330	14	7.92	0.345	1.260	0.100	2.66	2.670
			7.230	20.20	2.890					13.900	19.60	1.450
			13.400	56.70	0.168					27.200	54.40	0.168
7.66	0.356	1.300	0.100	2.58	5.330	15	6.93	0.394	1.440	0.100	2.66	2.670
			7.780	21.60	2.890					14.900	20.90	1.450
			14.400	60.60	0.180					29.200	57.90	0.180
						16	6.93	0.394	1.440	0.100	2.66	2.670
										16.000	22.20	1.450
										31.200	61.40	0.192
						17	5.94	0.460	1.680	0.100	2.66	2.670
										17.100	23.50	1.450
										33.300	64.80	0.204
						18	5.94	0.460	1.680	0.100	2.66	2.670
										18.100	24.80	1.450
										35.300	68.20	0.216
						19	5.94	0.460	1.680	0.100	2.66	2.670
										19.200	26.10	1.450
										37.300	71.50	0.228
						20	4.94	0.552	2.020	0.100	2.66	2.670
										20.300	27.40	1.450
										39.300	74.80	0.240
						21	4.94	0.552	2.020	0.100	2.66	2.670
										21.300	28.70	1.450
										41.300	78.00	0.252
						22	4.94	0.552	2.020	0.100	2.66	2.670
										22.400	30.00	1.450
										43.300	81.20	0.264
						23	4.94	0.552	2.020	0.100	2.66	2.670
										23.400	31.30	1.450
										45.400	84.30	0.276
						24	3.95	0.691	2.530	0.100	2.66	2.670
										24.500	32.60	1.450
										47.400	87.40	0.288
						25	3.95	0.691	2.530	0.100	2.66	2.670
										25.600	33.90	1.450
										49.400	90.40	0.300
						26	3.95	0.691	2.530	0.100	2.66	2.670
										26.600	35.20	1.450
										51.400	93.40	0.312
						27	3.95	0.691	2.530	0.100	2.66	2.670
										27.700	36.50	1.450
										53.400	96.40	0.324
						28	3.95	0.691	2.530	0.100	2.66	2.670
										28.800	37.80	1.450
										55.400	99.30	0.336
						29	3.95	0.691	2.530	0.100	2.66	2.670
										29.800	39.10	1.450
										57.500	102.00	0.348
						30	2.96	0.922	3.380	0.100	2.66	2.670
										30.900	40.30	1.450
										59.500	105.00	0.360
						31	2.96	0.922	3.380	0.100	2.66	2.670
										31.900	41.60	1.450
										61.500	108.00	0.372

Table 1. IBM System/370 Model 158 Channel Evaluation Factors (Part 8 of 18)

2702 Transmission Control, Terminal Control I 75 bps												
15 Line Maximum						*No. of Lines Available*	*31-Line Maximum*					
Wait Time	*Device Load*	*Previous Load*	*Priority Load*				*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
			Time	*A*	*B*					*Time*	*A*	*B*
116.00	0.013	0.086	0.100	2.73	0.012	1	116.00	0.013	0.086	0.100	2.73	0.012
			--	--	--					--		
58.10	0.025	0.172	0.100	2.58	5.330	2	57.50	0.026	0.174	0.100	2.66	2.670
			0.539	5.45	0.024					1.050	5.43	0.024
38.40	0.039	0.261	0.100	2.58	5.330	3	38.70	0.038	0.259	0.100	2.66	2.670
			1.050	8.15	0.036					2.080	8.12	0.036
28.80	0.051	0.347	0.100	2.58	5.330	4	28.80	0.051	0.348	0.100	2.66	2.670
			1.560	10.80	0.048					3.100	10.80	0.048
23.00	0.064	0.434	0.100	2.58	5.330	5	22.80	0.065	0.439	0.100	2.66	2.670
			2.080	13.50	0.060					4.120	13.40	0.060
19.20	0.077	0.521	0.100	2.58	5.330	6	18.80	0.079	0.531	0.100	2.66	2.670
			2.590	16.20	0.072					5.150	16.00	0.072
16.30	0.091	0.613	0.100	2.58	5.330	7	15.90	0.093	0.631	0.100	2.66	2.670
			3.100	18.90	0.084					6.170	18.60	0.084
14.40	0.103	0.695	0.100	2.58	5.330	8	13.90	0.107	0.721	0.100	2.66	2.670
			3.610	21.50	0.096					7.200	21.10	0.096
12.50	0.119	0.802	0.100	2.58	5.330	9	12.90	0.115	0.776	0.100	2.66	2.670
			4.120	24.10	0.108					8.220	23.70	0.108
11.50	0.129	0.869	0.100	2.58	5.330	10	10.90	0.136	0.918	0.100	2.66	2.670
			4.640	26.70	0.120					9.240	26.20	0.120
10.50	0.140	0.948	0.100	2.58	5.330	11	9.90	0.149	1.010	0.100	2.66	2.670
			5.150	29.40	0.132					10.300	28.70	0.132
9.58	0.154	1.040	0.100	2.58	5.330	12	8.91	0.166	1.120	0.100	2.66	2.670
			5.660	31.90	0.144					11.300	31.10	0.144
8.62	0.172	1.160	0.100	2.58	5.330	13	8.91	0.166	1.120	0.100	2.66	2.670
			6.170	34.50	0.156					12.300	33.60	0.156
8.14	0.182	1.230	0.100	2.58	5.330	14	7.92	0.187	1.260	0.100	2.66	2.670
			6.680	37.10	0.168					13.300	36.00	0.168
7.66	0.193	1.300	0.100	2.58	5.330	15	6.93	0.214	1.440	0.100	2.66	2.670
			7.200	39.70	0.180					14.400	38.40	0.180
						16	6.93	0.214	1.440	0.100	2.66	2.670
										15.400	40.70	0.192
						17	5.94	0.249	1.680	0.100	2.66	2.670
										16.400	43.10	0.204
						18	5.94	0.249	1.680	0.100	2.66	2.670
										17.400	45.40	0.216
						19	5.94	0.249	1.680	0.100	2.66	2.670
										18.500	47.70	0.228
						20	4.94	0.299	2.020	0.100	2.66	2.670
										19.500	49.90	0.240
						21	4.94	0.299	2.020	0.100	2.66	2.670
										20.500	52.20	0.252
						22	4.94	0.299	2.020	0.100	2.66	2.670
										21.500	54.40	0.264
						23	4.94	0.299	2.020	0.100	2.66	2.670
										22.600	56.60	0.276
						24	3.95	0.374	2.530	0.100	2.66	2.670
										23.600	58.70	0.288
						25	3.95	0.374	2.530	0.100	2.66	2.670
										24.600	60.90	0.300
						26	3.95	0.374	2.530	0.100	2.88	2.670
										25.600	63.00	0.312
						27	3.95	0.374	2.530	0.100	2.66	2.670
										26.700	65.10	0.324
						28	3.95	0.374	2.530	0.100	2.66	2.670
										27.700	67.10	0.336
						29	3.95	0.374	2.530	0.100	2.66	2.670
										28.700	69.20	0.348
						30	2.96	0.500	3.380	0.100	2.66	2.670
										29.700	71.20	0.360
						31	2.96	0.500	3.380	0.100	2.66	2.670
										30.700	73.20	0.372

Table 1. IBM System/370 Model 158 Channel Evaluation Factors (Part 9 of 18)

2702 Transmission Control, Terminal Control I 134.5 bps
(With Autopolling)

15-Line Maximum						*No. of Lines Available*	*31-Line Maximum*					
Wait Time	*Device Load*	*Previous Load*	*Priority Load*				*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
			Time	*A*	*B*					*Time*	*A*	*B*
66.70	0.041	0.150	0.100	2.64	3.170	1	66.40	0.041	0.150	0.100	2.69	1.510
			0.495	4.20	0.021					1.010	4.19	0.021
			--	--	--					--	--	--
33.10	0.082	0.302	0.100	2.58	5.330	2	32.70	0.083	0.306	0.100	2.66	2.670
			0.630	4.12	2.890					1.140	4.05	1.450
			1.490	8.36	0.042					3.020	8.29	0.042
22.10	0.124	0.453	0.100	2.58	5.330	3	21.80	0.125	0.459	0.100	2.66	2.670
			1.180	5.46	2.890					2.200	5.35	1.450
			2.480	12.50	0.063					5.040	12.30	0.063
16.30	0.167	0.613	0.100	2.58	5.330	4	15.90	0.172	0.631	0.100	2.66	2.670
			1.730	6.81	2.890					3.270	6.64	1.450
			3.470	16.50	0.084					7.050	16.20	0.084
12.90	0.211	0.773	0.100	2.58	5.330	5	12.90	0.212	0.776	0.100	2.66	2.670
			2.280	8.15	2.890					4.330	7.94	1.450
			4.460	20.60	0.105					9.070	20.10	0.105
11.00	0.248	0.907	0.100	2.58	5.330	6	10.90	0.251	0.918	0.100	2.66	2.670
			2.830	9.49	2.890					5.390	9.24	1.450
			5.450	24.60	0.126					11.100	23.90	0.126
9.10	0.300	1.100	0.100	2.58	5.330	7	8.91	0.306	1.120	0.100	2.66	2.670
			3.380	10.80	2.890					6.450	10.50	1.450
			6.450	28.50	0.147					13.100	27.50	0.147
8.14	0.335	1.230	0.100	2.58	5.330	8	7.92	0.345	1.260	0.100	2.66	2.670
			3.930	12.20	2.890					7.510	11.80	1.450
			7.440	32.40	0.168					15.100	31.10	0.168
7.18	0.380	1.390	0.100	2.58	5.330	9	6.93	0.394	1.440	0.100	2.66	2.670
			4.480	13.50	2.890					8.580	13.10	1.450
			8.43	36.30	0.189					17.100	34.70	0.189
6.22	0.439	1.610	0.100	2.58	5.330	10	5.94	0.460	1.680	0.100	2.66	2.670
			5.030	14.90	2.890					9.640	14.40	1.450
			9.420	40.10	0.210					19.200	38.10	0.210
5.74	0.475	1.740	0.100	2.58	5.330	11	5.94	0.460	1.680	0.100	2.66	2.670
			5.580	16.20	2.890					10.700	15.70	1.450
			10.400	43.90	0.231					21.200	41.40	0.231
5.26	0.519	1.900	0.100	2.58	5.330	12	4.94	0.552	2.020	0.100	2.66	2.670
			6.130	17.50	2.890					11.800	17.00	1.450
			11.400	47.60	0.252					23.200	44.70	0.252
4.78	0.571	2.090	0.100	2.58	5.330	13	4.94	0.552	2.020	0.100	2.66	2.670
			6.680	18.90	2.890					12.800	18.30	1.450
			12.400	51.30	0.273					25.200	47.90	0.273
4.30	0.634	2.320	0.100	2.58	5.330	14	3.95	0.691	2.530	0.100	2.66	2.670
			7.230	20.20	2.890					13.900	19.60	1.450
			13.400	55.00	0.294					27.200	50.90	0.294
4.30	0.634	2.320	0.100	2.58	5.330	15	3.95	0.691	2.530	0.100	2.66	2.670
			7.780	21.60	2.890					14.900	20.90	1.450
			14.400	58.60	0.315					29.200	53.90	0.315
						16	3.95	0.691	2.530	0.100	2.66	2.670
										16.000	22.20	1.450
										31.200	56.90	0.336
						17	2.96	0.922	3.380	0.100	2.66	2.670
										17.100	23.50	1.450
										33.300	59.70	0.357
						18	2.96	0.922	3.380	0.100	2.66	2.670
										18.100	24.80	1.450
										35.300	62.40	0.378
						19	2.96	0.922	3.380	0.100	2.66	2.670
										19.200	26.10	1.450
										37.300	65.10	0.399
						20	2.96	0.922	3.380	0.100	2.66	2.670
										20.300	27.40	1.450
										39.300	67.70	0.420
						21	2.96	0.922	3.380	0.100	2.66	2.670
										21.300	28.70	1.450
										41.300	70.20	0.441
						22	2.96	0.922	3.380	0.100	2.66	2.670
										22.400	30.00	1.450
										43.300	72.60	0.462
						23	1.97	1.390	5.080	0.100	2.66	2.670
										23.400	31.30	1.450
										45.400	74.90	0.483
						24	1.97	1.390	5.080	0.100	2.66	2.670
										24.500	32.60	1.450
										47.400	77.20	0.504
						25	1.97	1.390	5.080	0.100	2.66	2.670
										25.600	33.90	1.450
										49.400	79.30	0.525
						26	1.97	1.390	5.080	0.100	2.66	2.670
										26.600	35.20	1.450
										51.400	81.40	0.546
						27	1.97	1.390	5.080	0.100	2.66	2.670
										27.700	36.50	1.450
										53.400	83.40	0.567
						28	1.97	1.390	5.080	0.100	2.66	2.670
										28.800	37.80	1.450
										55.400	85.30	0.588
						29	1.97	1.390	5.080	0.100	2.66	2.670
										29.800	39.10	1.450
										57.500	87.10	0.609
						30	1.97	1.390	5.080	0.100	2.66	2.670
										30.900	40.30	1.450
										59.500	88.80	0.630
						31	1.97	1.390	5.080	0.100	2.66	2.670
										31.900	41.60	1.450
										61.500	90.50	0.651

Table 1. **IBM System/370 Model 158 Channel Evaluation Factors (Part 10 of 18)**

2702 Transmission Control, Terminal Control I 134.5 bps												
15-Line Maximum						*No. of Lines Available*	*31-Line Maximum*					
Wait Time	*Device Load*	*Previous Load*	*Priority Load*				*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
			Time	*A*	*B*					*Time*	*A*	*B*
66.70	0.022	0.150	0.100	2.73	0.021	1	66.40	0.022	0.150	0.100	2.73	0.021
			--	--	--					--	--	--
33.10	0.045	0.302	0.100	2.58	5.330	2	32.70	0.045	0.306	0.100	2.66	2.670
			0.539	5.44	0.042					1.050	5.42	0.042
22.10	0.067	0.453	0.100	2.58	5.330	3	21.80	0.068	0.459	0.100	2.66	2.670
			1.050	8.12	0.063					2.080	8.06	0.063
16.30	0.091	0.613	0.100	2.58	5.330	4	15.90	0.093	0.631	0.100	2.66	2.670
			1.560	10.80	0.084					3.100	10.70	0.084
12.90	0.114	0.773	0.100	2.58	5.330	5	12.90	0.115	0.776	0.100	2.66	2.670
			2.080	13.40	0.105					4.120	13.20	0.105
11.00	0.134	0.907	0.100	2.58	5.330	6	10.90	0.136	0.918	0.100	2.66	2.670
			2.590	16.10	0.126					5.150	15.70	0.126
9.10	0.163	1.100	0.100	2.58	5.330	7	8.91	0.166	1.120	0.100	2.66	2.670
			3.100	18.70	0.147					6.170	18.20	0.147
8.14	0.182	1.230	0.100	2.58	5.330	8	7.92	0.187	1.260	0.100	2.66	2.670
			3.610	21.20	0.168					7.200	20.60	0.168
7.18	0.206	1.390	0.100	2.58	5.330	9	6.93	0.214	1.440	0.100	2.66	2.670
			4.120	23.80	0.189					8.220	23.00	0.189
6.22	0.238	1.610	0.100	2.58	5.330	10	5.94	0.249	1.680	0.100	2.66	2.670
			4.640	26.30	0.210					9.240	25.40	0.210
5.74	0.258	1.740	0.100	2.58	5.330	11	5.94	0.249	1.680	0.100	2.66	2.670
			5.150	28.80	0.231					10.300	27.70	0.231
5.26	0.281	1.900	0.100	2.58	5.330	12	4.94	0.299	2.020	0.100	2.66	2.670
			5.660	31.30	0.252					11.300	29.90	0.252
4.78	0.309	2.090	0.100	2.58	5.330	13	4.94	0.299	2.020	0.100	2.66	2.670
			6.170	33.80	0.273					12.300	32.10	0.273
4.30	0.344	2.320	0.100	2.58	5.330	14	3.95	0.374	2.530	0.100	2.66	2.670
			6.680	36.30	0.294					13.300	34.30	0.294
4.30	0.344	2.320	0.100	2.58	5.330	15	3.95	0.374	2.530	0.100	2.66	2.670
			7.200	38.70	0.315					14.400	36.40	0.315
						16	3.95	0.374	2.530	0.100	2.66	2.670
										15.400	38.50	0.336
						17	2.96	0.500	3.380	0.100	2.66	2.670
										16.400	40.60	0.357
						18	2.96	0.500	3.380	0.100	2.66	2.670
										17.400	42.50	0.378
						19	2.96	0.500	3.380	0.100	2.66	2.670
										18.500	44.50	0.399
						20	2.96	0.500	3.380	0.100	2.66	2.670
										19.500	46.40	0.420
						21	2.96	0.500	3.380	0.100	2.66	2.670
										20.500	48.30	0.441
						22	2.96	0.500	3.380	0.100	2.66	2.670
										21.500	50.10	0.462
						23	1.97	0.752	5.080	0.100	2.66	2.670
										22.600	51.90	0.483
						24	1.97	0.752	5.080	0.100	2.66	2.670
										23.600	53.60	0.504
						25	1.97	0.752	5.080	0.100	2.66	2.670
										24.600	55.30	0.525
						26	1.97	0.752	5.080	0.100	2.66	2.670
										25.600	57.00	0.546
						27	1.97	0.752	5.080	0.100	2.66	2.670
										26.700	58.60	0.567
						28	1.97	0.752	5.080	0.100	2.66	2.670
										27.700	60.20	0.588
						29	1.97	0.752	5.080	0.100	2.66	2.670
										28.700	61.70	0.609
						30	1.97	0.752	5.080	0.100	2.66	2.670
										29.700	63.20	0.630
						31	1.97	0.752	5.080	0.100	2.66	2.670
										30.700	64.60	0.651

Table 1. IBM System/370 Model 158 Channel Evaluation Factors (Part 11 of 18)

2702 Transmission Control, Terminal Control I 600 bps												
No Autopolling						*No. of Lines Available*	*With Autopolling*					
			Priority Load							*Priority Load*		
Wait Time	*Device Load*	*Previous Load*	*Time*	*A*	*B*		*Wait Time*	*Device Load*	*Previous Load*	*Time*	*A*	*B*
14.400	0.103	0.695	0.100	2.73	0.098	1	14.400	0.190	0.695	0.100	2.64	3.170
			--	--	--					0.495	4.16	0.098
										--	--	--
7.180	0.206	1.390	0.100	2.58	5.330	2	7.180	0.380	1.390	0.100	2.58	5.330
			0.539	5.35	0.196					0.630	4.12	2.890
										1.490	8.13	0.196
4.780	0.309	2.090	0.100	2.58	5.330	3	4.780	0.571	2.090	0.100	2.58	5.330
			1.050	7.88	0.294					1.180	5.46	2.890
										2.480	11.90	0.294
3.340	0.443	2.990	0.100	2.58	5.330	4	3.340	0.816	2.990	0.100	2.58	5.330
			1.560	10.30	0.392					1.730	6.81	2.890
										3.470	15.50	0.392
2.860	0.517	3.490	0.100	2.58	5.330	5	2.860	0.953	3.490	0.100	2.58	5.330
			2.080	12.60	0.490					2.280	8.15	2.890
										4.460	18.90	0.490
2.380	0.621	4.190	0.100	2.58	5.330	6	2.380	1.150	4.190	0.100	2.58	5.330
			2.590	14.90	0.588					2.830	9.49	2.890
										5.450	22.10	0.588
1.900	0.777	5.250	0.100	2.58	5.330	7	1.900	1.430	5.250	0.100	2.58	5.330
			3.100	17.00	0.686					3.380	10.80	2.890
										6.450	25.00	0.686
1.420	1.040	7.020	0.100	2.58	5.330	8	1.420	1.920	7.020	0.100	2.58	5.330
			3.610	19.00	0.784					3.930	12.20	2.890
										7.440	27.80	0.784
1.420	1.040	7.020	0.100	2.58	5.330	9	1.420	1.920	7.020	0.100	2.58	5.330
			4.120	20.90	0.882					4.480	13.50	2.890
										8.430	30.50	0.882
1.420	1.040	7.020	0.100	2.58	5.330	10	1.420	1.920	7.020	0.100	2.58	5.330
			4.640	22.80	0.980					5.030	14.90	2.890
										9.420	32.90	0.980
0.944	1.570	10.600	0.100	2.58	5.330	11	0.944	2.890	10.600	0.100	2.58	5.330
			5.150	24.50	1.08					5.580	16.20	2.890
										10.400	35.10	1.080
0.944	1.570	10.600	0.100	2.58	5.330	12	0.944	2.890	10.600	0.100	2.58	5.330
			5.660	26.10	1.180					6.130	17.50	2.890
										11.400	37.10	1.180
0.944	1.570	10.600	0.100	2.58	5.330	13	0.944	2.890	10.600	0.100	2.58	5.330
			6.170	27.60	1.270					6.680	18.90	2.890
										12.400	38.90	1.270
0.944	1.570	10.600	0.100	2.58	5.330	14	0.944	2.890	10.600	0.100	2.58	5.330
			6.680	29.10	1.370					7.230	20.20	2.890
										13.400	40.60	1.370
0.944	1.570	10.600	0.100	2.58	5.330	15	0.944	2.890	10.600	0.100	2.58	5.330
			7.200	30.40	1.470					7.780	21.60	2.890
										14.400	42.00	1.470

Table 1. IBM System/370 Model 158 Channel Evaluation Factors (Part 12 of 18)

2702 Transmission Control, Terminal Control II 600 bps												
No Autopolling						*No. of Lines Available*	*With Autopolling*					
Wait Time	*Device Load*	*Previous Load*	*Priority Load*				*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
			Time	*A*	*B*					*Time*	*A*	*B*
14.400	0.103	0.695	0.100	2.73	0.092	1	14.400	0.190	0.695	0.100	2.64	3.170
			--	--	--					0.495	4.16	0.092
										--	--	--
7.180	0.206	1.390	0.100	2.58	5.330	2	7.180	0.380	1.390	0.100	2.58	5.330
			0.539	5.36	0.184					0.630	4.12	2.890
										1.490	8.15	0.184
4.780	0.309	2.090	0.100	2.58	5.330	3	4.780	0.571	2.090	0.100	2.58	5.330
			1.050	7.90	0.276					1.180	5.46	2.890
										2.480	11.90	0.276
3.340	0.443	2.990	0.100	2.58	5.330	4	3.340	0.816	2.990	0.100	2.58	5.330
			1.560	10.30	0.368					1.730	6.81	2.890
										3.470	15.60	0.368
2.860	0.517	3.490	0.100	2.58	5.330	5	2.860	0.953	3.490	0.100	2.58	5.330
			2.080	12.70	0.460					2.280	8.15	2.890
										4.460	19.00	0.460
2.38	0.621	4.190	0.100	2.58	5.330	6	2.380	1.150	4.190	0.100	2.58	5.330
			2.590	15.00	0.552					2.830	9.49	2.890
										5.450	22.20	0.552
1.900	0.777	5.250	0.100	2.58	5.330	7	1.900	1.430	5.250	0.100	2.58	5.330
			3.100	17.10	0.644					3.380	10.80	2.890
										6.450	25.30	0.644
1.420	1.040	7.020	0.100	2.58	5.330	8	1.420	1.920	7.020	0.100	2.58	5.330
			3.610	19.20	0.736					3.930	12.20	2.890
										7.440	28.20	0.736
1.420	1.040	7.020	0.100	2.58	5.330	9	1.420	1.920	7.020	0.100	2.58	5.330
			4.120	21.20	0.828					4.480	13.50	2.890
										8.430	30.90	0.828
1.420	1.040	7.020	0.100	2.58	5.330	10	1.420	1.920	7.020	0.100	2.58	5.330
			4.640	23.00	0.920					5.030	14.90	2.890
										9.420	33.40	0.920
0.944	1.570	10.600	0.100	2.58	5.330	11	0.944	2.890	10.600	0.100	2.58	5.330
			5.150	24.80	1.010					5.580	16.20	2.890
										10.400	35.80	1.010
0.944	1.570	10.600	0.100	2.58	5.330	12	0.944	2.890	10.600	0.100	2.58	5.330
			5.660	26.50	1.100					6.130	17.50	2.890
										11.400	37.90	1.100
0.944	1.570	10.600	0.100	2.58	5.330	13	0.944	2.890	10.600	0.100	2.58	5.330
			6.170	28.10	1.200					6.680	18.90	2.890
										12.400	39.90	1.200
0.944	1.570	10.600	0.100	2.58	5.330	14	0.944	2.890	10.600	0.100	2.58	5.330
			6.680	29.60	1.290					7.230	20.20	2.890
										13.400	41.70	1.290
0.944	1.570	10.600	0.100	2.58	5.330	15	0.944	2.890	10.600	0.100	2.58	5.330
			7.200	31.00	1.380					7.780	21.60	2.890
										14.400	43.30	1.380

Table 1. IBM System/370 Model 158 Channel Evaluation Factors (Part 13 of 18)

2702 Transmission Control, Telegraph Control I 45 bps												
15-Line Maximum						*No. of Lines Available*	*31-Line Maximum*					
Wait Time	*Device Load*	*Previous Load*	*Priority Load*				*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
			Time	*A*	*B*					*Time*	*A*	*B*
159.0	0.009	0.063	0.100	2.73	0.008	1	159.00	0.009	0.063	0.100	2.73	0.008
			--	--	--					--	--	--
79.7	0.019	0.126	0.100	2.58	5.330	2	79.30	0.019	0.126	0.100	2.66	2.670
			0.539	5.45	0.016					1.050	5.44	0.016
52.8	0.028	0.189	0.100	2.58	5.330	3	52.60	0.028	0.190	0.100	2.66	2.670
			1.050	8.16	0.024					2.080	8.14	0.024
39.8	0.037	0.251	0.100	2.58	5.330	4	39.70	0.037	0.252	0.100	2.66	2.670
			1.560	10.90	0.032					3.100	10.80	0.032
31.7	0.047	0.316	0.100	2.58	5.330	5	31.70	0.047	0.315	0.100	2.66	2.670
			2.080	13.60	0.040					4.120	13.50	0.040
26.4	0.056	0.379	0.100	2.58	5.330	6	25.80	0.057	0.388	0.100	2.66	2.670
			2.590	16.30	0.048					5.150	16.10	0.048
22.5	0.066	0.444	0.100	2.58	5.330	7	21.80	0.068	0.459	0.100	2.66	2.670
			3.100	18.90	0.056					6.170	18.80	0.056
19.7	0.075	0.509	0.100	2.58	5.330	8	19.80	0.075	0.504	0.100	2.66	2.670
			3.610	21.60	0.064					7.200	21.40	0.064
17.3	0.086	0.579	0.100	2.58	5.330	9	16.80	0.088	0.594	0.100	2.66	2.670
			4.120	24.30	0.072					8.220	24.00	0.072
15.8	0.094	0.632	0.100	2.58	5.330	10	15.90	0.093	0.631	0.100	2.66	2.670
			4.640	26.90	0.080					9.240	26.60	0.080
14.4	0.103	0.695	0.100	2.58	5.330	11	13.90	0.107	0.721	0.100	2.66	2.670
			5.150	29.60	0.088					10.300	29.10	0.088
12.9	0.114	0.773	0.100	2.58	5.330	12	12.90	0.115	0.776	0.100	2.66	2.670
			5.660	32.20	0.096					11.300	31.70	0.096
12.0	0.124	0.834	0.100	2.58	5.330	13	11.90	0.125	0.841	0.100	2.66	2.670
			6.170	34.80	0.104					12.300	34.20	0.104
11.0	0.134	0.907	0.100	2.58	5.330	14	10.90	0.136	0.918	0.100	2.66	2.670
			6.680	37.50	0.112					13.300	36.70	0.112
10.5	0.140	0.948	0.100	2.58	5.330	15	9.90	0.149	1.010	0.100	2.66	2.670
			7.200	40.10	0.120					14.400	39.20	0.120
						16	9.90	0.149	1.010	0.100	2.66	2.670
										15.400	41.70	0.128
						17	8.91	0.166	1.120	0.100	2.66	2.670
										16.400	44.20	0.136
						18	7.92	0.187	1.260	0.100	2.66	2.670
										17.400	46.60	0.144
						19	7.92	0.187	1.260	0.100	2.66	2.670
										18.500	49.10	0.152
						20	7.92	0.187	1.260	0.100	2.66	2.670
										19.500	51.50	0.160
						21	6.93	0.214	1.440	0.100	2.66	2.670
										20.500	53.90	0.168
						22	6.93	0.214	1.440	0.100	2.66	2.670
										21.500	56.30	0.176
						23	5.94	0.249	1.680	0.100	2.66	2.670
										22.600	58.60	0.184
						24	5.94	0.249	1.680	0.100	2.66	2.670
										23.600	61.00	0.192
						25	5.94	0.249	1.680	0.100	2.66	2.670
										24.600	63.30	0.200
						26	5.94	0.249	1.680	0.100	2.66	2.670
										25.600	65.70	0.208
						27	4.94	0.299	2.020	0.100	2.66	2.670
										26.700	68.00	0.216
						28	4.94	0.299	2.020	0.100	2.66	2.670
										27.700	70.20	0.224
						29	4.94	0.299	2.020	0.100	2.66	2.670
										28.700	72.50	0.232
						30	4.94	0.299	2.020	0.100	2.66	2.670
										29.700	74.80	0.240
						31	4.94	0.299	2.020	0.100	2.66	2.670
										30.700	77.00	0.248

Table 1. IBM Svstem/370 Model 158 Channel Evaluation Factors (Part 14 of 18)

2702 Transmission Control, Telegraph Control I 57 bps												
15-Line Maximum						*No. of Lines Available*	*31-Line Maximum*					
Wait Time	*Device Load*	*Previous Load*	*Priority Load*				*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
			Time	*A*	*B*					*Time*	*A*	*B*
125.00	0.012	0.080	0.100	2.73	0.011	1	125.00	0.012	0.080	0.100	2.73	0.011
			--	--	--					--	--	--
62.40	0.024	0.160	0.100	2.58	5.330	2	62.50	0.024	0.160	0.100	2.66	2.670
			0.539	5.45	0.022					1.050	5.44	0.022
41.30	0.036	0.242	0.100	2.58	5.330	3	41.60	0.036	0.240	0.100	2.66	2.670
			1.050	8.16	0.033					2.080	8.12	0.033
31.20	0.047	0.321	0.100	2.58	5.330	4	30.70	0.048	0.325	0.100	2.66	2.670
			1.560	10.90	0.044					3.100	10.80	0.044
24.90	0.059	0.401	0.100	2.58	5.330	5	24.80	0.060	0.403	0.100	2.66	2.670
			2.080	13.50	0.055					4.120	13.40	0.055
20.60	0.072	0.485	0.100	2.58	5.330	6	20.80	0.071	0.480	0.100	2.66	2.670
			2.590	16.20	0.066					5.150	16.00	0.066
17.70	0.083	0.564	0.100	2.58	5.330	7	17.80	0.083	0.561	0.100	2.66	2.670
			3.100	18.90	0.077					6.170	18.60	0.077
15.30	0.096	0.652	0.100	2.58	5.330	8	14.90	0.100	0.673	0.100	2.66	2.670
			3.610	21.50	0.088					7.200	21.20	0.088
13.40	0.110	0.745	0.100	2.58	5.330	9	13.90	0.107	0.721	0.100	2.66	2.670
			4.120	24.20	0.099					8.220	23.80	0.099
12.50	0.119	0.802	0.100	2.58	5.330	10	11.90	0.125	0.841	0.100	2.66	2.670
			4.640	26.80	0.110					9.240	26.30	0.110
11.00	0.134	0.907	0.100	2.58	5.330	11	10.90	0.136	0.918	0.100	2.66	2.670
			5.150	29.40	0.121					10.300	28.80	0.121
10.10	0.147	0.994	0.100	2.58	5.330	12	9.90	0.149	1.010	0.100	2.66	2.670
			5.660	32.00	0.132					11.300	31.30	0.132
9.58	0.154	1.040	0.100	2.58	5.330	13	8.91	0.166	1.120	0.100	2.66	2.670
			6.170	34.60	0.143					12.300	33.70	0.143
8.62	0.172	1.160	0.100	2.58	5.330	14	8.91	0.166	1.120	0.100	2.66	2.670
			6.680	37.20	0.154					13.300	36.20	0.154
8.14	0.182	1.230	0.100	2.58	5.330	15	7.92	0.187	1.260	0.100	2.66	2.670
			7.200	39.80	0.165					14.400	38.60	0.165
						16	6.93	0.214	1.440	0.100	2.66	2.670
										15.400	41.00	0.176
						17	6.93	0.214	1.440	0.100	2.66	2.670
										16.400	43.30	0.187
						18	6.93	0.214	1.440	0.100	2.66	2.670
										17.400	45.70	0.198
						19	5.94	0.249	1.680	0.100	2.66	2.670
										18.500	48.00	0.209
						20	5.94	0.249	1.680	0.100	2.66	2.670
										19.500	50.30	0.220
						21	5.94	0.249	1.680	0.100	2.66	2.670
										20.500	52.60	0.231
						22	4.94	0.299	2.020	0.100	2.66	2.670
										21.500	54.80	0.242
						23	4.94	0.299	2.020	0.100	2.66	2.670
										22.600	57.10	0.253
						24	4.94	0.299	2.020	0.100	2.66	2.670
										23.600	59.30	0.264
						25	4.94	0.299	2.020	0.100	2.66	2.670
										24.600	61.50	0.275
						26	3.95	0.374	2.530	0.100	2.66	2.670
										25.600	63.70	0.286
						27	3.95	0.374	2.530	0.100	2.66	2.670
										26.700	65.80	0.297
						28	3.95	0.374	2.530	0.100	2.66	2.670
										27.700	67.90	0.308
						29	3.95	0.374	2.530	0.100	2.66	2.670
										28.700	70.00	0.319
						30	3.95	0.374	2.530	0.100	2.66	2.670
										29.700	72.10	0.330
						31	3.95	0.374	2.530	0.100	2.66	2.670
										30.700	74.10	0.341

Table 1. IBM System/370 Model 158 Channel Evaluation Factors (Part 15 of 18)

2702 Transmission Control, Telegraph Control I 75 bps												
15-Line Maximum						*No. of Lines Available*	*31-Line Maximum*					
Wait Time	*Device Load*	*Previous Load*	*Priority Load*				*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
			Time	*A*	*B*					*Time*	*A*	*B*
96.00	0.015	0.104	0.100	2.73	0.014	1	95.20	0.016	0.105	0.100	2.73	0.014
			--	--	--					--	--	--
48.00	0.031	0.208	0.100	2.58	5.330	2	47.60	0.031	0.210	0.100	2.66	2.670
			0.539	5.44	0.028					1.050	5.43	0.028
31.70	0.047	0.316	0.100	2.58	5.330	3	31.70	0.047	0.315	0.100	2.66	2.670
			1.050	8.15	0.042					2.080	8.10	0.042
24.00	0.082	0.417	0.100	2.58	5.330	4	23.80	0.062	0.420	0.100	2.66	2.670
			1.560	10.80	0.056					3.100	10.70	0.056
19.20	0.077	0.521	0.100	2.58	5.330	5	18.80	0.079	0.531	0.100	2.66	2.670
			2.080	13.50	0.070					4.120	13.40	0.070
15.80	0.094	0.632	0.100	2.58	5.330	6	15.90	0.093	0.631	0.100	2.66	2.670
			2.590	16.20	0.084					5.150	15.90	0.084
13.40	0.110	0.745	0.100	2.58	5.330	7	12.90	0.115	0.776	0.100	2.66	2.670
			3.100	18.80	0.098					6.170	18.50	0.098
12.00	0.124	0.834	0.100	2.58	5.330	8	11.90	0.125	0.841	0.100	2.66	2.670
			3.610	21.40	0.112					7.200	21.00	0.112
10.50	0.140	0.948	0.100	2.58	5.330	9	9.90	0.149	1.010	0.100	2.66	2.670
			4.120	24.10	0.126					8.220	23.50	0.126
9.58	0.154	1.040	0.100	2.58	5.330	10	8.91	0.166	1.120	0.100	2.66	2.670
			4.640	26.70	0.140					9.240	26.00	0.140
8.62	0.172	1.160	0.100	2.58	5.330	11	7.92	0.187	1.260	0.100	2.66	2.670
			5.150	29.20	0.154					10.300	28.40	0.154
7.66	0.193	1.300	0.100	2.58	5.330	12	7.92	0.187	1.260	0.100	2.66	2.670
			5.660	31.80	0.168					11.300	30.90	0.168
7.18	0.206	1.390	0.100	2.58	5.330	13	6.93	0.214	1.440	0.100	2.66	2.670
			6.170	34.40	0.182					12.300	33.20	0.182
6.70	0.221	1.490	0.100	2.58	5.330	14	5.94	0.249	1.680	0.100	2.66	2.670
			6.680	36.90	0.196					13.300	35.60	0.196
6.22	0.238	1.610	0.100	2.58	5.330	15	5.94	0.249	1.680	0.100	2.66	2.670
			7.200	39.40	0.210					14.400	37.90	0.210
						16	5.94	0.249	1.680	0.100	2.66	2.670
										15.400	40.20	0.224
						17	4.94	0.299	2.020	0.100	2.66	2.670
										16.400	42.50	0.238
						18	4.94	0.299	2.020	0.100	2.66	2.670
										17.400	44.70	0.252
						19	4.94	0.299	2.020	0.100	2.66	2.670
										18.500	47.00	0.266
						20	3.95	0.374	2.530	0.100	2.66	2.670
										19.500	49.10	0.280
						21	3.95	0.374	2.530	0.100	2.66	2.670
										20.500	51.30	0.294
						22	3.95	0.374	2.530	0.100	2.66	2.670
										21.500	53.40	0.308
						23	3.95	0.374	2.530	0.100	2.66	2.670
										22.600	55.50	0.322
						24	3.95	0.374	2.530	0.100	2.66	2.670
										23.600	57.60	0.336
						25	2.96	0.500	3.380	0.100	2.66	2.670
										24.600	59.60	0.350
						26	2.96	0.500	3.380	0.100	2.66	2.670
										25.600	61.70	0.364
						27	2.96	0.500	3.380	0.100	2.66	2.670
										26.700	63.60	0.378
						28	2.96	0.500	3.380	0.100	2.66	2.670
										27.700	65.60	0.392
						29	2.96	0.500	3.380	0.100	2.66	2.670
										28.700	67.50	0.406
						30	2.96	0.500	3.380	0.100	2.66	2.670
										29.700	69.40	0.420
						31	2.96	0.500	3.380	0.100	2.66	2.670
										30.700	71.30	0.434

Table 1. IBM System/370 Model 158 Channel Evaluation Factors (Part 16 of 18)

2702 Transmission Control, Telegraph Control II 110 bps												
15-Line Maximum						*No. of Lines Available*	*31-Line Maximum*					
Wait Time	*Device Load*	*Previous Load*	*Priority Load*				*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
			Time	*A*	*B*					*Time*	*A*	*B*
96.90	0.015	0.103	0.100	2.73	0.014	1	97.20	0.015	0.103	0.100	2.73	0.014
			--	--	--					--	--	--
48.50	0.031	0.206	0.100	2.58	5.330	2	48.60	0.030	0.206	0.100	2.66	2.670
			0.539	5.44	0.028					1.050	5.43	0.028
32.10	0.046	0.311	0.100	2.58	5.330	3	31.70	0.047	0.315	0.100	2.66	2.670
			1.050	8.15	0.042					2.080	8.10	0.042
24.00	0.062	0.417	0.100	2.58	5.330	4	23.80	0.062	0.420	0.100	2.66	2.670
			1.560	10.80	0.056					3.100	10.70	0.056
19.20	0.077	0.521	0.100	2.58	5.330	5	18.80	0.079	0.531	0.100	2.66	2.670
			2.080	13.50	0.070					4.120	13.40	0.070
15.80	0.094	0.632	0.100	2.58	5.330	6	15.90	0.093	0.631	0.100	2.66	2.670
			2.590	16.20	0.084					5.150	15.90	0.084
13.40	0.110	0.745	0.100	2.58	5.330	7	13.90	0.107	0.721	0.100	2.66	2.670
			3.100	18.80	0.098					6.170	18.50	0.098
12.00	0.124	0.834	0.100	2.58	5.330	8	11.90	0.125	0.841	0.100	2.66	2.670
			3.610	21.40	0.112					7.200	21.00	0.112
10.50	0.140	0.948	0.100	2.58	5.330	9	9.90	0.149	1.010	0.100	2.66	2.670
			4.120	24.10	0.126					8.220	23.50	0.126
9.58	0.154	1.040	0.100	2.58	5.330	10	8.91	0.166	1.120	0.100	2.66	2.670
			4.640	26.70	0.140					9.240	26.00	0.140
8.62	0.172	1.160	0.100	2.58	5.330	11	7.92	0.187	1.260	0.100	2.66	2.670
			5.150	29.20	0.154					10.300	28.40	0.154
7.66	0.193	1.300	0.100	2.58	5.330	12	7.92	0.187	1.260	0.100	2.66	2.670
			5.660	31.80	0.168					11.300	30.90	0.168
7.18	0.206	1.390	0.100	2.58	5.330	13	6.93	0.214	1.440	0.100	2.66	2.670
			6.170	34.40	0.182					12.300	33.20	0.182
6.70	0.221	1.490	0.100	2.58	5.330	14	6.93	0.214	1.440	0.100	2.66	2.670
			6.680	36.90	0.196					13.300	35.60	0.196
6.22	0.238	1.610	0.100	2.58	5.330	15	5.94	0.249	1.680	0.100	2.66	2.670
			7.200	39.40	0.210					14.400	37.90	0.210
						16	5.94	0.249	1.680	0.100	2.66	2.670
										15.400	40.20	0.224
						17	4.94	0.299	2.020	0.100	2.66	2.670
										16.400	42.50	0.238
						18	4.94	0.299	2.020	0.100	2.66	2.670
										17.400	44.70	0.252
						19	4.94	0.299	2.020	0.100	2.66	2.670
										18.500	47.00	0.266
						20	3.95	0.374	2.530	0.100	2.66	2.670
										19.500	49.10	0.280
						21	3.95	0.374	2.530	0.100	2.66	2.670
										20.500	51.30	0.294
						22	3.95	0.374	2.530	0.100	2.66	2.670
										21.500	53.40	0.308
						23	3.95	0.374	2.530	0.100	2.66	2.670
										22.600	55.50	0.322
						24	3.95	0.374	2.530	0.100	2.66	2.670
										23.600	57.60	0.336
						25	2.96	0.500	3.380	0.100	2.66	2.670
										24.600	59.60	0.350
						26	2.96	0.500	3.380	0.100	2.66	2.670
										25.600	61.70	0.364
						27	2.96	0.500	3.380	0.100	2.66	2.670
										26.700	63.60	0.378
						28	2.96	0.500	3.380	0.100	2.66	2.670
										27.700	65.60	0.392
						29	2.96	0.500	3.380	0.100	2.66	2.670
										28.700	67.50	0.406
						30	2.96	0.500	3.380	0.100	2.66	2.670
										29.700	69.40	0.420
						31	2.96	0.500	3.380	0.100	2.66	2.670
										30.700	71.30	0.434

Table 1. IBM System/370 Model 158 Channel Evaluation Factors (Part 17 of 18)

2702 Transmission Control, WTC Telegraph Control 50 bps												
15-Line Maximum						*No. of Lines Available*	*31-Line Maximum*					
Wait Time	*Device Load*	*Previous Load*	*Priority Load*				*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
			Time	*A*	*B*					*Time*	*A*	*B*
144.00	0.010	0.069	0.100	2.73	0.009	1	144.00	0.010	0.070	0.100	2.73	0.009
			--	--	--					--	--	--
72.00	0.021	0.139	0.100	2.58	5.330	2	71.40	0.021	0.140	0.100	2.66	2.670
			0.539	5.45	0.018					1.050	5.44	0.018
48.00	0.031	0.208	0.100	2.58	5.330	3	47.60	0.031	0.210	0.100	2.66	2.670
			1.050	8.16	0.027					2.080	8.13	0.027
36.00	0.041	0.278	0.100	2.58	5.330	4	35.70	0.041	0.280	0.100	2.66	2.670
			1.560	10.90	0.036					3.100	10.80	0.036
28.80	0.051	0.347	0.100	2.58	5.330	5	28.80	0.051	0.348	0.100	2.66	2.670
			2.080	13.60	0.045					4.120	13.50	0.045
24.00	0.062	0.417	0.100	2.58	5.330	6	23.80	0.062	0.420	0.100	2.66	2.670
			2.590	16.20	0.054					5.150	16.10	0.054
20.10	0.730	0.496	0.100	2.58	5.330	7	19.80	0.075	0.504	0.100	2.66	2.670
			3.100	18.90	0.063					6.170	18.70	0.063
17.70	0.083	0.564	0.100	2.58	5.330	8	17.80	0.083	0.561	0.100	2.66	2.670
			3.610	21.60	0.072					7.200	21.30	0.072
15.80	0.094	0.632	0.100	2.58	5.330	9	15.90	0.093	0.631	0.100	2.66	2.670
			4.120	24.20	0.081					8.220	23.90	0.081
14.40	0.103	0.695	0.100	2.58	5.330	10	13.90	0.107	0.721	0.100	2.66	2.670
			4.640	26.90	0.090					9.240	26.50	0.090
12.90	0.114	0.773	0.100	2.58	5.330	11	12.90	0.115	0.776	0.100	2.66	2.670
			5.150	29.50	0.099					10.300	29.00	0.099
12.00	0.124	0.834	0.100	2.58	5.330	12	11.90	0.125	0.841	0.100	2.66	2.670
			5.660	32.10	0.108					11.300	31.50	0.108
11.00	0.134	0.907	0.100	2.58	5.330	13	10.90	0.136	0.918	0.100	2.66	2.670
			6.170	34.80	0.117					12.300	34.00	0.117
10.10	0.147	0.994	0.100	2.58	5.330	14	9.90	0.149	1.010	0.100	2.66	2.670
			6.680	37.40	0.126					13.300	36.50	0.126
9.58	0.154	1.040	0.100	2.58	5.330	15	8.91	0.166	1.120	0.100	2.66	2.670
			7.200	40.00	0.135					14.400	39.00	0.135
						16	8.91	0.166	1.120	0.100	2.66	2.670
										15.400	41.50	0.144
						17	7.92	0.187	1.260	0.100	2.66	2.670
										16.400	43.90	0.153
						18	7.92	0.187	1.260	0.100	2.66	2.670
										17.400	46.30	0.162
						19	6.93	0.214	1.440	0.100	2.66	2.670
										18.500	48.70	0.171
						20	6.93	0.214	1.440	0.100	2.66	2.670
										19.500	51.10	0.180
						21	5.94	0.249	1.680	0.100	2.66	2.670
										20.500	53.50	0.189
						22	5.94	0.249	1.680	0.100	2.66	2.670
										21.500	55.80	0.198
						23	5.94	0.249	1.680	0.100	2.66	2.670
										22.600	58.10	0.207
						24	5.94	0.249	1.680	0.100	2.66	2.670
										23.600	60.40	0.216
						25	4.94	0.299	2.020	0.100	2.66	2.670
										24.600	62.70	0.225
						26	4.94	0.299	2.020	0.100	2.66	2.670
										25.600	65.00	0.234
						27	4.94	0.299	2.020	0.100	2.66	2.670
										26.700	67.20	0.243
						28	4.94	0.299	2.020	0.100	2.66	2.670
										27.700	69.50	0.252
						29	4.94	0.299	2.020	0.100	2.66	2.670
										28.700	71.70	0.261
						30	3.95	0.374	2.530	0.100	2.66	2.670
										29.700	73.90	0.270
						31	3.95	0.374	2.530	0.100	2.66	2.670
										30.700	76.10	0.279

Table 1. IBM System/370 Model 158 Channel Evaluation Factors (Part 18 of 18)

2702 Transmission Control, WTC Telegraph Control 75 bps												
15-Line Maximum						*No. of Lines Available*	*31-Line Maximum*					
Wait Time	*Device Load*	*Previous Load*	*Priority Load*				*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
			Time	*A*	*B*					*Time*	*A*	*B*
96.00	0.015	0.104	0.100	2.73	0.014	1	95.20	0.016	0.105	0.100	2.73	0.014
			--	--	--					--	--	--
48.00	0.031	0.208	0.100	2.58	5.330	2	47.60	0.031	0.210	0.100	2.66	2.670
			0.539	5.44	0.028					1.050	5.43	0.028
31.70	0.047	0.316	0.100	2.58	5.330	3	31.70	0.047	0.315	0.100	2.66	2.670
			1.050	8.15	0.042					2.080	8.10	0.042
24.00	0.062	0.417	0.100	2.58	5.330	4	23.80	0.062	0.420	0.100	2.66	2.670
			1.560	10.80	0.056					3.100	10.70	0.056
19.20	0.077	0.521	0.100	2.58	5.330	5	18.80	0.079	0.531	0.100	2.66	2.670
			2.080	13.50	0.070					4.120	13.40	0.070
15.80	0.094	0.632	0.100	2.58	5.330	6	15.90	0.093	0.631	0.100	2.66	2.670
			2.590	16.20	0.084					5.150	15.90	0.084
13.40	0.110	0.745	0.100	2.58	5.330	7	12.90	0.115	0.776	0.100	2.66	2.670
			3.100	18.80	0.098					6.170	18.50	0.098
12.00	0.124	0.834	0.100	2.58	5.330	8	11.90	0.125	0.841	0.100	2.66	2.670
			3.610	21.40	0.112					7.200	21.00	0.112
10.50	0.140	0.948	0.100	2.58	5.330	9	9.90	0.149	1.010	0.100	2.66	2.670
			4.120	24.10	0.126					8.220	23.50	0.126
9.58	0.154	1.040	0.100	2.58	5.330	10	8.91	0.166	1.120	0.100	2.66	2.670
			4.640	26.70	0.140					9.240	26.00	0.140
8.62	0.172	1.160	0.100	2.58	5.330	11	7.92	0.187	1.260	0.100	2.66	2.670
			5.150	29.20	0.154					10.300	28.40	0.154
7.66	0.193	1.300	0.100	2.58	5.330	12	7.92	0.187	1.260	0.100	2.66	2.670
			5.660	31.80	0.168					11.300	30.90	0.168
7.18	0.206	1.390	0.100	2.58	5.330	13	6.93	0.214	1.440	0.100	2.66	2.670
			6.170	34.40	0.182					12.300	33.20	0.182
6.70	0.221	1.490	0.100	2.58	5.330	14	5.94	0.249	1.680	0.100	2.66	2.670
			6.680	36.90	0.196					13.300	35.60	0.196
6.22	0.238	1.610	0.100	2.58	5.330	15	5.94	0.249	1.680	0.100	2.66	2.670
			7.200	39.40	0.210					14.400	37.90	0.210
						16	5.94	0.249	1.680	0.100	2.66	2.670
										15.400	40.20	0.224
						17	4.94	0.299	2.020	0.100	2.66	2.670
										16.400	42.50	0.238
						18	4.94	0.299	2.020	0.100	2.66	2.670
										17.400	44.70	0.252
						19	4.94	0.299	2.020	0.100	2.66	2.670
										18.500	47.00	0.266
						20	3.95	0.374	2.530	0.100	2.66	2.670
										19.500	49.10	0.280
						21	3.95	0.374	2.530	0.100	2.66	2.670
										20.500	51.30	0.294
						22	3.95	0.374	2.530	0.100	2.66	2.670
										21.500	53.40	0.308
						23	3.95	0.374	2.530	0.100	2.66	2.670
										22.600	55.50	0.322
						24	3.95	0.374	2.530	0.100	2.66	2.670
										23.600	57.60	0.336
						25	2.96	0.500	3.380	0.100	2.66	2.670
										24.600	59.60	0.350
						26	2.96	0.500	3.380	0.100	2.66	2.670
										25.600	61.70	0.364
						27	2.96	0.500	3.380	0.100	2.66	2.670
										26.700	63.60	0.378
						28	2.96	0.500	3.380	0.100	2.66	2.670
										27.700	65.60	0.392
						29	2.96	0.500	3.380	0.100	2.66	2.670
										28.700	67.50	0.406
						30	2.96	0.500	3.380	0.100	2.66	2.670
										29.700	69.40	0.420
						31	2.96	0.500	3.380	0.100	2.66	2.670
										30.700	71.30	0.434

Table 2. System/370 Model 158 b Factors for 2702 Evaluation

IBM 2702 Transmission Control	*b*
IBM Terminal Control Type I	
75 bps	0.012
134.5 bps	0.021
600 bps	0.098
IBM Terminal Control Type II	
600 bps	0.092
Telegraph Terminal Control Type I	
45.5 bps	0.008
56.9 bps	0.011
74.2 bps	0.014
Telegraph Terminal Control Type II	
110 bps	0.014
World Trade Telegraph Terminal Control	
50 bps	0.009
75 bps	0.014

Table 3. 2703 Internal Priorities as a Function of Base Types and Lines per Base

Base Types and Lines per Base	*Priority*							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
12 Lines (2A) Synchronous Base 8-bit, 4800 bps			4		8			12
16 Lines (IB) Synchronous Base 6-bit, 2400 bps		4		8		12		16
24 Lines (IA) Synchronous Base 8-bit, 2400 bps	4		8	12	16	18	20	24
24 Lines Start-Stop Base Type II 600 bps	8		16	24				
88 Lines Start-Stop Base Type I 180 bps	16	32	48	64	80	88		

Table 4. Model 158 Channel Evaluation Factors for 2703

Input/Output Device	*Line Speed*		*Wait Time (ms)*
	(bps)	*(cps)*	
Communication Equipment			
2703 Transmission Control			
IBM Terminal Control Type I	75.0	8.3	108.5
	134.5	14.8	59.5
	600.0	66.7	13.3
IBM Terminal Control Type II	600.0	60.0	13.3
Telegraph Terminal Control			
Type I	45.5	6.0	131.0
	56.9	7.5	105.0
	74.2	10.0	80.9
Type II	110.0	100.0	81.8
Synchronous Terminal Control, Synchronous Base Type 1A (24 lines)			
Eight-bit code	600*	75	51.0
(no autopolling)	1,200	150	24.0
	2,000	250	15.0
	2,400	300	12.0
(with autopolling)	600*	75	24.0
	1,200	150	12.0
	2,000	250	6.0
	2,400	300	6.0
Synchronous Terminal Control, Synchronous Base Type 1B (16 lines)			
Eight-bit code	600*	75	53.0
(no autopolling)	1,200	150	24.5
	2,000	250	14.3
	2,400	300	12.2
(with autopolling)	600*	75	26.5
	1,200	150	12.2
	2,000	250	6.1
	2,400	300	6.1
Six-bit code			
(no autopolling)	600*	100	38.7
	1,200	200	16.4
	2,000	333	10.2
	2,400	400	8.2
(with autopolling)	600*	100	18.3
	1,200	200	8.2
	2,000	333	4.1
	2,400	400	4.1
Synchronous Terminal Control, Synchronous Base Type 2A (12 lines)			
Eight-bit code			
(no autopolling)	4,800	600	6.2
(with autopolling)	4,800	600	3.1

* World Trade TTY Only

Table 5. Model 158 Channel Evaluation Factors for 3704 and 3705 Type I Scanner

Combinations of Medium and Low Speed Lines									
Highest Speed Line				*Byte Multiplexer Channel*					
bps	*cps*		*Loading Factor (L)*	*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
	S/S	*BSC*					*Time*	*A*	*B*
134.5 or less	14.8	–	0.1	16.8	0.2	0.2			
			0.2	9.8	0.4	0.4			
			0.3	6.9	0.6	0.6			
			0.4	5.3	0.8	0.8			
600	66.7	75	0.1	7.72	0.5	0.5			
			0.2	5.74	0.7	0.7			
			0.3	4.57	0.9	0.9			
			0.4	3.78	1.1	1.1			
			0.5	3.21	1.3	1.3			
			0.6	2.76	1.5	1.5			
			0.7	2.39	1.7	1.7			
			0.8	2.04	2.0	2.0			
			0.9	1.64	2.4	2.4			
1200	120	150	0.1	4.72	0.8	0.8			
			0.2	3.8	1.0	1.0			
			0.3	3.22	1.2	1.2			
			0.4	2.78	1.4	1.4			
			0.5	2.44	1.6	1.6			
			0.6	2.15	1.9	1.9			
			0.7	1.89	2.1	2.1			
			0.8	1.63	2.5	2.5			
			0.9	1.29	3.1	3.1			
2000	–	250	0.1	3.19	1.3	1.3			
			0.2	2.64	1.5	1.5			
			0.3	2.31	1.7	1.7			
			0.4	2.06	2.0	2.0			
			0.5	1.84	2.2	2.2			
			0.6	1.65	2.4	2.4			
			0.7	1.47	2.7	2.7			
			0.8	1.26	3.2	3.2			
			0.9	0.98	4.1	4.1			
2400	240	300	0.1	2.77	1.4	1.4			
			0.2	2.30	1.7	1.7			
			0.3	2.03	2.0	2.0			
			0.4	1.82	2.2	2.2			
			0.5	1.64	2.4	2.4			
			0.6	1.48	2.7	2.7			
			0.7	1.31	3.1	3.1			
			0.8	1.13	3.5	3.5			
			0.9	0.86	4.7	4.7			
4800	480	600	0.1	1.66	2.4	2.4			
			0.2	1.33	3.0	3.0			
			0.3	1.18	3.4	3.4			
			0.4	1.07	3.8	3.8			
			0.5	0.97	4.1	4.1			
			0.6	0.88	4.5	4.5			
			0.7	0.78	5.1	5.1			
			0.8	0.65	6.2	6.2			
			0.9	0.42	9.6	9.6			

Priority load for all configurations is determined from the following set of factors:

Time	A	B
0.100	0	40
0.200	$8 - \frac{CPS}{5000}$	$\frac{CPS}{1000}$

Where
CPS is the total rate in characters per second of all attached lines.

Table 6. Model 158 Channel Evaluation Factors for 3704 and 3705 Type II Scanner (Part 1 of 2)

Highest Speed Line				*Byte Multiplexer Channel*					
	cps		*Loading Factor (L)*	*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
bps	*S/S*	*BSC*					*Time*	*A*	*B*
134.5 or less	14.8	–	0.1	4.59	0.9	0.9			
			0.2	2.34	1.7	1.7			
			0.3	1.54	2.6	2.6			
			0.4	1.13	3.5	3.5			
600	66.7	75	0.1	3.46	1.2	1.2			
			0.2	1.99	2.0	2.0			
			0.3	1.37	2.9	2.9			
			0.4	1.03	3.9	3.9			
			0.5	0.81	5.0	5.0			
			0.6	0.65	6.2	6.2			
			0.7	0.53	7.6	7.6			
			0.8	0.42	9.5	9.5			
			0.9	0.33	12.2	12.2			
1200	120	150	0.1	2.69	1.5	1.5			
			0.2	1.68	2.4	2.4			
			0.3	1.21	3.3	3.3			
			0.4	0.93	4.3	4.3			
			0.5	0.74	5.4	5.4			
			0.6	0.60	6.7	6.7			
			0.7	0.49	8.2	8.2			
			0.8	0.39	10.2	10.2			
			0.9	0.30	13.2	13.2			
2000	–	250	0.1	2.12	1.9	1.9			
			0.2	1.40	2.9	2.9			
			0.3	1.04	3.9	3.9			
			0.4	0.82	4.9	4.9			
			0.5	0.66	6.1	6.1			
			0.6	0.54	7.4	7.4			
			0.7	0.44	9.1	9.1			
			0.8	0.36	11.3	11.3			
			0.9	0.27	14.6	14.6			
2400	240	300	0.1	1.93	2.1	2.1			
			0.2	1.29	3.1	3.1			
			0.3	0.97	4.1	4.1			
			0.4	0.77	5.2	5.2			
			0.5	0.63	6.4	6.4			
			0.6	0.51	7.8	7.8			
			0.7	0.42	9.5	9.5			
			0.8	0.34	11.8	11.8			
			0.9	0.26	15.4	15.4			
4800	480	600	0.1	1.35	3.0	3.0			
			0.2	0.91	4.4	4.4			
			0.3	0.71	5.6	5.6			
			0.4	0.58	6.9	6.9			
			0.5	0.48	8.3	8.3			
			0.6	0.40	10.0	10.0			
			0.7	0.33	12.1	12.1			
			0.8	0.26	15.3	15.3			
			0.9	0.20	20.0	20.0			

Priority load for all configurations is determined from the following set of factors:

0.100	0	40
0.200	$8 - \frac{CPS}{5000}$	$\frac{CPS}{1000}$

Where
CPS is the total rate in characters per second of all attached lines.

Table 6. Model 158 Channel Evaluation Factors for 3704 and 3705 Type II Scanner (Part 2 of 2)

Highest Speed Line				*Byte Multiplexer Channel*					
	cps		*Loading Factor (L)*	*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
bps	*S/S*	*BSC*					*Time*	*A*	*B*
7200	–	900	0.1	1.11	3.6	3.6			
			0.2	0.73	5.5	5.5			
			0.3	0.57	7.0	7.0			
			0.4	0.47	8.6	8.6			
			0.5	0.39	10.3	10.3			
			0.6	0.32	12.4	12.4	Priority load for all configurations is determined from the following set of factors:		
			0.7	0.26	15.2	15.2			
			0.8	0.21	19.5	19.5			
			0.9	0.15	27.2	27.2			
							0.100	0	40
9600*		1200	0.1	0.96	4.1	4.1	0.200	$8 - \frac{\text{CPS}}{5000}$	$\frac{\text{CPS}}{1000}$
			0.2	0.62	6.4	6.4			
			0.3	0.48	8.3	8.3			
			0.4	0.39	10.2	10.2	Where CPS is the total rate in characters per second of all attached lines.		
			0.5	0.32	12.5	12.5			
			0.6	0.27	15.0	15.0			
			0.7	0.22	18.4	18.4			
			0.8	0.17	24.1	24.1			
			0.9	0.11	35.9	35.9			

* 9600 bps may be obtained by RPQ.

Table 7. Combinations Containing High-Speed Lines for 3704 and 3705

Select High Speed Line Configuration on High Priority				*Byte Multiplexer Channel*					
							Priority Load		
50,000 bps (6,250 cps)	*40,800 bps (5,100 cps)*	*19,200 bps (2,400 cps)*	*Loading Factor (Ln)*	*Wait Time*	*Device Load*	*Previous Load*	*Time*	*A*	*B*
2	0	0	0.0	0.13	30.8	30.8			
1	1	0	0.0	0.19	21.0	21.0			
1	0	0	0.0	0.54	7.4	7.4			
			0.1	0.26	15.4	15.4			
			0.2	0.23	17.4	17.4			
			0.3	0.21	19.1	19.1			
			0.4	0.17	23.5	23.5			
			0.5	0.11	36.7	36.7			
0	2	1*	0.0	0.12	33.3	33.3			
0	2	0	0.0	0.25	16.0	16.0			
			0.1	0.12	33.3	33.3			
			0.2	0.10	40.0	40.0			
0	1	0	0.0	0.68	5.9	5.9			
			0.1	0.36	11.1	11.1			
			0.2	0.34	11.8	11.8			
			0.3	0.31	12.9	12.9			
			0.4	0.28	14.3	14.3			
			0.5	0.23	17.4	17.4			
			0.6	0.16	25.0	25.0			
0	0	5	0.0	0.12	33.3	33.3			
			0.1	0.10	40.0	40.0			
0	0	4	0.0	0.25	16.0	16.0			
0	0	4	0.1	0.22	18.2	18.2			
0	0	4	0.2	0.19	21.0	21.0			
0	0	4	0.3	0.14	28.6	28.6			
0	0	3	0.0	0.40	10.0	10.0			
0	0	3	0.1	0.35	11.4	11.4			
0	0	3	0.2	0.33	12.1	12.1			
0	0	3	0.3	0.30	13.3	13.3			
0	0	3	0.4	0.25	16.0	16.0			
0	0	2	0.0	0.70	5.7	5.7			
0	0	2	0.1	0.55	7.3	7.3			
0	0	2	0.2	0.53	7.5	7.5			
0	0	2	0.3	0.50	8.0	8.0			
0	0	2	0.4	0.47	8.6	8.6			
0	0	2	0.5	0.43	9.3	9.3			
0	0	2	0.6	0.37	10.8	10.8			
0	0	1	0.0	1.54	2.6	2.6			
0	0	1	0.1	0.92	4.3	4.3			
0	0	1	0.2	0.90	4.4	4.4			
0	0	1	0.3	0.88	4.5	4.5			
0	0	1	0.4	0.86	4.7	4.7			
0	0	1	0.5	0.82	4.9	4.9			
0	0	1	0.6	0.80	5.0	5.0			
0	0	1	0.7	0.72	5.6	5.6			

Priority load for all configurations is determined from the following set of factors:

0.100	0	40
0.200	$8 - \frac{CPS}{5000}$	$\frac{CPS}{1000}$

Where
CPS is the total rate in characters per second of all attached lines.

* 19,200 bps line is on the normal priority.

Table 8. Model 158 Channel Evaluation Factors for 3704 and 3705 (Part 1 of 5)

Highest Speed Line on Normal Priority					*Byte Multiplexer Channel*					
Loading Factor (Lh)	*bps*	*cps*		*Loading Factor (Ln)*	*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
		S/S	*BSC*					*Time*	*A*	*B*
0.2	134.5 or less	14.8	–	0.1	1.13	3.5	3.5			
				0.2	1.06	3.8	3.8			
				0.3	0.93	4.3	4.3			
				0.4	0.77	5.2	5.2			
0.2	600	66.7	75	0.1	1.12	3.6	3.6			
				0.2	1.04	3.9	3.9			
				0.3	0.90	4.5	4.5			
				0.4	0.73	5.5	5.5			
				0.5	0.58	6.9	6.9			
				0.6	0.44	9.0	9.0			
				0.7	0.32	12.3	12.3			
0.2	1200	120	150	0.1	1.11	3.6	3.6			
				0.2	1.01	4.0	4.0			
				0.3	0.86	4.7	4.7			
				0.4	0.69	5.8	5.8			
				0.5	0.54	7.4	7.4			
				0.6	0.42	9.6	9.6			
				0.7	0.30	13.2	13.2			
0.2	2000	–	250	0.1	1.09	3.7	3.7			
				0.2	0.97	4.1	4.1			
				0.3	0.80	5.0	5.0			
				0.4	0.64	6.3	6.3			
				0.5	0.50	8.0	8.0			
				0.6	0.38	10.4	10.4			
				0.7	0.28	14.5	14.5	Priority load for all configurations is determined from the following set of factors:		
0.2	2400	240	300	0.1	1.08	3.7	3.7			
				0.2	0.95	4.3	4.3			
				0.3	0.78	5.2	5.2	0.100	0	0
				0.4	0.62	6.5	6.5			
				0.5	0.48	8.3	8.3	0.200	$8 - \frac{CPS}{5000}$	$\frac{CPS}{1000}$
				0.6	0.37	10.8	10.8			
				0.7	0.26	15.4	15.4			
0.2	4800	480	600	0.1	0.99	4.0	4.0	Where CPS is the total rate in characters per second of all attached lines.		
				0.2	0.81	4.9	4.9			
				0.3	0.64	6.3	6.3			
				0.4	0.50	8.0	8.0			
				0.5	0.39	10.3	10.3			
				0.6	0.29	13.8	13.8			
				0.7	0.20	20.0	20.0			
0.2	7200	–	900	0.1	0.88	4.6	4.6			
				0.2	0.69	5.8	5.8			
				0.3	0.53	7.6	7.6			
				0.4	0.41	9.8	9.8			
				0.5	0.32	12.5	12.5			
				0.6	0.24	16.7	16.7			
				0.7	0.16	25.0	25.0			
0.2	9600*	–	1200	0.1	0.76	5.3	5.3			
				0.2	0.59	6.8	6.8			
				0.3	0.45	8.9	8.9			
				0.4	0.35	11.4	11.4			
				0.5	0.27	14.8	14.8			
				0.6	0.19	21.0	21.0			
				0.7	0.12	33.3	33.3			

* 9600 bps may be obtained by RPQ.

Table 8. Model 158 Channel Evaluation Factors for 3704 and 3705 (Part 2 of 5)

Highest Speed Line on Normal Priority					*Byte Multiplexer Channel*					
Loading Factor (Lh)	*bps*	*cps*		*Loading Factor (Ln)*	*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
		S/S	*BSC*					*Time*	*A*	*B*
0.3	134.5 or less	14.8	–	0.1	0.71	5.6	5.6			
				0.2	0.66	6.1	6.1			
				0.3	0.60	6.7	6.7			
				0.4	0.51	7.8	7.8			
0.3	600	66.7	75	0.1	0.70	5.7	5.7			
				0.2	0.65	6.2	6.2			
				0.3	0.59	6.8	6.8			
				0.4	0.50	8.0	8.0			
				0.5	0.39	10.3	10.3			
				0.6	0.29	13.8	13.8			
0.3	1200	120	150	0.1	0.70	5.7	5.7			
				0.2	0.64	6.3	6.3			
				0.3	0.57	7.0	7.0			
				0.4	0.48	8.3	8.3			
				0.5	0.38	10.5	10.5			
				0.6	0.27	14.8	14.8			
0.3	2000	–	250	0.1	0.69	5.8	5.8			
				0.2	0.63	6.4	6.4			
				0.3	0.55	7.3	7.3			
				0.4	0.45	8.9	8.9			
				0.5	0.35	11.4	11.4			
				0.6	0.25	16.0	16.0			
0.3	2400	240	300	0.1	0.68	5.9	5.9	Priority load for all configurations is determined from the following set of factors:		
				0.2	0.62	6.5	6.5			
				0.3	0.54	7.4	7.4			
				0.4	0.44	9.1	9.1	0.100	0	40
				0.5	0.34	11.8	11.8	0.200	$8 - \frac{CPS}{5000}$	$\frac{CPS}{1000}$
				0.6	0.24	16.7	16.7			
0.3	4800	480	600	0.1	0.65	6.2	6.2	Where CPS is the total rate in characters per second of all attached lines.		
				0.2	0.57	7.0	7.0			
				0.3	0.47	8.5	8.5			
				0.4	0.38	10.5	10.5			
				0.5	0.28	14.3	14.3			
				0.6	0.14	21.0	21.0			
0.3	7200	–	900	0.1	0.60	6.7	6.7			
				0.2	0.51	7.8	7.8			
				0.3	0.41	9.8	9.8			
				0.4	0.32	12.5	12.5			
				0.5	0.23	17.4	17.4			
				0.6	0.15	26.6	26.6			
0.3	9600*	–	1200	0.1	0.55	7.3	7.3			
				0.2	0.46	8.7	8.7			
				0.3	0.36	11.1	11.1			
				0.4	0.28	14.3	14.3			
				0.5	0.20	20.0	20.0			
				0.6	0.12	33.3	33.3			
0.3	19,200	–	2400	0.1	0.35	11.4	11.4			
				0.2	0.29	13.8	13.8			
				0.3	0.22	18.2	18.2			
				0.4	0.16	25.0	25.0			
				0.5	0.10	40.0	40.0			

* 9600 bps may be obtained by RPQ.

Table 8. Model 158 Channel Evaluation Factors for 3704 and 3705 (Part 3 of 5)

Highest Speed Line on Normal Priority					*Byte Multiplexer Channel*					
		cps						*Priority Load*		
Loading Factor (Lh)	*bps*	*S/S*	*BSC*	*Loading Factor (Ln)*	*Wait Time*	*Device Load*	*Previous Load*	*Time*	*A*	*B*
0.4	134.5 of less	14.8	–	0.1	0.49	8.2	8.2			
				0.2	0.45	8.9	8.9			
				0.3	0.40	10.0	10.0			
				0.4	0.33	12.1	12.1			
0.4	600	66.7	75	0.1	0.49	8.2	8.2			
				0.2	0.45	8.9	8.9			
				0.3	0.39	10.3	10.3			
				0.4	0.32	12.5	12.5			
				0.5	0.24	16.7	16.7			
0.4	1200	120	150	0.1	0.48	8.3	8.3			
				0.2	0.44	9.1	9.1			
				0.3	0.38	10.5	10.5			
				0.4	0.31	12.9	12.9			
				0.5	0.23	17.4	17.4			
0.4	2000	–	250	0.1	0.48	8.3	8.3			
				0.2	0.43	9.3	9.3			
				0.3	0.37	10.8	10.8	Priority load for all configurations is determined from the following set of factors:		
				0.4	0.30	13.3	13.3			
				0.5	0.21	19.1	19.1			
0.4	2400	240	300	0.1	0.47	8.5	8.5	0.100	0	40
				0.2	0.42	9.5	9.5	0.200	$8 - \frac{CPS}{5000}$	$\frac{CPS}{1000}$
				0.3	0,36	11.1	11.1			
				0.4	0.29	13.8	13.8			
				0.5	0.21	19.1	19.1			
0.4	4800	480	600	0.1	0.45	8.9	8.9	Where CPS is the total rate in characters per second of all attached lines.		
				0.2	0.40	10.0	10.0			
				0.3	0.33	12.1	12.1			
				0.4	0.25	16.0	16.0			
				0.5	0.17	23.6	23.6			
0.4	7200	–	900	0.1	0.42	9.5	9.5			
				0.2	0.36	11.1	11.1			
				0.3	0.29	13.8	13.8			
				0.4	0.22	18.2	18.2			
				0.5	0.14	28.6	28.6			
0.4	9600*	–	1200	0.1	0.39	10.3	10.3			
				0.2	0.33	12.1	12.1			
				0.3	0.26	15.4	15.4			
				0.4	0.19	21.0	21.0			
				0.5	0.11	36.4	36.4			
0.4	19,200	–	2400	0.1	0.27	14.8	14.8			
				0.2	0.22	18.2	18.2			
				0.3	0.16	25.0	25.0			
				0.4	0.10	40.0	40.0			

* 9600 bps may be obtained by RPQ.

Table 8. Model 158 Channel Evaluation Factors for 3704 and 3705 (Part 4 of 5)

Highest Speed Line On Normal Priority					*Byte Multiplexer Channel*					
Loading Factor (Lh)	*bps*	*cps*		*Loading Factor (Ln)*	*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
		S/S	*BSC*					*Time*	*A*	*B*
0.5	134.5 or less	14.8	–	0.1	0.35	11.4	11.4			
				0.2	0.31	12.9	12.9			
				0.3	0.26	15.4	15.4			
				0.4	0.20	20.0	20.0			
0.5	600	66.7	75	0.1	0.35	11.4	11.4			
				0.2	0.31	12.9	12.9			
				0.3	0.26	15.4	15.4			
				0.4	0.19	21.0	21.0			
0.5	1200	120	150	0.1	0.34	11.8	11.8			
				0.2	0.30	13.3	13.3			
				0.3	0.25	16.0	16.0			
				0.4	0.18	22.2	22.2			
0.5	2000	–	250	0.1	0.34	11.8	11.8			
				0.2	0.30	13.3	13.3			
				0.3	0.24	16.7	16.7			
				0.4	0.17	23.6	23.6			
0.5	2400	240	300	0.1	0.34	11.8	11.8			
				0.2	0.29	13.8	13.8			
				0.3	0.24	16.7	16.7			
				0.4	0.17	23.6	23.6			
0.5	4800	480	600	0.1	0.32	12.5	12.5			
				0.2	0.27	14.8	14.8			
				0.3	0.21	19.1	19.1			
				0.4	0.14	28.6	28.6			
0.5	7200	–	900	0.1	0.30	13.3	13.3			
				0.2	0.25	16.0	16.0			
				0.3	0.19	21.0	21.0			
				0.4	0.12	33.3	33.3			
0.5	9600*	–	1200	0.1	0.28	14.3	14.3			
				0.2	0.23	17.4	17.4			
				0.3	0.16	25.0	25.0			
				0.4	0.10	40.0	40.0			
0.6	134.5 or less	14.8	–	0.1	0.25	16.0	16.0			
				0.2	0.21	19.1	19.1			
				0.3	0.15	26.6	26.6			
0.6	600	66.7	75	0.1	0.25	16.0	16.0			
				0.2	0.20	20.0	20.0			
				0.3	0.15	26.6	26.6			
0.6	1200	120	150	0.1	0.24	16.7	16.7			
				0.2	0.20	20.0	20.0			
				0.3	0.14	28.6	28.6			
0.6	2000	–	250	0.1	0.24	16.7	16.7			
				0.2	0.19	21.0	21.0			
				0.3	0.14	28.6	28.6			

Priority load for all configurations is determined from the following set of factors:

0.100	0	40
0.200	$8 - \frac{CPS}{5000}$	$\frac{CPS}{1000}$

Where
CPS is the total rate in characters per second of all attached lines.

* 9600 bps may be obtained by RPQ.

Table 8. Model 158 Channel Evaluation Factors for 3704 and 3705 (Part 5 of 5)

Highest Speed Line on Normal Priority					*Byte Multiplexer Channel*					
Loading Factor (Lh)	*bps*	*cps*		*Loading Factor (Ln)*	*Wait Time*	*Device Load*	*Previous Load*	*Priority Load*		
		S/S	*BSC*					*Time*	*A*	*B*
0.6	2400	240	300	0.1 0.2 0.3	0.24 0.19 0.13	16.7 21.0 30.8	16.7 21.0 30.8			
0.6	4800	480	600	0.1 0.2 0.3	0.22 0.17 0.11	18.2 23.6 36.4	18.2 23.6 36.4			
0.6	7200	–	900	0.1 0.2 0.3	0.21 0.16 0.10	19.1 25.0 40.0	19.1 25.0 40.0	Priority load for all configurations is determined from the following set of factors:		
0.6	9600*	–	1200	0.1 0.2	0.19 0.14	21.0 28.6	21.0 28.6	0.100 0.200	0 8 – $\frac{\text{CPS}}{5000}$	40 $\frac{\text{CPS}}{1000}$
0.7	134.5 or less	14.8	–	0.1 0.2	0.17 0.12	23.6 33.3	23.6 33.3			
0.7	600	66.7	75	0.1 0.2	0.16 0.12	25.0 33.3	25.0 33.3	Where CPS is the total rate in characters per second of all attached lines.		
0.7	1200	120	150	0.1 0.2	0.16 0.11	25.0 36.4	25.0 36.4			
0.7	2000	–	250	0.1 0.2	0.16 0.11	25.0 36.4	25.0 36.4			
0.7	2400	240	300	0.1 0.2	0.16 0.10	25.0 40.0	25.0 40.0			
0.7	4800	480	600	0.1 0.2	0.14 0.10	28.6 40.0	28.6 40.0			
0.7	7200	–	900	0.1	0.13	30.8	30.8			
0.7	9600*	–	1200	0.1	0.11	36.4	36.4			

* 9600 bps may be obtained by RPQ.

Table 9. R Factors for I/O Devices

Device			*Nominal Speed (megabyte/second)*	*R Factor*	*Users Command Retry on Command Overrun*	*Users Command Retry on Data Overrun*
1287			0.120	73	No	No
1288			0.120	73	No	No
2250-3			0.526	17	No	No
2303-1			0.3038	29	No	No
2305-2			1.500	6	Yes	Yes
2311-1			0.156	56	No	No
2314-A or 2314-B			0.312	28	No	No
2321-1			0.055	158	No	No
3270			0.680	12.8	No	No
3330			0.806	11	Yes	Yes
3340 or 3344			0.885	10.2	Yes	Yes
3350			1.198	7.3	Yes	Yes
3850 (see 3330)						
2401, 2, 3, 4						
Model	*Density (Bytes/Inch)*	*Data Conversion in Operation*				
1	200	No	0.0075	1159		
		Yes	0.0056	1153		
	556	No	0.0208	418		
		Yes	0.0156	557		
	800	No	0.0300	290		
		Yes	0.0225	387		
2	200	No	0.0150	580		
		Yes	0.0113	770		
	556	No	0.0417	209		
		Yes	0.0313	278		
	800	No	0.0600	145		
		Yes	0.0450	193		
3	200	No	0.0225	387		
		Yes	0.0169	515		
	556	No	0.0625	159		
		Yes	0.0469	185		
	800	No	0.0900	97		
		Yes	0.0675	129		
4	800	--	0.0300	290		
	1,600	--	0.0600	145		
5	800	--	0.0600	145		
	1,600	--	0.1200	73		
6	800	--	0.0900	97		
	1,600	--	0.1800	48		
2415	200	*	0.0038	2320		
2415	556	*	0.0104	835		
2415	800	*	0.0150	580		
2415	1,600	--	0.0300	290		
2420-5	1,600	--	0.1600	54		
2420-7	1,600	--	0.3200	27		
3410-1	1,600	--	0.0200	435		
	800	*	0.0100	870		
	556	*	0.0070	1250		
	200	*	0.0025	3475		
3410-2	1,600	--	0.0400	217		
	800	*	0.0200	435		
	556	*	0.0139	625		
	200	*	0.0050	1740		
3410-3	1,600	--	0.0800	109		
	800	*	0.0400	217		
	556	*	0.0278	313		
	200	*	0.0100	870		
3420-3	1,600	--	0.1200	73		
	800	*	0.0600	145		
	556	*	0.0417	208		
3420-4	6,250	--	0.4688	19		
	1,600	--	0.1200	73		
3420-5	1,600	--	0.2000	44		
	800	*	0.1000	87		
	556	*	0.0695	125		
3420-6	6,250	--	0.7813	11		
	1,600	--	0.2000	44		
3420-7	1,600	--	0.3200	27		
	800	*	0.1600	54		
	556	*	0.1112	78		
3420-8	6,250	--	1.2500	7		
	1,600	--	0.3200	27		

*Disregard data conversion

Table 10. Block Multiplexer Channel Maximum Rates

Condition	Maximum Rate (mb/sec)	
	Uniprocessor	Multiprocessor
1. No data chaining, only data transfer	1.5	1.5
2. For data chained blocks on which the block begins on other than word boundaries	0.09	0.08
3. For data chained blocks in which the number of bytes to be transferred per CCW is 24 or greater	1.5	1.5
4. For data chained blocks in which the number of bytes to be transferred per CCW is less than 24, and there is no TIC between data chained commands	0.057 times number of bytes to be transferred	0.053 times number of bytes to be transferred
5. For data chained blocks as in Item 4 but with a TIC to be executed between data chained commands	0.052 times number of bytes to be transferred	0.041 times number of bytes to be transferred

Table 11. X and Y Factors Used to Calculate Previous Load for 2703

Device	*Operating Mode*	*x*	*y*
1017/1018	1-byte	0.00	0.005
1403	1-byte	4.47	0
1403	4-byte	2.32	0
1443	1-byte	7.30	0
1443	2-byte	5.49	0
1443	4-byte	4.58	0
2260	1-byte	0.00	0.090
2495	1-byte	0.00	0.036
2520-B2/B3 Punching EBCDIC	1-byte	2.59	0
2520-B2/B3 Punching Col Bin	2-byte	5.05	0
2540 Reading EBCDIC	1-byte	2.42	0
2540 Reading EBCDIC	2-byte	1.96	0
2540 Reading Col Bin	1-byte	4.74	0
2540 Reading Col Bin	2-byte	3.84	0
2540 Punching EBCDIC	1-byte	2.95	0
2540 Punching EBCDIC	2-byte	2.09	0
2540 Punching Col Bin	1-byte	5.80	0
2540 Punching Col Bin	2-byte	4.09	0
3211	1-byte	5.08	0
3211	6-byte	2.26	0

Table 12. CPU Interference Factors

Channel Activity	*Interference Factor in Microseconds*	
	Byte Mode	*Block Multiplex or Selector Mode*
Data Service		
Byte mode	10.0	–
Burst mode	3.6	0.094/byte
Command Chaining	14.0	12.9
Data Chaining	3.6	7.4
Transfer in Channel (TIC) Command	2.6	1.8
Indirect Address List Access	2.6	2.0
I/O Interruption Condition		
PCI Flag in CCW	14.1	12.8 + A
Channel End (CE · $\overline{\text{DE}}$ or CE · DE)	25.3	22.2 + A
Device End Alone	24.1 + U	26.1 + A + U
Channel Available	–	10.2 + A

Key: A = 0.6 x (channel number + 1)
For 1442/2501/2520, U = 28
For graphic and teleprocessing devices, U = 5
For all other devices, U = 20

BYTE MULTIPLEXER CHANNEL WORKSHEET

SYSTEM IDENTIFICATION ____________

DATE ____________

POSITION ON BYTE MULTIPLEXER CHANNEL					1		2		3		4		5		6		7		8	
DEVICE																				
WAIT TIME																				
		TIME	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
CHANNEL 1																				
DEVICE																				
CHANNEL 2																				
DEVICE																				
CHANNEL 3																				
DEVICE																				
CHANNEL 4																				
DEVICE																				
CHANNEL 5																				
DEVICE																				
POSITION ON BYTE MULTIPLEXER CHANNEL	1				A SUM * A QUOTIENT *	▨ *														
	2				DEVICE LOAD PREVIOUS LOAD		A SUM * A QUOTIENT *	▨ *												
	3				LOAD SUM		DEVICE LOAD PREVIOUS LOAD		A SUM * A QUOTIENT *	▨ *										
	4						LOAD SUM		DEVICE LOAD PREVIOUS LOAD		A SUM * A QUOTIENT *	▨ *								
	5								LOAD SUM		DEVICE LOAD PREVIOUS LOAD		A SUM * A QUOTIENT *	▨ *						
	6										LOAD SUM		DEVICE LOAD PREVIOUS LOAD		A SUM * A QUOTIENT *	▨ *				
	7												LOAD SUM		DEVICE LOAD PREVIOUS LOAD		A SUM * A QUOTIENT *	▨ *		
	8														LOAD SUM		DEVICE LOAD PREVIOUS LOAD		A SUM * A QUOTIENT *	▨ *
																	LOAD SUM		DEVICE LOAD PREVIOUS LOAD	
																			LOAD SUM	

* For systems with the MP feature. A Quotient = $\left(\frac{\text{A sum}}{\text{WAIT TIME}}\right) \times 1.5$

Figure 6. Example of Blank Worksheet

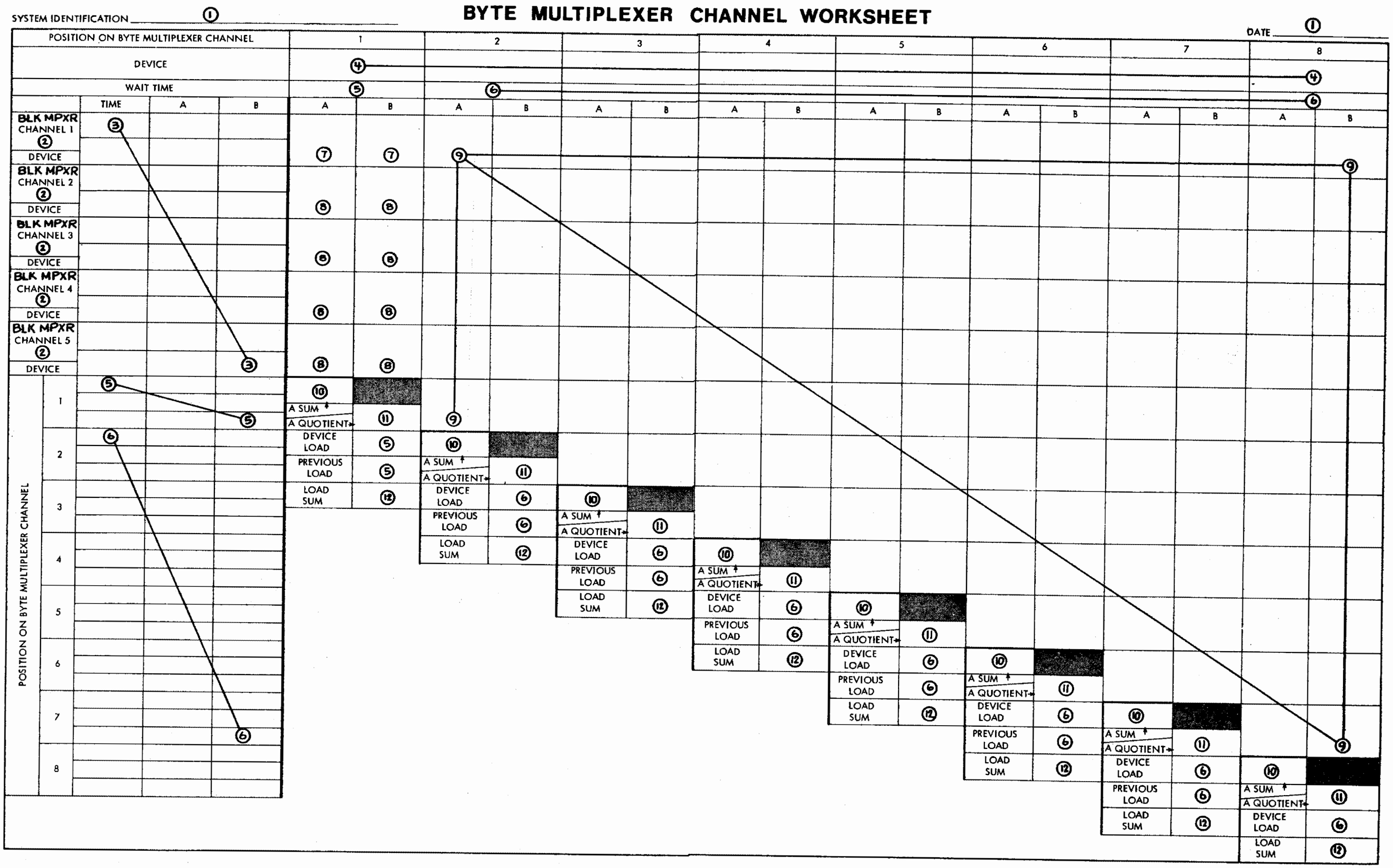


Figure 7. Sequence of Worksheet Entries

SYSTEM IDENTIFICATION ____________________

BYTE MULTIPLEXER CHANNEL WORKSHEET

DATE ____________

POSITION ON BYTE MULTIPLEXER CHANNEL					1		2		3		4		5		6		7		8	
DEVICE					2501-B2 READING EBCDIC		1288 FORMATTED ALPHAMERIC													
WAIT TIME					.915		1.0													
		TIME	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
CHANNEL 1 3330		.100	0.00	7.5																
DEVICE					0.00	7.5	0.00	7.5												
CHANNEL 2 3330		.100	0.00	7.5																
DEVICE					0.00	7.5	0.00	7.5												
CHANNEL 3 2420-7		.100	1.59	0.0																
DEVICE		.531	0.00	3.0	0.00	3.0	0.00	3.0												
CHANNEL 4 2420-7		.100	1.59	0.0																
DEVICE		.531	0.00	3.0	0.00	3.0	0.00	3.0												
CHANNEL 5 2420-7		.100	1.59	0.0																
DEVICE		.531	0.00	3.0	0.00	3.0	0.00	3.0												
POSITION ON BYTE MULTIPLEXER CHANNEL	1	.100	8.51	0.00	0.00	▨														
		.764	1.89	8.67	A SUM ↑ A QUOTIENT →	0.00	1.89	8.67												
		39.721	112.30	5.94	DEVICE LOAD	8.85														
	2	.100	10.66	0.00	PREVIOUS LOAD	10.92	1.89	▨												
		1.000	8.44	2.22	LOAD SUM	43.77	A SUM ↑ A QUOTIENT →	1.89												
							DEVICE LOAD	1.82												
	3						PREVIOUS LOAD	10.00		▨										
							LOAD SUM	46.38	A SUM ↑ A QUOTIENT →											
									DEVICE LOAD											
	4								PREVIOUS LOAD			▨								
									LOAD SUM		A SUM ↑ A QUOTIENT →									
											DEVICE LOAD									
	5										PREVIOUS LOAD			▨						
											LOAD SUM		A SUM ↑ A QUOTIENT →							
													DEVICE LOAD							
	6												PREVIOUS LOAD			▨				
													LOAD SUM		A SUM ↑ A QUOTIENT →					
															DEVICE LOAD					
	7														PREVIOUS LOAD			▨		
															LOAD SUM		A SUM ↑ A QUOTIENT →			
																	DEVICE LOAD			
	8																PREVIOUS LOAD			▨
																	LOAD SUM		A SUM ↑ A QUOTIENT →	
																			DEVICE LOAD	
																			PREVIOUS LOAD	
																			LOAD SUM	

Figure 8. Worksheet Example with a 2501-B2 and a 1288

SYSTEM IDENTIFICATION ____________________

BYTE MULTIPLEXER CHANNEL WORKSHEET

DATE ____________

POSITION ON BYTE MULTIPLEXER CHANNEL				1		2		3		4		5		6		7		8	
DEVICE				2702-15 LINES 1030 @ 600 bps		2702-31 LINES 1050 @ 134.5 bps													
WAIT TIME				0.944		1.97													
	TIME	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
CHANNEL 1 2305-2 DEVICE	0.100	0.00	14.0	0-00	14.0	0.00	14.0												
CHANNEL 2 3330 DEVICE	0.100	0.00	7.5	0-00	7.5	0.00	7.5												
CHANNEL 3 3330 DEVICE	0.100	0.00	7.5	0.00	7.5	0.00	7.5												
CHANNEL 4 2401-5 DEVICE	0.100 1.415	1.59 0.00	0.00 1.1	1.59	0.00	0.00	1.1												
CHANNEL 5 2401-5 DEVICE	0.100 1.415	1.59 0.00	0.00 1.1	1.59	0.00	0.00	1.1												
POSITION ON BYTE MULTIPLEXER CHANNEL 1	0.100	2.58	5.33	3.18		2.58	5.33												
	7.200	31.00	1.38	A SUM ↑ A QUOTIENT →	3.36														
2	0.100	2.66	2.67	DEVICE LOAD	1.57	2.58	▨												
	30.700	64.60	0.651	PREVIOUS LOAD	10.60	A SUM ↑ A QUOTIENT →	1.31												
				LOAD SUM	44.53	DEVICE LOAD	0.75		▨										
3						PREVIOUS LOAD	5.08	A SUM ↑ A QUOTIENT →											
						LOAD SUM	43.67	DEVICE LOAD			▨								
4								PREVIOUS LOAD		A SUM ↑ A QUOTIENT →									
								LOAD SUM		DEVICE LOAD			▨						
5										PREVIOUS LOAD		A SUM ↑ A QUOTIENT →							
										LOAD SUM		DEVICE LOAD			▨				
6												PREVIOUS LOAD		A SUM ↑ A QUOTIENT →					
												LOAD SUM		DEVICE LOAD			▨		
7														PREVIOUS LOAD		A SUM ↑ A QUOTIENT →			
														LOAD SUM		DEVICE LOAD			▨
8																PREVIOUS LOAD		A SUM ↑ A QUOTIENT →	
																LOAD SUM		DEVICE LOAD	
																		LOAD SUM	

Figure 9. Worksheet Example with Two 2702's

Figure 10. 2703 Worksheet

<table>
<tr><th></th><th colspan="3">Base A</th><th colspan="3">Base B</th><th colspan="3">Base C</th></tr>
<tr><td>Enter</td><td>Number of lines on Base A
Priority of lines on Base A (see Table 3)
Wait time for highest speed line on Base A (see Table 4)</td><td>N(A)
P(A)
tc(A)</td><td></td><td>Number of lines on Base B
Priority of lines on Base B (see Table 3)
Wait time for highest speed line on Base B (see Table 4)</td><td>N(B)
P(B)
tc(B)</td><td></td><td>Number of lines on Base C
Priority of lines on Base C (see Table 3)
Wait time for highest speed line on Base C (see Table 4)</td><td>N(C)
P(C)
tc(C)</td><td></td></tr>
<tr><td>Calculate</td><td colspan="2">$N(A,B) = N(A)\frac{P(B)}{P(A)}$
up to max $N(A,B) = 2 \cdot N(B)$
$N(A,C) = N(A)\frac{P(C)}{P(A)}$
up to max $N(A,C) = 2 \cdot N(C)$
$Ne(A) = N(A) + N(A,B) + N(A,C)$
$Te(A) = \frac{tc(A)}{Ne(A)}$</td><td></td><td colspan="2">$N(B,A) = N(B)\frac{P(A)}{P(B)}$
up to max $N(B,A) = 2 \cdot N(A)$
$N(B,C) = N(B)\frac{P(C)}{P(B)}$
up to max $N(B,C) = 2 \cdot N(C)$
$Ne(B) = N(B) + N(B,A) + N(B,C)$
$Te(B) = \frac{tc(B)}{Ne(B)}$</td><td></td><td colspan="2">$N(C,A) = N(C)\frac{P(A)}{(P(C)}$
up to max $N(C,A) = 2 \cdot N(A)$
$N(C,B) = N(C)\frac{P(B)}{P(C)}$
up to max $N(C,B) = 2 \cdot N(B)$
$Ne(C) = N(C) + N(C,A) + N(C,B)$
$Te(C) = \frac{tc(C)}{Ne(C)}$</td><td></td></tr>
<tr><td rowspan="4">Select</td><td>Te(min)</td><td></td><td colspan="7">The smallest Te determines the critical base. Select Te(min) from Te(A), Te(B), and Te(C).</td></tr>
<tr><td>Ne(crit)</td><td></td><td colspan="7">The corresponding Ne for the critical base that was determined above.</td></tr>
<tr><td>T</td><td></td><td colspan="7">The corresponding tc for the critical base that was determined above.</td></tr>
<tr><td>Ne(max)</td><td></td><td colspan="7">The largest Ne determines the priority load on other 2703's. Select Ne(max) from Ne(A), Ne(B), and Ne(C).</td></tr>
</table>

Figure 11. 2703 Worksheet Example with One 2703

	Base A			*Base B*			*Base C*		
Enter	Number of lines on Base A	N(A)	88	Number of lines on Base B	N(B)	24	Number of lines on Base C	N(C)	24
	Priority of lines on Base A (see Table 3)	P(A)	6	Priority of lines on Base B (see Table 3)	P(B)	4	Priority of lines on Base C (see Table 3)	P(C)	8
	Wait time for highest speed line on Base A (see Table 4)	tc(A)	59.5	Wait time for highest speed line on Base B (see Table 4)	tc(B)	13.3	Wait time for highest speed line on Base C (see Table 4)	tc(C)	6.0
Calculate	$N(A,B) = N(A)\frac{P(B)}{P(A)}$ up to max $N(A,B) = 2 \cdot N(B)$		48	$N(B,A) = N(B)\frac{P(A)}{P(B)}$ up to max $N(B,A) = 2 \cdot N(A)$		36	$N(C,A) = N(C)\frac{P(A)}{(P(C))}$ up to max $N(C,A) = 2 \cdot N(A)$		18
	$N(A,C) = N(A)\frac{P(C)}{P(A)}$ up to max $N(A,C) = 2 \cdot N(C)$		48	$N(B,C) = N(B)\frac{P(C)}{P(B)}$ up to max $N(B,C) = 2 \cdot N(C)$		48	$N(C,B) = N(C)\frac{P(B)}{P(C)}$ up to max $N(C,B) = 2 \cdot N(B)$		12
	$Ne(A) = N(A) + N(A,B) + N(A,C)$		184	$Ne(B) = N(B) + N(B,A) + N(B,C)$		108	$Ne(C) = N(C) + N(C,A) + N(C,B)$		54
	$Te(A) = \frac{tc(A)}{Ne(A)}$		.323	$Te(B) = \frac{tc(B)}{Ne(B)}$		.123	$Te(C) = \frac{tc(C)}{Ne(C)}$		.111

Select	Te(min)	.111	The smallest Te determines the critical base. Select Te(min) from Te(A), Te(B), and Te(C).
	Ne(crit)	54	The corresponding Ne for the critical base that was determined above.
	T	6.0	The corresponding tc for the critical base that was determined above.
	Ne(max)	184	The largest Ne determines the priority load on other 2703's. Select Ne(max) from Ne(A), Ne(B), and Ne(C).

BYTE MULTIPLEXER CHANNEL WORKSHEET

SYSTEM IDENTIFICATION ____________

DATE ________

POSITION ON BYTE MULTIPLEXER CHANNEL					1		2		3		4		5		6		7		8	
DEVICE					2501-81		2703													
WAIT TIME					0.915		6.0													
		TIME	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
CHANNEL 1 2305-2 DEVICE		0.100	0.00	14.0	0.00	14.0	0.00	14.0												
CHANNEL 2 3330 DEVICE		0.100	0.00	7.5	0.00	7.5	0.00	7.5												
CHANNEL 3 DEVICE																				
CHANNEL 4 DEVICE																				
CHANNEL 5 DEVICE																				
POSITION ON BYTE MULTIPLEXER CHANNEL	1	0.100 0.762	8.51 1.84	0.00 8.85	0.00 A SUM A QUOTIENT	▨ 0.00	1.84	8.85												
	2				DEVICE LOAD PREVIOUS LOAD	1.85 10.95	1.84 A SUM A QUOTIENT	▨ 0.31												
	3				LOAD SUM	34.30	DEVICE LOAD PREVIOUS LOAD	29.61 29.61	A SUM A QUOTIENT	▨										
	4						LOAD SUM	89.88	DEVICE LOAD PREVIOUS LOAD		A SUM A QUOTIENT	▨								
	5								LOAD SUM		DEVICE LOAD PREVIOUS LOAD		A SUM A QUOTIENT	▨						
	6										LOAD SUM		DEVICE LOAD PREVIOUS LOAD		A SUM A QUOTIENT	▨				
	7												LOAD SUM		DEVICE LOAD PREVIOUS LOAD		A SUM A QUOTIENT	▨		
	8														LOAD SUM		DEVICE LOAD PREVIOUS LOAD		A SUM A QUOTIENT	▨
																	LOAD SUM		DEVICE LOAD LOAD SUM	

Figure 12. Worksheet Example with One 2703

	Base A			*Base B*			*Base C*		
Enter	Number of lines on Base A	N(A)	32	Number of lines on Base B	N(B)	24	Number of lines on Base C	N(C)	16
	Priority of lines on Base A (see Table 3)	P(A)	2	Priority of lines on Base B (see Table 3)	P(B)	4	Priority of lines on Base C (see Table 3)	P(C)	8
	Wait time for highest speed line on Base A (see Table 4)	tc(A)	59.5	Wait time for highest speed line on Base B (see Table 4)	tc(B)	13.3	Wait time for highest speed line on Base C (see Table 4)	tc(C)	4.1
Calculate	$N(A,B) = N(A)\frac{P(B)}{P(A)}$			$N(B,A) = N(B)\frac{P(A)}{P(B)}$			$N(C,A) = N(C)\frac{P(A)}{(P(C)}$		
	up to max $N(A,B) = 2 \cdot N(B)$		48	up to max $N(B,A) = 2 \cdot N(A)$		12	up to max $N(C,A) = 2 \cdot N(A)$		4
	$N(A,C) = N(A)\frac{P(C)}{P(A)}$			$N(B,C) = N(B)\frac{P(C)}{P(B)}$			$N(C,B) = N(C)\frac{P(B)}{P(C)}$		
	up to max $N(A,C) = 2 \cdot N(C)$		32	up to max $N(B,C) = 2 \cdot N(C)$		32	up to max $N(C,B) = 2 \cdot N(B)$		8
	$Ne(A) = N(A) + N(A,B) + N(A,C)$		112	$Ne(B) = N(B) + N(B,A) + N(B,C)$		68	$Ne(C) = N(C) + N(C,A) + N(C,B)$		28
	$Te(A) = \frac{tc(A)}{Ne(A)}$		.53	$Te(B) = \frac{tc(B)}{Ne(B)}$		.196	$Te(C) = \frac{tc(C)}{Ne(C)}$		.146

Select	Te(min)	.146	The smallest Te determines the critical base. Select Te(min) from Te(A), Te(B), and Te(C).
	Ne(crit)	28	The corresponding Ne for the critical base that was determined above.
	T	4.1	The corresponding tc for the critical base that was determined above.
	Ne(max)	112	The largest Ne determines the priority load on other 2703's. Select Ne(max) from Ne(A), Ne(B), and Ne(C).

Figure 13. 2703 Worksheet Example with Two 2703's

BYTE MULTIPLEXER CHANNEL WORKSHEET

SYSTEM IDENTIFICATION ____________________

DATE ____________

POSITION ON BYTE MULTIPLEXER CHANNEL				1		2		3		4		5		6		7		8	
DEVICE				2703		2703													
WAIT TIME				6.0		4.1													
	TIME	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
CHANNEL 1 3330 DEVICE	0.100	0.00	7.5	0.00	7.5	0.00	7.5												
CHANNEL 2 3330 DEVICE	0.100	0.00	7.5	0.00	7.5	0.00	7.5												
CHANNEL 3 3330 DEVICE	0.100	0.00	7.5	0.00	7.5	0.00	7.5												
CHANNEL 4 DEVICE																			
CHANNEL 5 DEVICE																			

POSITION ON BYTE MULTIPLEXER CHANNEL	TIME	A	B	1 A	1 B	2 A	2 B	3 A	3 B	4 A	4 B	5 A	5 B	6 A	6 B	7 A	7 B	8 A	8 B
1	0.100	0.00	22.5	0.00	▨	0.00	22.5												
2							▨												
3									▨										
4											▨								
5													▨						
6															▨				
7																	▨		
8																			▨

	1	2	3	4	5	6	7	8
A SUM ↑ / A QUOTIENT ←	0.00							
DEVICE LOAD	29.61	22.5						
PREVIOUS LOAD	29.61	0.0						
LOAD SUM	81.72	67.50						

Figure 14. Worksheet Example with Two 2703's

Figure 15. Worksheet Example with Two 3705's

BYTE MULTIPLEXER CHANNEL WORKSHEET

SYSTEM IDENTIFICATION ____________________

DATE __________

POSITION ON BYTE MULTIPLEXER CHANNEL					1		2		3		4		5		6		7		8	
DEVICE					3705 max.at 19200bps		3705 max.at 2400 bps													
WAIT TIME					0.33		2.03													
		TIME	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
CHANNEL 1 2305-2 DEVICE		0.100	0	14.0	0	14.0	0	14.0												
CHANNEL 2 3330 DEVICE		0.100	0	7.5	0	7.5	0	7.5												
CHANNEL 3 3330 DEVICE		0.100	0	7.5	0	7.5	0	7.5												
CHANNEL 4 2401-5 DEVICE		0.100	1.59	0	1.59	0	0	1.1												
		1.415	0	1.10																
CHANNEL 5 2401-5 DEVICE		0.100	1.59	0	1.59	0	0	1.1												
		1.415	0	1.10																
POSITION ON BYTE MULTIPLEXER CHANNEL	1	0.100	0	40	3.18		5.96	10.2												
		0.200	5.96	10.2	A SUM A QUOTIENT*	9.64 *														
	2	0.100	0	40	DEVICE LOAD	12.1	5.96													
		0.200	7.73	1.35	PREVIOUS LOAD	12.1	A SUM A QUOTIENT*	2.94 *												
	3				LOAD SUM	62.8	DEVICE LOAD	2.0												
							PREVIOUS LOAD	2.0	A SUM A QUOTIENT*	*										
	4						LOAD SUM	48.3	DEVICE LOAD											
									PREVIOUS LOAD		A SUM A QUOTIENT*	*								
	5								LOAD SUM		DEVICE LOAD									
											PREVIOUS LOAD		A SUM A QUOTIENT*	*						
	6										LOAD SUM		DEVICE LOAD							
													PREVIOUS LOAD		A SUM A QUOTIENT*	*				
	7												LOAD SUM		DEVICE LOAD					
															PREVIOUS LOAD		A SUM A QUOTIENT*	*		
	8														LOAD SUM		DEVICE LOAD			
																	PREVIOUS LOAD		A SUM A QUOTIENT*	*
																	LOAD SUM		DEVICE LOAD	
																			LOAD SUM	

* For systems with the MP feature. A Quotient = $\left(\frac{\text{A sum}}{\text{WAIT TIME}}\right) \times 1.5$

Figure 16. Worksheet Example with Two 3704's

SYSTEM IDENTIFICATION ______

BYTE MULTIPLEXER CHANNEL WORKSHEET

DATE ______

POSITION ON BYTE MULTIPLEXER CHANNEL					1		2		3		4		5		6		7		8	
DEVICE					3704 max. at 19200 bps		3704 max. at 2400 bps													
WAIT TIME					0.27		1.83													
		TIME	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
CHANNEL 1 2305-2 DEVICE		0.100	0	14.0	0	14.0	0	14.0												
CHANNEL 2 3330 DEVICE		0.100	0	7.5	0	7.5	0	7.5												
CHANNEL 3 3330 DEVICE		0.100	0	7.5	0	7.5	0	7.5												
CHANNEL 4 2401-5 DEVICE		0.100 1.415	1.59 0	0 1.10	1.59	0	0	1.10												
CHANNEL 5 2401-5 DEVICE		0.100 1.415	1.59 0	0 1.10	1.59	0	0	1.10												
POSITION ON BYTE MULTIPLEXER CHANNEL	1	0.100 0.200	0 6.56	40 10.20	3.18 A SUM ÷ A QUOTIENT*	▨ 11.8	6.56	10.2												
	2	0.100 0.200	0 8.50	40 1.35	DEVICE LOAD PREVIOUS LOAD	14.6 14.6	6.56 A SUM ÷ A QUOTIENT*	▨ 3.6												
	3				LOAD SUM	70.0	DEVICE LOAD PREVIOUS LOAD	2.2 2.2	A SUM ÷ A QUOTIENT*	▨										
	4						LOAD SUM	49.4	DEVICE LOAD PREVIOUS LOAD		A SUM ÷ A QUOTIENT*	▨								
	5								LOAD SUM		DEVICE LOAD PREVIOUS LOAD		A SUM ÷ A QUOTIENT*	▨						
	6										LOAD SUM		DEVICE LOAD PREVIOUS LOAD		A SUM ÷ A QUOTIENT*	▨				
	7												LOAD SUM		DEVICE LOAD PREVIOUS LOAD		A SUM ÷ A QUOTIENT*	▨		
	8														LOAD SUM		DEVICE LOAD PREVIOUS LOAD		A SUM ÷ A QUOTIENT*	▨
																	LOAD SUM		DEVICE LOAD LOAD SUM	

* For systems with the MP feature. A Quotient = $\left(\frac{\text{A sum}}{\text{WAIT TIME}}\right) \times 1.5$

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31, 32
35, 36
59, 60
65-70
73, Back Cover

The changed pages carry a revision notice in the upper margin. Any significant technical change to the text or to an illustration is indicated by a vertical line to the left of the change.

Summary of Amendments

This newsletter incorporates additional or new information to update data on the 3350 Direct Access Storage device.

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