ELECTRONIC DATA PROCESSING SYSTEMS AND PROCEDURES

GEORGE A. GLEIM

Department of Computer Technology
Bucks County Community College

Prentice-Hall, Inc., Englewood Cliffs, New Jersey

Current Printing (last digit):

10 9 8 7 6 5 4 3 2 1

C – 13-250514-2
P – 13-250506-1
Library of Congress Catalog Card Number: 71-152447
Printed in the United States of America

ELECTRONIC DATA PROCESSING SYSTEMS AND PROCEDURES

PRENTICE-HALL INTERNATIONAL, INC., *London*
PRENTICE-HALL OF AUSTRALIA, PTY. LTD., *Sydney*
PRENTICE-HALL OF CANADA, LTD., *Toronto*
PRENTICE-HALL OF INDIA PRIVATE LIMITED, *New Delhi*
PRENTICE-HALL OF JAPAN, INC., *Tokyo*

TO MY WIFE, ELSIE

PREFACE

There are several reasons why this book has been written. First of all, emphasis in the computer curriculum has shifted from unit-record and second generation computer techniques to third generation concepts which encompass high level languages, systems analysis, and the use of mass storage devices.

Second, industry indicates a desire to have data processors trained in systems concepts as well as in programming. It would appear that the emphasis is on the development of a programmer-analyst.

In using this book, an instructor may supplement the exercise material by having the students actually write the programs to implement the systems presented. This, of course, would be extremely beneficial for those students who have a background in programming.

The standards manual shown in Appendix A demonstrates to the student the need for a data processing organization to standardize all of its functions. This includes detailed information concerning the available software and hardware, the coding techniques and procedures required in the development of program and system documentation. Few students are ever exposed to a standards manual until they enter industry.

Appendix B illustrates proposed inventory control systems specifications which were developed for the Pennwalt Corporation. This material serves to demonstrate to the data processing student those elements in the makeup of systems specifications pertaining to the systems discussed in Chapters 3, 4, and 5.

The student, in reviewing the materials in the text should also relate the systems specifications to appropriate elements of the standards manual. Furthermore, if the student has the opportunity to implement any of the specifications by actually writing the programs, he should also document the programs according to the guidelines defined by the standards manual.

Acknowledgements are in order at this time. I want to thank the Pennwalt Corporation for generously allowing me to use their Standards Manual and Inventory Control Systems Specifications. Jim McGrath and his very excellent staff in Information Services have always been very helpful in answering whatever requests that I have made. Pennwalt is a manufacturer of centrifuges, tabletting, and dental equipment, with corporate headquarters located in the center of Philadelphia. Until 1968 they were known as Pennsalt. Through a merger they became the Pennwalt Corporation.

I thank the IBM Corporation for permission to use the copyrighted photographs of the machines, schematics manuals, and forms presented in the text. I am also indebted to the Standard Register Corporation for the use of specimen invoice and order forms used in Chapter 5.

Last, but far from least, I want to thank Prentice-Hall, Inc. for all the help I have received during the development of this book.

Newtown, Pennsylvania George A. Gleim

CONTENTS

1 AN OVERVIEW OF EDP

EDP SYSTEM

A system is the sum total of procedures and devices which are required to produce some end result. While this definition is accurate for both manual and automated data processing systems, emphasis in this text is placed on electronic data processing (EDP) systems.

Procedures consist of:

1. Capturing the data to be used as input
2. Converting the data into a machine processable form
3. Processing the data as directed by the program
4. Producing predetermined end results

The physical devices, or *hardware*, may consist of input/output (I/O) devices, or storage and processing devices as shown in Figure 1-1, an IBM System/360 Model 40 data processing system. Shown in this particular system are magnetic tape and disk units, considered as both input/output devices and storage devices; the card reader punch, printer, and console typewriter devices; and the main storage and the central processing unit (CPU).

Figure 1-1 IBM System/360 Model 40 data processing system

CENTRAL PROCESSING UNIT

The central processing unit, illustrated in Figure 1-2, is the nerve center of the EDP system. It consists of the arithmetic/logical unit and the control unit.

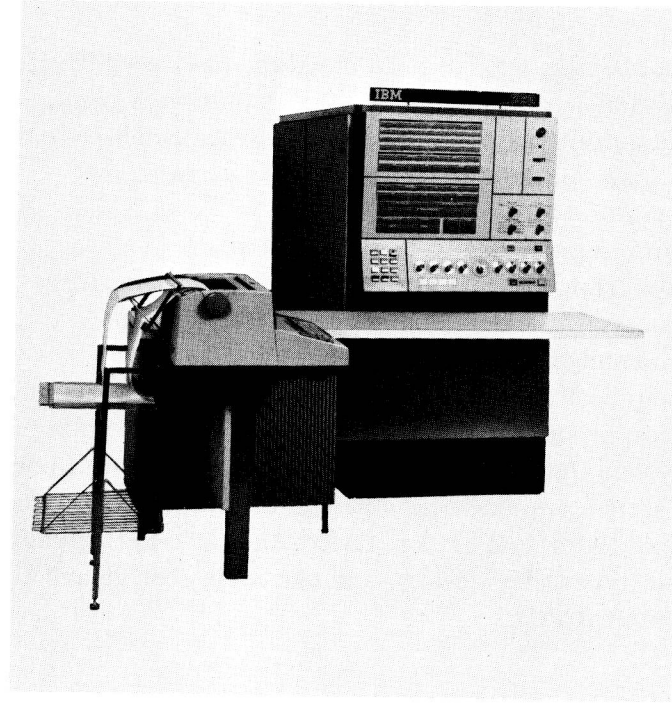


Figure 1-2 Central processing unit and console

The arithmetic/logical unit performs arithmetic operations such as addition, subtraction, multiplication, and division; data manipulation operations such as moving information from one storage location to another; and logical operations such as the comparing of data in one storage location to the data in another location.

The control unit coordinates the entire computer system. It controls the input/output units and the arithmetic/logical operations of the central processing unit and transfers data between main storage and input/output devices. The control unit directs all operations of the computer system by following the instructions provided by the programmer.

STORAGE

Specimen storage devices are shown in Figure 1-3. Two kinds of storage devices are available to an EDP system; that is, storage is classified as main storage or auxiliary storage. The core storage unit is considered main storage, whereas the drum, disk, and data cell units are auxiliary storage. Auxiliary storage devices are also considered input/output devices since it is possible to transfer data between the device and main storage.

Main storage accepts data from an input or an auxiliary storage device, communicates with the central processing unit, and transfers data to an output or an auxiliary storage device.

Each main storage location is uniquely identified by an address and is capable of holding data. For instance, storage locations 25,000, 25,001, and 25,002 could contain the characters *e, d,* and *p,* respectively, forming a three position field within storage.

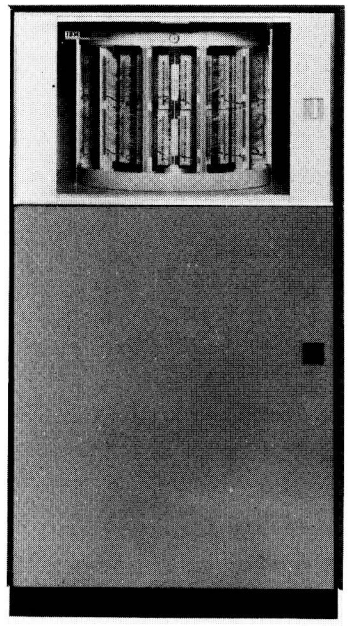
The capacity of main storage determines the amount of data that can be brought into the system at any one time. Main storage capacities may range from four thousand (4K) to over one million storage positions in larger configurations.

Auxiliary storage devices provide additional off-line storage capacities. The IBM 2311 disk unit, for instance, is capable of providing over seven million characters of information. However, only a small fraction of the data in auxiliary storage may be brought into main storage for processing at any one time.

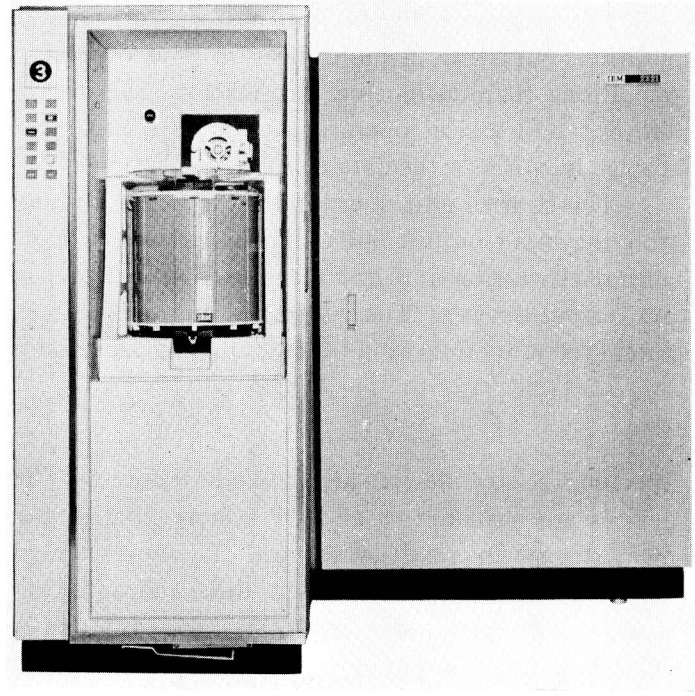
INPUT/OUTPUT DEVICES

Before data can be processed it must be brought into main storage by input devices. Once the data has been processed in main storage it is transferred from main storage to output devices as part of auxiliary storage or in the form of a final document.

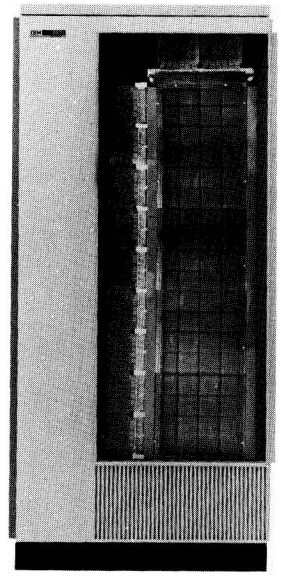
Input/output devices shown in Figure 1-4 include magnetic disk and tape drives, a printer, a card reader punch, a visual display unit, and a data transmission unit.



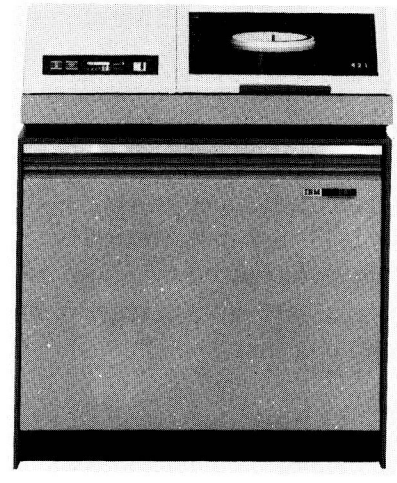
IBM 2303 Drum Storage



IBM Data Cell Drive Model 1



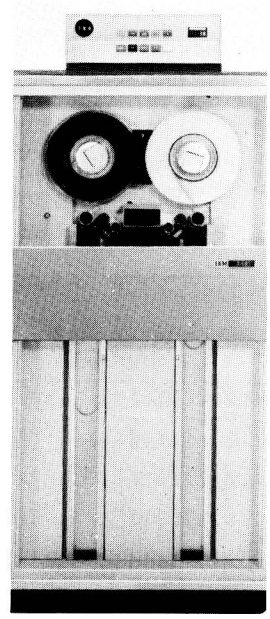
IBM 2361 Core Storage



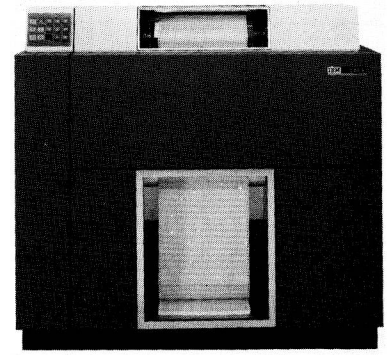
IBM 2311 Disk Storage Drive

Figure 1-3 IBM Storage Devices

IBM 2311 Disk Storage Drive

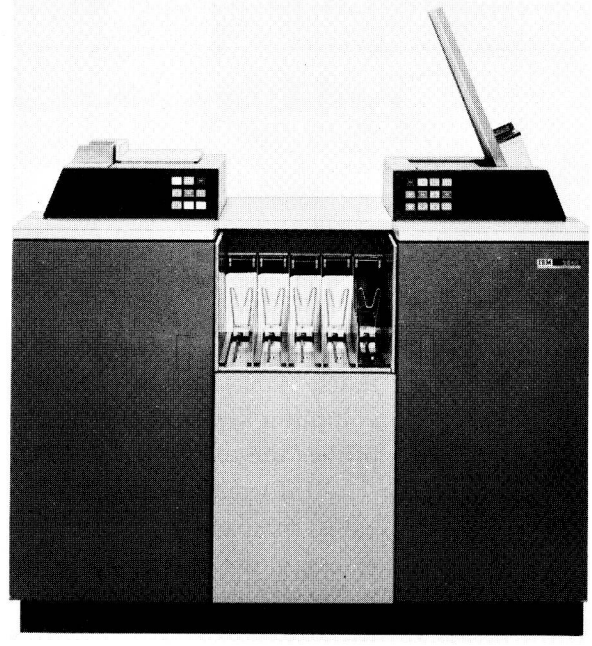


IBM 2401 Magnetic Tape Drive



IBM 1403 Printer

IBM 2260 Display Station



IBM 2540 Card Read Punch

Figure 1-4 Input/output devices

The punched card shown in Figure 1-5 records data in the form of combinations of holes punched in vertical columns. The card illustrated provides 80 vertical columns with 12 punching positions in each column. The data stored in the punched card is read by the reader unit of the card reader punch, which sends the data into storage for processing.

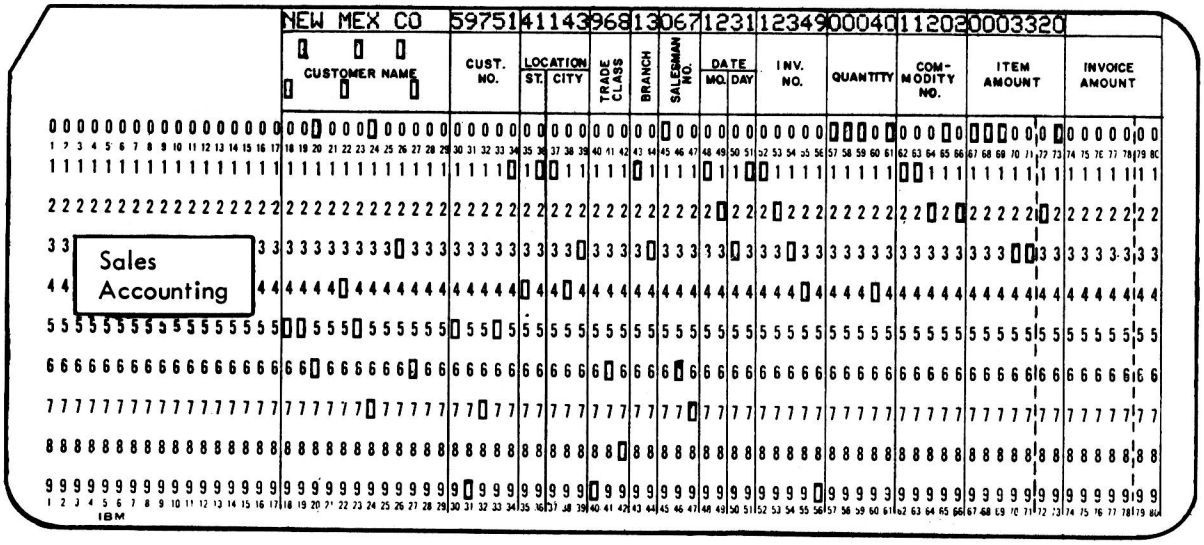


Figure 1-5 IBM punched card, standard hole pattern

Data in main storage may be transferred as output in the form of a punched card via the punch unit of the card reader punch; or the data may be transferred as output via the printer in the form of a printed report, paycheck, or invoice.

Magnetic tape is one of the principal media utilized by EDP systems. The tape unit functions as both input and output device for the computer system. The tape passes over a read/write head, which accomplishes the reading or writing of data on the tape.

Information is recorded on tape in the form of magnetized spots called *bits*, as shown in Figure 1-6. Data is stored in parallel channels or tracks along the length of the tape, similar in concept to those of the punched card. The information can be retained indefinitely or erased by writing over it.

Figure 1-7 shows how records are represented on a segment of tape. In the first example, single records are separated by interblock gaps. In the second example, the records are blocked four records per block, and the blocks are separated by interblock gaps. The interblock gap, which varies in different computers from .6 to .75 inches in length, is automatically produced at the end of each block of records during writing.

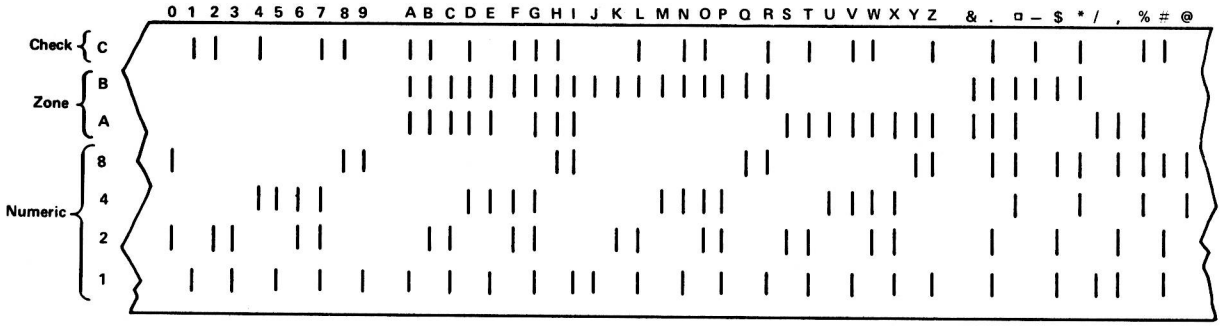


Figure 1-6 Magnetic tape, seven-track, seven-bit alphameric code

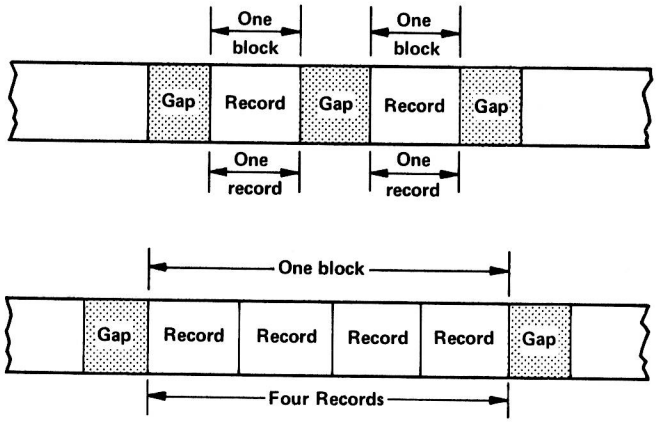


Figure 1-7 On magnetic tape, a single unit or block of information is marked by an interblock gap before and after the data. A record block may contain one record or several.

Again, a block may consist of one record or an integral number of records. In addition to separating records or blocks of records on the magnetic tape, the gap also allows time for starting and stopping the tape between the processing of the record blocks.

Tape densities vary from 200 to 1600 characters per inch (cpi). For example, the data stored in 20 punched cards may be stored in one inch of tape with a density of 1600 cpi. Since tape may be as much as 2400 feet in length it is possible to permit large numbers of data records to be recorded on the medium.

An interesting exercise is to determine the record capacity of a magnetic tape. Let us consider this problem by assuming the following specifications:

1. 2400 feet tape reel
2. 1600 cpi tape density
3. .6 inch interblock gap
4. Unblocked records
5. 80 character data record