

THE M & E HANDBOOK SERIES

*Data Processing
and Management
Information Systems*

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FIFTH EDITION



MACDONALD AND EVANS

PREFACE TO THE FIFTH EDITION

The fifth edition of this HANDBOOK was commenced at the time the fourth edition was published, such is the velocity of technological development in the field of data processing, information technology and computers.

This edition has two main aims, the first being to present information to the reader in an easily assimilated form in pursuit of success in the examinations of the various examining bodies for whom this book is specially written. The second is to bring to the attention of the reader not only the principles and concepts relating to data processing, computing and management information systems but to highlight the current developments in the relevant technology.

This edition has been restructured and rebalanced to accord to current needs of the student, the administrator, systems staff and the general reader. Details relating to punched cards and paper tape have been largely eliminated as these media are not used now to any great extent. Expert systems are also included.

Electronic desktop systems using icons are included as are Local Area Networks (LANs). Chapters relating to data capture and computer input methods have been enlarged and their coverage expanded as have the section on computer storage methods including electronic document storage and retrieval systems. The chapter on computer output includes details of the latest electronic printing systems and printer/plotters as used on small computers.

Greater emphasis has been placed on the software for micros and small business computers which exists in such profusion. This includes utilities, disassemblers, electronic diaries and electronic spreadsheets for business planning, database systems, systems to convert micros into word processors, accounting packages and packages for insurance brokers and for tax computations. The information given on programming concepts has been increased as has that relating to public databases, such as Prestel, and private databases, such as ICL's Bulletin, as well as those databases developed for the microcomputer.

As the graphical presentation of information is gaining momen-

tum computer graphics relating to pixel, sprite and turtle graphics has been included. Current computer architecture and VLSI (Very Large Scale Integration) technology embracing an outline of main-frame computers and details relating to the IBM PC, ACT Apricot, NCR's Decision Mate V and their new Tower computer system have also been included.

Concepts regarding computer logic based on Boolean algebra have been provided greater prominence as have details relating to computer literacy in modern society. A new chapter has been included covering checks and controls in computerised systems.

This edition also includes details of systems analysis and design, processing techniques including batch, on-line processing encompassing transaction, real-time and time sharing, as well as data entry systems and random enquiries, centralised and distributed processing and multiprogramming.

Cybernetic concepts are also included as well as system concepts relating to systems in general and management information systems and data bases in particular. Considerations of privacy and confidentiality of information are also outlined.

This HANDBOOK is designed to provide a comprehensive course of study, and to act as a work of reference, concerning the field of data processing, general systems concepts and management information systems. Its contents should prove invaluable for administrative managers, accountants, and anyone requiring a basic knowledge of data processing methods, concepts and principles together with an appreciation of the importance of management information in the everyday running of a business.

In particular, the HANDBOOK should be invaluable for students preparing for professional examinations where a knowledge of data processing, systems concepts, types of systems, systems behaviour and systems analysis and design is required. The syllabuses of the following bodies have been catered for:

Chartered Institute of Finance and Accountancy (CIFA).

City and Guilds of London Institute (Data Processing for Computer Users) (C & G).

Institute of Data Processing Management (IDPM).

The Institute of Cost and Management Accountants (ICMA).

Institute of Administrative Accountants (IAA).

The Institute of Administrative Management (IAM).

The Institute of Management Services (IMS).

The Association of Certified Accountants (ACA).

Association of International Accountants (AIA).

The Institute of Chartered Secretaries and Administrators (ICSA).
The Institute of Chartered Accountants (ICA).
The Society of Company and Commercial Accountants (SCCA).
The Association of Accounting Technicians (AAT).
The HANDBOOK is also suitable for the requirements of the Business and Technician Education Council (BTEC).

Attributed examination questions for these bodies have been included in the progress tests at the end of each chapter. In most cases it will be possible to ascertain the answers to these questions by reference to the text of the relevant chapter.

The reader is recommended to refer to the author's *A Dictionary of Data Processing and Computer Terms* for a concise Glossary of Terms.

Acknowledgments. I gratefully acknowledge permission to quote from the past examination papers of The Institute of Cost and Management Accountants, The Association of Certified Accountants, the City and Guilds of London Institute and the Institute of Data Processing Management. The cooperation and assistance of the following organisations and persons, without whose help this book would not have been possible, are also gratefully acknowledged.

ACT (UK) Limited: provision of details and photographs relating to the Apricot computer.

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British Telecom: provision of information relating to Datel services, Prestel viewdata system, packet switching, electronic mail and Teletex.

Cadbury Limited: provision of details relating to the EAN bar code.

Compsoft Limited: details relating to their Data Management System.

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Datastream International Limited: provision of details relating to their on-line financial information service.

DVW Microelectronics Limited: provision of details and photograph of the Husky microcomputer.

Electronic Business Systems Ltd: provision of details and

photograph relating to the Facit D12E electronic accounting machine (office computer).

IBM United Kingdom Limited: provision of information and various pamphlets and photographs relating to magnetic tape code, tape drives, 3081 computer, IBM3290 Information Panel and the IBM Personal Computer.

ICL: details, diagrams and photographs relating to Bulletin viewdata system, the DRS20 workstation, networks, DNX-2000 digital PABX exchange and various other items.

Integer Computer Systems: details of TAXCOMP packages.

Intelligence (UK) PLC: details and diagram of Micromodeller and Microbroker package.

Jones Sewing Machine Company Limited: Details and photograph of the Brother EP22 printer.

Keen Computers Limited: details and diagram relating to the Corvus Omninet local area network.

Litton Business Systems Ltd: examples of Kimball tags.

MicroProducts Software Limited: details relating to accounting packages-BOS (Business Operating Software).

Midlands Electricity Board: supply of optical mark meter reading sheets and procedure chart.

NCR Limited: details and photographs relating to minicomputer configuration, NCR 9300, NCR Tower 1632, NCR Decision Mate V, diagram of processor module and details of Integrated General ledger package.

Office Technology Ltd: details and photograph of the Information Management Processor,

Philips Data Systems: details and photograph of optical disc.

Quest Micropad Limited: details and photograph of Micropad.

Rank Xerox (UK) Limited: details and photographs of the Xerox 2700 distributed electronic printer, Xerox 9700 electronic printing system, diagram of mouse, details and diagram of Xerox 8000 Ethernet network system and the Star Information System together with diagrams of icons.

J. Sainsbury Ltd: details of supermarket ordering system.

Sharp Electronics (UK) Ltd: details of MZ-80K display code and the MZ-3541 Business computer.

Sinclair Research Ltd, details and photographs of ZX Microdrive.

Telford Management Services Ltd: details and photograph of TEL-time terminal system.

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PART ONE

PROFILE OF DATA PROCESSING AND COMPUTING

CHAPTER 1

Data Processing and Computing Concepts

DATA PROCESSING—A SPECIALIST ACTIVITY

1. Data processing defined. Data processing is a specialist activity performed by the administrative organisation for the business as a whole and is concerned with the systematic recording, arranging, filing, processing and dissemination of facts relating to the physical events occurring in the business.

Before production can be commenced in the factory, raw materials and parts have to be procured, which involves the data processing system in the preparation of purchase orders. When supplies are received they have to be recorded on appropriate stock or job records, which again involves data processing. The accounts of suppliers have to be updated to show the value of the goods purchased from them and the remittances made to them.

When production is due to commence, materials and parts have to be issued to the production centres and suitability recorded on issue notes which are subsequently recorded on stock and job records. The issues are often priced and extended, which are also data processing operations.

Factory operatives are remunerated either for their attendance time, piecework or bonus earnings, and here the data processing system is concerned with wages calculation, preparation of payslips and payrolls and the collection and summarisation of data with regard to production orders or jobs.

On completion of production, the goods are despatched to customers, which involves the data processing system in the preparation of despatch documentation, invoices, sales ledger updating and the preparation of statements of account. Eventually, remittances are received from customers, which involves further

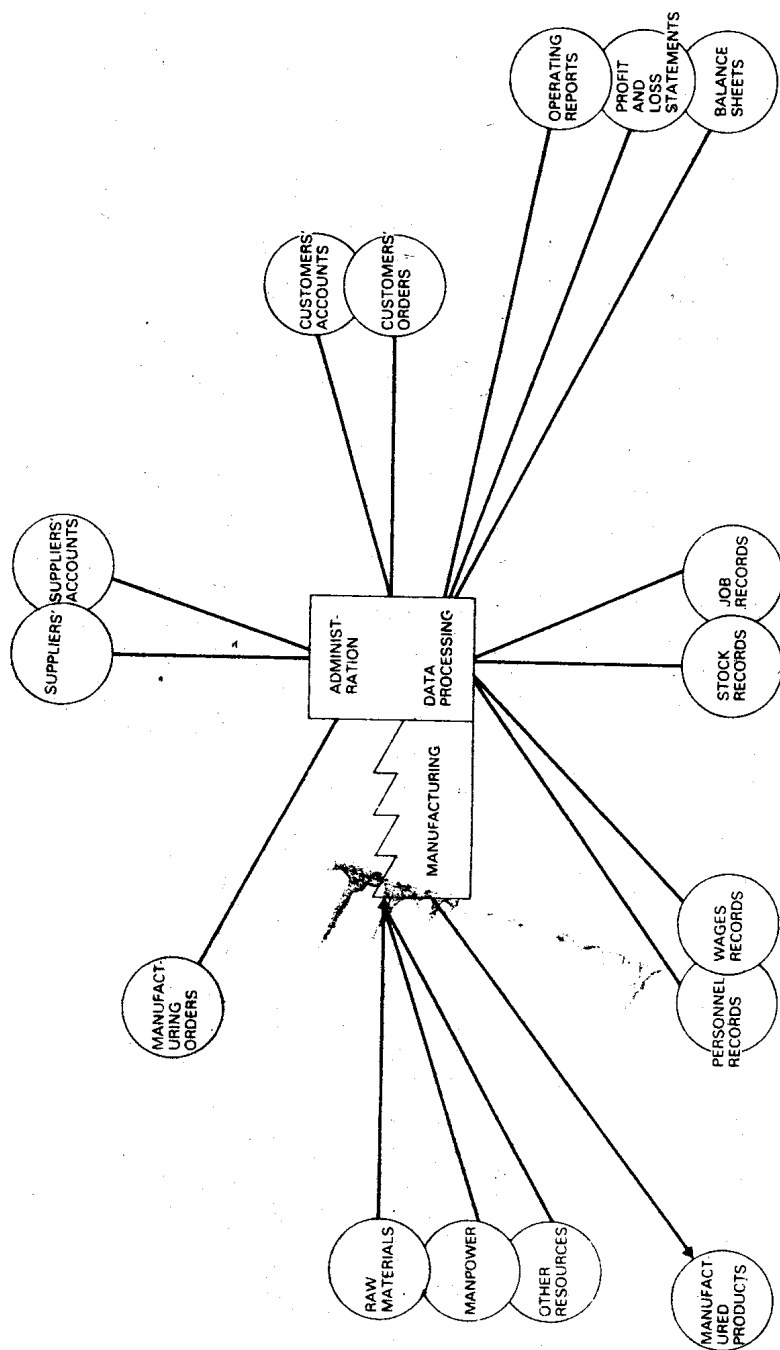


FIG. 1 Outline of manufacturing and related data processing activities.

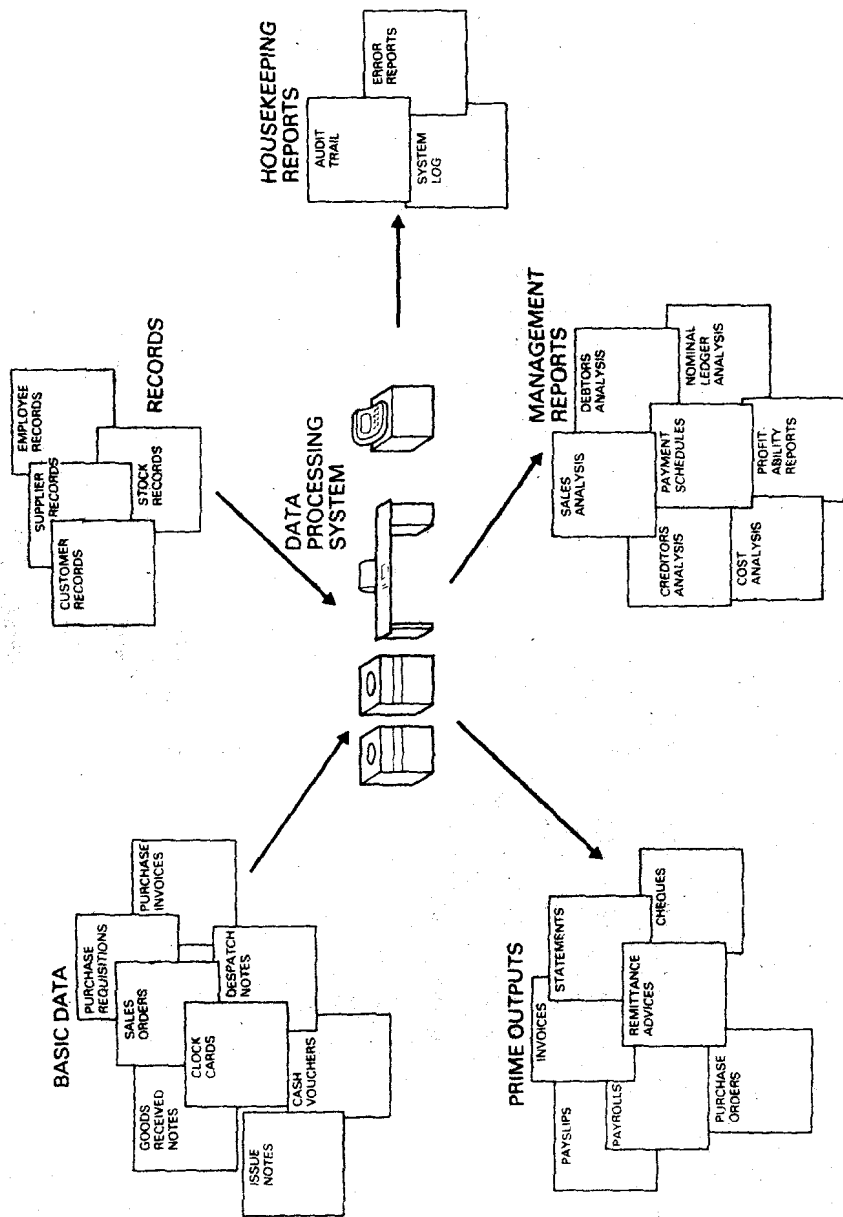


FIG. 2 The nature of data processing.

data processing in respect of adjustments to the balances on customers' accounts.

The results of business operations for specific operation periods are summarised and presented to management in the form of operating reports, profit and loss statements and balance sheets. All of this, and more, is the province of data processing which, if effectively performed, may be classified as the information service of the business (see Figs. 1 and 2).

From this, it can be seen that data processing systems provide information and information provides the basis for managerial control of business operations to achieve corporate objectives as effectively as possible, which means making the most suitable decisions based on the information provided.

A management information system therefore embraces the data processing systems, control systems (using information provided by the data processing system) and decision-making based on the facts indicated by the control systems.

2. Processing operations. In order to put data processing into its correct perspective, it is important to appreciate that although data processing activities are largely computerised there is very little actual "computing" performed in most business applications. No doubt this is why the activity is called "data processing" (see 1) and not "computing". Computing is a term restricted to performing "number crunching", i.e. arithmetical calculations including adding, multiplying, subtracting and dividing as well as exponentiation (raising numbers to specified powers) etc. The primary operations for processing business data are summarised below.

- (a) Capture and record data.
- (b) Collect/transmit data.
- (c) Control data throughout all stages of processing-prepare control totals.
- (d) Prepare data in machine sensible form when relevant.
- (e) Verify accuracy of data preparation.
- (f) Input data to the computer.
- (g) Validate data and generate control totals.
- (h) Sort data to master file sequence.
- (i) Compute value of variables.
- (j) Update master files.
- (k) Print list of transactions and control totals for accounting and audit trail purposes.
- (l) Print schedules.
- (m) Reinput data.
- (n) Re-sort data for analysis purposes.

(o) Produce analyses and statistical reports.
(See Fig. 89.)

TABLE I COMPUTING EXAMPLES

<i>Application</i>	<i>Computations</i>
Invoicing	Gross value = Quantity sold \times Price
	Discount = Gross value \times Discount rate
	Net value = Gross value - Discount
	VAT = Net value \times VAT rate
	Invoice value = Net value + VAT
Wages	Gross wages = Standard hours \times standard rate
	+
	Hours @ time and half \times premium rate
	+
	Hours @ double time \times premium rate
	or:
	Number of units produced \times piece rate
	+
	Piecework supplement
	Net wages = Gross wages - (income tax + standard deductions, etc.)
Stock control	New quantity in stock = Old quantity in stock
	+
	Receipts
	+
	Returns to store
	-
	Issues
	-
	Returns to supplier
	Electricity bill
	Amount due = Standing charge + Unit charge
	Unit charge = (Present reading - Previous reading) \times unit rate
Telephone bill	Total payable = Rental and other standing charges
	+
	Unit charge
	+
	Value added tax at 15.00%
	Unit charge = (Present reading - Previous reading) \times unit rate

Examples of computing operations performed by a computer for a number of business applications include those shown in Table I on p. 5.

It is the phenomenal speed of computers that makes them particularly well suited to pursuing activities that require instant solutions to complex dynamic problems. They are thus extensively used in the control and monitoring of space vehicles; where they can respond to situations as they are occurring and in a fraction of a second make the corrections necessary to keep the vehicles on course. In addition, computers are ideal for high volume computing tasks such as the computation and analysis of statistical and mathematical data as well as scientific and engineering calculations.

NATURE OF DATA PROCESSING AND COMPUTER SYSTEMS

3. Elements of a data processing system. A data processing system in its simplest form consists of three primary elements, i.e. input, processing and output. These elements apply whether the system is manual, mechanical or electronic. Data relating to business transactions such as items sold to customers, issues to production from the stores and hours worked by employees is input for processing. The data is subjected to processing operations in order to convert it into a more meaningful form prior to being output. The output, referred to as information, consists of documents such as invoices and payslips; schedules such as payrolls and sales summaries; and reports relating to customer credit standing and stock availability.

4. Characteristics of a data processing system. The characteristics of a data processing system may be contrasted with those of a factory manufacturing system; they are very similar although one processes raw facts and the other raw materials. The input to the factory system consists of raw materials for conversion into finished or partly finished products, whereas the finished product of a data processing system is information.

Two secondary, but nevertheless important, elements may be added to the primary elements of a data processing system. These are storage and control. Storage is concerned with filing documents and records relating to business transactions so that the state of affairs of specific business situations is readily available; e.g. amounts owing to customers, amounts owed by suppliers and the quantity of items in stock. Control relates to the monitoring by a supervisor to ensure that activities are conducted in the prescribed manner (see Fig. 3).