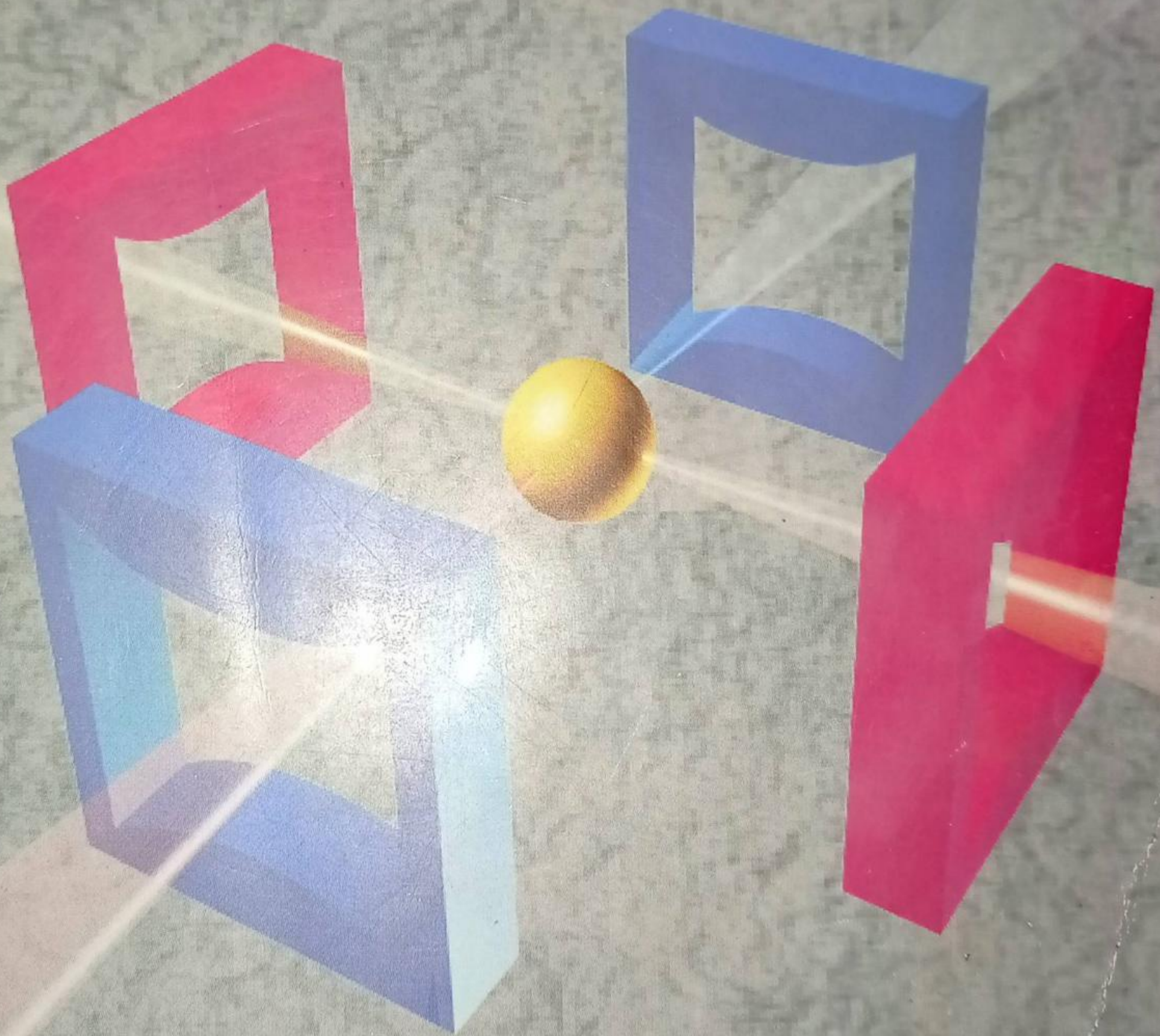


Computer Fundamentals



Pearl Software

Contents

Chapter-1

Computer Basics

- 1.1 Introduction 1
- 1.2 What is a Computer? 1
- 1.3 Functional Units of a Computer 2
 - Input/Output Unit 2
 - CPU 2
 - Control Unit (CU) 2
 - Arithmetic and Logic Unit (ALU) 3
 - Memory 3
- 1.4 Characteristics of a Computer 3
- 1.5 History of Computer 6
- 1.6 Generations of Computers 7
 - 1.6.1 First Generation of Computers 7
 - 1.6.2 Second Generation of Computers 8
 - 1.6.3 Third Generation of Computers 9
 - 1.6.4 Fourth Generation of Computers 11
 - 1.6.5 Future Generations of Computer 12
- 1.7 Classification According to Data Processing Mode 14
 - 1.7.1 Analog Computers 14
 - 1.7.2 Digital Computer 14
 - 1.7.3 Hybrid Computer 14
- 1.8 Classification According to Size/Function 15
 - 1.8.1 Micro Computer 15
 - 1.8.2 Mini Computer 16
 - 1.8.3 Mainframe Computers 16
 - 1.8.4 Super Computer 16
- 1.9 Laptop, Notebook and Desktop Computer 17
- Review Questions 17

Chapter-2

Binary Arithmetic

- 2.1 Introduction 19
- 2.2 The Number System 19
 - 2.2.1 Decimal System 19
 - 2.2.2 The Binary Number System 20
 - 2.2.3 The Octal Number System 20
 - 2.2.4 Hexadecimal Number System 21
- 2.3 Number Base Conversions 21
 - 2.3.1 Decimal - to - Binary Conversion 21
 - 2.3.2 Binary - to - Decimal Conversion 22
 - 2.3.3 Binary Fractions 22
 - 2.3.4 Binary - to - Octal Conversion 23
 - 2.3.5 Binary - to - Hexadecimal Conversion 23
 - 2.3.6 Conversion from Octal (or) Hexadecimal to Binary 24
 - 2.3.7 Conversion from Octal or Hexadecimal to Decimal 24
 - 2.3.8 Conversion from Decimal to Octal (or) Hexadecimal 24
- 2.4 Binary Representation of Integers 25
 - 2.4.1 Sign Representation and Magnitude Representation 25
 - 2.4.2 1's Complement Representation 26
 - 2.4.3 2's Complement Representation 27
- 2.5 Binary Arithmetic 27
 - 2.5.1 Binary Addition 27
 - 2.5.2 Binary Subtraction 28
 - 2.5.3 Binary Multiplication 30
 - 2.5.4 Binary Division 33
- 2.6 Floating Point Representation of Numbers 35
- 2.7 Computer Codes 35
- Review Questions 37

Chapter-3

Input/Output Units

- 3.1 Introduction 39
- 3.2 Input and Output Devices 39
 - 3.2.1 Input Devices 40
 - Off-line Keyboard Devices 40
 - Keyboard 41

Mouse	42
Bar Code Readers	43
Optical Character Reader (OCR)	44
Optical Mark Reader (OMR)	45
Magnetic Ink Character Reader (MICR)	45
Smart Cards	46
The Joystick	47
Light Pen	47
Touch Screen	48
Voice/Speech Input	48
Digitiser	48
3.3 Output Devices	49
3.3.1 Monitor	49
3.3.2 Microfilm	50
3.3.3 Printer	50
3.3.4 High-speed Printers	53
3.3.5 Plotters	54
3.3.6 Voice Output Systems	55
3.4 Input/Output Module Interface	56
3.5 I/O Transfer	56
3.6 Programmed I/O	58
3.7 Interrupt I/O	60
3.7.1 Main Features of Interrupt I/O	61
3.7.2 Polled Interrupts	61
3.7.3 Daisy Chain Interrupts	61
3.8 Autonomous Input/Output –DMA	61
3.9 Input/Output Channels	63
3.9.1 Selector channels	63
3.9.2 Multiplexer Channel	63
3.9.3 Block Multiplexer Channel	64
3.10 External Interfaces	64
Review Questions	65

Chapter-4

Memory Organisation

4.1 Introduction	67
4.2 Characteristics of Memory Devices	68
4.3 Main Memory	69

- 4.3.1 Read Only Memory (ROM) 69
- 4.3.2 Random-access Memory (RAM) 70
 - Dynamic RAM 71
 - Static RAM 71
- 4.4 Secondary Storage 72
 - 4.4.1 Magnetic Disk 72
 - 4.4.2 Hard Disk 73
 - 4.4.3 Floppy Disk 73
 - Floppy Disk Care 74
 - 4.4.4 Winchester Disks 75
 - 4.4.5 Magnetic Tape 76
 - 4.4.6 Optical Disk Technology (CD-ROM Disks) 77
 - 4.4.7 WORM 78
- 4.5 Erasable Optical Disk 78
- 4.6 High Speed Memories 79
 - 4.6.1 Cache Memory 79
- 4.7 Terminology Related to Disk 80
- 4.8 Performance of Disk Memories 81
- Review Questions 83

Chapter-5

Input-Output Processor

- 5.1 The Processor 85
 - 5.1.1 Point-to-Point Bus System 85
 - 5.1.2 Common Bus System 85
 - 5.1.3 Multiple Bus System 86
- 5.2 The Central Processing Unit 86
 - 5.2.1 Internal Registers 88
 - 5.2.2 The Arithmetic and Logic Unit 90
 - 5.2.3 Floating Point Unit 91
- 5.3 Execution of a Complete Instruction 91
 - 5.3.1 Branching Instruction 93
 - 5.3.2 Indirect and Index Addressing 93
- 5.4 Control Unit 94
- 5.5 Operations of a Hypothetical Computer 96
 - 5.5.1 The Instruction Format 97
 - 5.5.2 Different Instructions of an Instruction Set 97
 - LDA (Load the Accumulator) 98

ADD	98
SUB	98
JMP	98
STA	99
OUT (output)	99
HLT	99
5.5.3 Mnemonics	100
5.5.4 The Instruction Cycle	100
The Fetch Cycle	101
Indirect Cycle	101
The Execution Cycle	101
5.5.5 Machine Language and Assembly Language Programming	102
Review Questions	103

Chapter-6

Software and Language Classification

6.1 Introduction	105
6.2 Hardware	105
6.3 Software	106
6.3.1 What is Software?	106
System Software	106
Operating System (OS)	106
Language Translator	107
Application Software	107
6.4 Packages	108
6.4.1 Editor	108
6.4.2 Word Processors	108
6.4.3 Electronic Spreadsheets	108
6.4.4 Database System	108
6.4.5 Accounting Packages	109
6.4.6 DTP Packages	109
6.4.7 Graphics Packages	110
6.5 Utilities	110
6.5.1 File Management Utilities	110
6.5.2 Norton Utilities - A disk and file management utility	111
6.5.3 Anti-virus Software	113
NASHOT	113
Dr Solomon's Anti-virus Toolkit	113

- 6.6 Programming Languages 114
 - 6.6.1 Machine Language 114
 - 6.6.2 Assembly Language 114
 - 6.6.3 High Level Language 115
- 6.7 Translation of HLL to Machine Language 116
 - 6.7.1 Interpreter 116
 - 6.7.2 Compiler 116
 - 6.7.3 Loader 117
 - 6.7.4 Linker 117
- 6.8 Examples of HLL 118
 - 6.8.1 LOGO 118
 - 6.8.2 FORTRAN 118
 - 6.8.3 COBOL 119
 - 6.8.4 BASIC 119
 - 6.8.5 PROLOG 119
 - 6.8.6 PASCAL 120
 - 6.8.7 C 120
 - 6.8.8 C++ 120
 - 6.8.9 JAVA 121
- 6.9 JAVA Programming by Example 122
 - 6.9.1 Import statement 123
- 6.10 4GL Languages 123
- Review Questions 124

Chapter-7

Algorithms

- 7.1 Introduction 127
- 7.2 Algorithm 127
- 7.3 Flowchart 129
 - 7.3.1 Using loops and loop controls 131
- Review Questions 133

Chapter-8

Boolean Algebra

- 8.1 Introduction 135
- 8.2 Basic Terminology 135
- 8.3 Boolean Algebra 137

- 8.4 Switching circuits representing NOT, AND and OR operations 138
- 8.5 Postulates of Boolean Algebra 139
- 8.6 Laws of Boolean Algebra 140
 - 8.6.1 Demorgan's Law 141
- 8.7 Duality Principle 144
- 8.8 Derivation of Boolean Expression 144
 - 8.8.1 Minterm 144
 - 8.8.2 Maxterm 145
 - 8.8.3 Shorthand Notation 146
 - 8.8.4 Canonical Form 146
 - Sum - of - product Form 146
 - Product - of - sum Form 147
- 8.9 Conversion of s-o-p into p-o-s and vice versa 149
- 8.10 Karnaugh Maps 150
 - 8.10.1 Two-variable Karnaugh Map 150
 - 8.10.2 Three-variable Karnaugh map 151
 - 8.10.3 Four-variable Karnaugh map 151
 - 8.10.4 Pairing for Simplifying Expression 152
 - 8.10.5 Quads 153
 - 8.10.6 Octet 153
- 8.11 Karnaugh Map Simplification 153
 - 8.11.1 Overlapping Groups 154
 - 8.11.2 Map Rolling 155
 - 8.11.3 Redundant Group 155
- 8.12 Logic Gates 157
- 8.13 NAND to NAND and NOR to NOR Design 160
- 8.14 Applications of Boolean Algebra 163
 - 8.14.1 Adders 163
 - Half Adders 163
 - Full Adder 164
 - 8.14.2 Decoders 165
 - 8.14.3 Encoders 167
- Review Questions 167

Chapter-9

Flip-flops Shift Register Counter

- 9.1 Introduction 171
 - 9.1.1 R-S storage latch (or) SR latch (or) direct coupled RS Flip—Flop 171

viii CONTENTS

- 9.1.2 Clocked RS Flip-flop 173
- 9.1.3 Clocked D Flip-flop (or) Gated D Latch 175
- 9.1.4 JK Flip-flop 176
- 9.1.5 T Flip-flop 178
- 9.1.6 Master –Slave Flip-flops 178
- 9.1.7 Triggering of a Flip-flop 181
- 9.2 Shift Registers 182
 - 9.2.1 Serial Transfer 184
- 9.3 Counters 186
 - 9.3.1 Ripple Counter 186
 - 9.3.2 Down Counter 187
 - 9.3.3 Up-down Counter 188
 - 9.3.4 Pre-settable Counter 188
 - 9.3.5 Synchronous Counter 188
 - 9.3.6 Modulo-n Counters 190
- Review Questions 192

Chapter-10

Operating System

- 10.1 Introduction 193
- 10.2 What is an Operating System? 194
- 10.3 Popular Operating Systems for PCs 194
- 10.4 Operating System as a Resource Manager 194
 - 10.4.1 Memory Management Functions 195
 - Single Contiguous Allocation 195
 - Partitioned Allocation 195
 - Compaction 197
 - Relocatable Partitioned Memory Management 197
 - Paged Memory Management 197
 - Swapping 197
 - Demand Memory Management 198
 - 10.4.2 Device Management 198
 - First-cum-first-served 199
 - Shortest-seeK-time-first 200
 - SCAN 201
 - 10.4.3 Information Management 201
 - Directories 201
 - 10.4.4 File Protection 203

Passwords	203
Access List	203
10.5 Process Management	203
10.5.1 Process Concept	204
10.5.2 Process Implementation	205
10.5.3 Process Scheduling	205
Types of Schedulers	205
Scheduling Algorithms	207
FCFS	207
Shortest-Job-First Scheduling (SJF)	207
Round Robin Scheduling	208
Scheduling and Performance Criteria	209
Review Questions	209

Chapter-11

More on Operating System

11.1 Introduction	211
11.2 Types of Operating System	211
11.2.1 Single User	211
11.2.2 Multi-programming	211
11.2.3 Multi-processing	212
11.2.4 Time Sharing	212
11.2.5. Real Time	213
11.3 Other Processing Programs	213
11.3.1 Language Processor	213
11.4 Job Control Language	214
11.5 Editors	215
11.6 Linkers and Loaders	215
11.6.1 Loader	216
11.6.2 Linker	216
Review Questions	217

Chapter-12

Local Area Network

12.1 Introduction	219
12.2 What is a Network?	219
12.3 Need for Networking	219

x CONTENTS

12.4 Elementary Terminology of Network 220
12.5 Types of Networks 220
 12.5.1 Local Area Network (LAN) 220
 12.5.2 Metropolitan Area Networks (MANs) 221
 12.5.3 Wide Area Network (WAN) 222
 12.5.4 Difference Between LANs and WANs 224
12.6 Communication Channels 224
 12.6.1 Twisted Pair Cable 224
 12.6.2 Coaxial Cable 224
 12.6.3 Optical Fibre Cable 225
12.7 Transmission Across Networks 225
12.8 Modem 226
12.9 Different Topologies 226
 12.9.1 Star or Radial Topology 227
 12.9.2 The BUS 228
 12.9.3 The Ring 229
 12.9.4 Hybrid Topologies 230
 12.9.5 The Tree 230
 12.9.6 The Star-Ring Topology 231
12.10 Network Access Control 232
12.11 Client-server Model 236
12.12 Internet 236
12.13 Tools and Services on Internet 237
12.14 Browsing Through Internet 238
 12.14.1 Gopher 238
 12.14.2 WWW 238
12.15 Finding Information on Internet 238
 12.15.1 Archie 239
 12.15.2 Veronica 239
 12.15.3 WAIS (Wide Area Information Server) 239
12.16 Other Concepts 239
Review Questions 239

Chapter-13

Information Technology, An Overview

13.1 Introduction 241
13.2 Data 241
 13.2.1 Virtual Data 241

- 13.2.2 Transparent data 241
- 13.3 Information 242
- 13.4 Knowledge 242
- 13.5 Need for Information 242
 - 13.5.1 Professionals 242
 - 13.5.2 Education and Research 242
- 13.6 Quality of Information 243
- 13.7 Properties of Information 243
- 13.8 Value of Information 243
 - 13.8.1 Value of information in Decision Making 243
 - 13.8.2 Value of Information Other Than that in a Decision 244
- 13.9 Logical Data Concepts 244
 - 13.9.1 Entities, Attributes and Relationships 244
 - 13.9.2 Field 244
 - 13.9.3 Record 244
 - 13.9.4 File 245
 - 13.9.5 Database 245
- 13.10 Physical Data Concepts 245
 - 13.10.1 Serial Access Devices 245
 - 13.10.2. Direct Access Device 246
- 13.11 Data Processing 246
- 13.12 Different Types of Data Processing 247
- 13.13 Development of Data Processing 247
- 13.14 Advantages of Electronic Data Processing 248
 - 13.14.1 Speed 248
 - 13.14.2 Accuracy 248
 - 13.14.3 Automatic Operation 248
 - 13.14.4 Decision-making Capability 248
 - 13.14.5 Complex Problems 249
 - 13.14.6 Compact Storage 249
 - 13.14.7 Adhoc Reports 249
- 13.15 Techniques and Methods of Data Processing 249
 - 13.15.1 Transaction Processing 249
 - 13.15.2 Batch Processing 250
 - 13.15.3 On-line Processing 250
- 13.16 Office Automation 250
- Review Questions 251

Chapter-14 System Analysis and Design

- 14.1 Introduction 253
 - What is a System? 253
- 14.2 System Analysis and Design 253
 - 14.2.1 Output 253
 - 14.2.2 Input 254
 - 14.2.3 Files 254
 - 14.2.4 Process 254
- 14.3 Information Systems 254
 - 14.3.1 The Disadvantages of Manual Information System 254
 - 14.3.2 The Advantages of Manual Information System 255
- 14.4 Computer-based Information Systems 255
 - 14.4.1 Advantages of Computerised Information Systems 255
- 14.5 Different Types of Information Systems 255
 - 14.5.1 Transaction Processing Information System 255
 - 14.5.2 Management Information System 255
 - 14.5.3 Decision Support System 256
- 14.6 The Role of the System Analyst 256
 - 14.6.1 The Prerequisites for an Effective System Analyst 257
- 14.7 System Development Life Cycle 257
 - 14.7.1 Preliminary Investigation 257
 - 14.7.2 System Analysis 258
 - 14.7.3 System Design 259
 - 14.7.4 Development of Software 260
 - 14.7.5 Testing 260
 - 14.7.6 Implementation 260
 - 14.7.7 Maintenance 261
- 14.8 System Design 261
 - 14.8.1 Design of Input 261
 - Data Dictionaries 261
 - How to Use a Layout Screen 263
 - 14.8.2 Output Design 263
 - Output Design Considerations 263
 - Design of Output Reports 264
 - 14.8.3 File Design 267
 - 14.8.4 Database Design 268
- 14.9 System Implementation 269

- 14.9.1 Training Personnel 270
- 14.9.2 Conversion Method 270
- 14.9.3 Post Implementation Review 271
- 14.10 System Testing 271
 - 14.10.1 Types of System Tests 271
- Review Questions 272**

Chapter-15

Application and Program Development Strategy

- 15.1 Introduction 275
- 15.2 Tools for Application Development 275
 - 15.2.1 Data Flow Diagram 275
 - 15.2.2 Data Dictionaries 276
 - 15.2.3 Decision Table 278
 - 15.2.4 Decision Tree 281
 - 15.2.5 Flowcharts 282
 - Systems flowcharts 283
 - Run flowcharts 284
 - Program Flowcharts 285
- 15.3 Documentation 285
 - 15.3.1 Characteristics of Good Documentation 285
 - 15.3.2 Need for Documentation 285
 - 15.3.3 Elements of Documentation Package 285
- 15.4 Types of Documentation 286
- 15.5 Tools of Documentation 288
- 15.6 Debugging and Testing Technique 290
- 15.7 Trace Window 292
- 15.8 Debug Window 293
- 15.9 System Testing 294
 - 15.9.1 Types of System Tests 294
- 15.10 Testing Techniques 295
- Review Questions 296**

Chapter-16

Computer Management and Virus Protection

- 16.1 Introduction 297
- 16.2 Virus 297

xiv CONTENTS

- 16.3 The Evolution of Virus 298
- 16.4 The Process of Infection 298
- 16.5 Classification of Viruses 299
 - 16.5.1 BOOT Infectors 299
 - 16.5.2 SYSTEM Infectors 300
 - 16.5.3 General COM and EXE Infectors 300
- 16.6 Other Viruses 300
- 16.7 Some Popular Viruses 300
 - 16.7.1 Scores Virus 300
 - 16.7.2 Brain Virus 301
 - 16.7.3 Lehigh Virus 301
 - 16.7.4 Friday the 13th 301
 - 16.7.5 Sunnyvale Slug 301
 - 16.7.6 Raindrops 301
 - 16.7.7 Happy Birthday 30th 302
 - 16.7.8 Jerusalem Virus 302
 - 16.7.9 Dark Avenger Virus 302
 - 16.7.10 Yankee Doodle Virus 302
- 16.9 The Cure 303
- 16.10 Computer Management 304
- 16.11 Breaches of Security 304
- 16.13 Security Measures 305
 - 16.13.1 Physical Security 306
 - 16.13.2 Software Security 307
 - 16.13.3 Network Security 307
 - 16.13.4 Password Security 308
- 16.14 Cryptography: A Brief History 309
- 16.15 Cryptography 310
 - 16.15.1 Cipher Systems 310
 - 16.15.2 Data Encryption Standard (DES) 311
 - 16.15.3 RSA approach to Encryption 312
- 16.16 Cryptanalysis 312
- Review Questions 313

Glossary 315

Index 331