

Lecture Notes CD Included

Computer Fundamentals

Fourth Edition



Pradeep K. Sinha • Priti Sinha



BPB PUBLICATIONS

Table of Contents

PREFACE.....	xvii
ABOUT LECTURE NOTES CD.....	xxi
LIST OF ABBREVIATIONS.....	xxiv

CHAPTER 1: INTRODUCTION	1
Characteristics of Computers	2
Evolution of Computers	3
Computer Generations	5
First Generation (1942-1955)	5
Second Generation (1955-1964)	6
Third Generation (1964-1975)	7
Fourth Generation (1975-1989)	9
Fifth Generation (1989-Present)	10
Points to Remember	12
Questions	14

CHAPTER 2: BASIC COMPUTER ORGANIZATION	15
Input Unit <i>key board, mouse, scanner</i>	16
Output Unit <i>monitor, printer</i>	16
Storage Unit	17
Arithmetic Logic Unit	18
Control Unit	18
Central Processing Unit	18
The System Concept	18
Points to Remember	19
Questions	19

CHAPTER 3: NUMBER SYSTEMS	20
Non-Positional Number Systems	20
Positional Number Systems	20

✓ <i>Binary Number System</i>	21
✓ <i>Octal Number System</i>	22
✓ <i>Hexadecimal Number System</i>	22
<i>Converting from One Number System to Another</i>	23
<i>Converting from Another Base to Decimal</i>	23
<i>Converting from Decimal to Another Base (Division-Remainder Technique)</i>	25
<i>Converting from a Base Other Than 10 to Another Base Other Than 10</i>	27
<i>Shortcut Method for Binary to Octal Conversion</i>	29
<i>Shortcut Method for Octal to Binary Conversion</i>	30
<i>Shortcut Method for Binary to Hexadecimal Conversion</i>	30
<i>Shortcut Method for Hexadecimal to Binary Conversion</i>	31
✓ <i>Fractional Numbers</i>	33
 Points to Remember	34
Questions	34
 CHAPTER 4: COMPUTER CODES	36
<i>BCD Code</i>	36
<i>EBCDIC</i>	38
<i>Zoned and Packed Decimal Numbers</i>	39
<i>ASCII</i>	40
<i>Unicode</i>	44
<i>Need for Unicode?</i>	44
<i>Unicode Features</i>	44
<i>Unicode Encoding Forms</i>	45
<i>Collating Sequence</i>	46
 Points to Remember	47
Questions	47
 CHAPTER 5: COMPUTER ARITHMETIC	49
<i>Why Binary?</i>	49
<i>Binary Arithmetic</i>	50
<i>Addition</i>	50
<i>Subtraction</i>	51
<i>Multiplication</i>	55
<i>Division</i>	56
 Points to Remember	58
Questions	59
 CHAPTER 6: BOOLEAN ALGEBRA AND LOGIC CIRCUITS	60
<i>Boolean Algebra</i>	60
<i>Fundamental Concepts of Boolean Algebra</i>	60
<i>Postulates of Boolean Algebra</i>	62
<i>The Principle of Duality</i>	63
<i>Theorems of Boolean Algebra</i>	63

Boolean Functions	67
Minimization of Boolean Functions	68
Complement of a Function	70
Canonical Forms of Boolean Functions	71
Conversion Between Canonical Forms	76
Logic Gates	77
AND Gate	77
OR Gate	77
NOT Gate	78
NAND Gate	79
NOR Gate	79
Logic Circuits	80
Converting Expressions to Logic Circuits	83
The Universal NAND Gate	84
The Universal NOR Gate	89
Exclusive-OR and Equivalence Functions	91
Design of Combinational Circuits	93
Design of Half-Adder	93
Design of Full-Adder	94
A Parallel Binary Adder	96
Points to Remember	97
Questions	98
CHAPTER 7: PROCESSOR AND MEMORY	101
Central Processing Unit (CPU)	101
Control Unit (CU)	101
Arithmetic Logic Unit (ALU)	103
Instruction Set	103
Registers	103
Processor Speed	105
Types of Processors	105
Main Memory	108
Storage Evaluation Criteria	108
Main Memory Organization	109
Main Memory Capacity	111
RAM, ROM, PROM and EPROM	112
Cache Memory	113
Points to Remember	114
Questions	115
CHAPTER 8: SECONDARY STORAGE DEVICES	117
Sequential and Direct-Access Devices	118
Magnetic Tape	119
Basic Principles of Operation	119
Types of Magnetic Tapes	121
Advantages and Limitations of Magnetic Tapes	123

<i>Uses of Magnetic Tapes</i>	124
<i>Magnetic Disk</i>	124
<i>Basic Principles of Operation</i>	125
<i>Types of Magnetic Disks</i>	130
<i>Advantages and Limitations of Magnetic Disks</i>	133
<i>Uses of Magnetic Disks</i>	134
<i>Optical Disk</i>	134
<i>Basic Principles of Operation</i>	135
<i>Types of Optical Disks</i>	137
<i>Advantages and Limitations of Optical Disks</i>	139
<i>Uses of Optical Disks</i>	140
<i>Memory Storage Devices</i>	140
<i>Flash Drive (Pen Drive)</i>	140
<i>Memory Card (SD/MMC)</i>	141
<i>Mass Storage Devices</i>	142
<i>Disk Array</i>	142
<i>Automated Tape Library</i>	142
<i>CD-ROM Jukebox</i>	143
<i>Storage Hierarchy</i>	143
<i>Points to Remember</i>	144
<i>Questions</i>	145

CHAPTER 9: INPUT-OUTPUT DEVICES 148

<i>Input Devices</i>	149
<i>Keyboard Devices</i>	149
<i>Point-and-Draw Devices</i>	149
<i>Data Scanning Devices</i>	153
<i>Digitizer</i>	157
<i>Electronic-card Reader</i>	158
<i>Speech Recognition Devices</i>	158
<i>Vision-Input System</i>	159
<i>Output Devices</i>	159
<i>Monitors</i>	160
<i>Printers</i>	160
<i>Plotters</i>	165
<i>Screen Image Projector</i>	166
<i>Voice Response Systems</i>	167
<i>Points to Remember</i>	168
<i>Questions</i>	169

CHAPTER 10: COMPUTER SOFTWARE 172

• <i>What is software?</i>	172
• <i>Relationship between Hardware and Software</i>	173
• <i>Types of Software</i>	173
• <i>System Software</i>	173
• <i>Application Software</i>	174

Logical System Architecture	175
Acquiring Software	176
Buying Pre-written Software	176
Ordering Customized Software	176
Developing Customized Software	177
Downloading Public-domain Software	178
Software Development Steps	178
Firmware	179
Middleware	179
 Points to Remember	181
Questions	181
 CHAPTER 11: PLANNING THE COMPUTER PROGRAM	183
Purpose of Program Planning	183
Algorithm	184
What is an Algorithm?	184
Sample Algorithms	184
Representation of Algorithms	185
Flowcharts	186
What is a Flowchart?	186
Why Use Flowcharts?	186
Flowchart Symbols	186
Sample Flowcharts	188
Levels of Flowcharts	196
Flowcharting Rules	196
Advantages and Limitations of Flowcharts	197
Pseudocode	198
What is Pseudocode?	198
Pseudocodes for Basic Logic (Control) Structures	199
Sample Pseudocode	203
Advantages and Limitations of Pseudocode	204
 Points to Remember	204
Questions	205
 CHAPTER 12: COMPUTER LANGUAGES	208
Analogy with Natural Languages	208
Machine Language	209
Advantages and Limitations of Machine Language	210
Assembly Language	211
Assembler	212
Advantages of Assembly Language over Machine Language	214
Limitations of Assembly Language	215
Assembly Languages with Macro Instructions	215
High-level Language	216
Compiler	217
Linker	219

<i>Interpreter</i>	220
<i>Intermediate Language Compiler and Interpreter</i>	221
<i>Advantages and Limitations of High-level Languages</i>	222
<i>Object-Oriented Programming Languages</i>	223
<i>Some High-level Languages</i>	223
<i>FORTRAN</i>	223
<i>COBOL</i>	224
<i>BASIC</i>	227
<i>Pascal</i>	228
<i>C and C++</i>	229
<i>Some More High-level Languages</i>	231
<i>Java</i>	231
<i>C#</i>	232
<i>RPG</i>	232
<i>LISP</i>	232
<i>SNOBOL</i>	233
<i>Characteristics of a Good Programming Language</i>	233
<i>Selecting a Language for Coding an Application</i>	234
<i>Subprogram</i>	235
 Points to Remember	236
Questions	237
 CHAPTER 13: SYSTEM IMPLEMENTATION AND OPERATION	239
 <i>Testing and Debugging</i>	239
<i>Definition of Testing and Debugging</i>	239
<i>Types of Program Errors</i>	240
<i>Testing a Program</i>	240
<i>Debugging a Program for Syntax Errors</i>	241
<i>Debugging a Program for Logic Errors</i>	241
<i>Difference between Testing and Debugging</i>	242
<i>Documentation</i>	243
<i>What is Documentation?</i>	243
<i>Need for Documentation</i>	243
<i>Forms of Documentation</i>	243
<i>Changeover to the New System</i>	245
<i>Changeover Operations</i>	245
<i>Changeover Methods</i>	245
<i>System Evaluation</i>	248
<i>System Maintenance</i>	248
 Points to Remember	249
Questions	249
 CHAPTER 14: OPERATING SYSTEMS	251
 <i>What is an Operating System?</i>	251
<i>Main Functions of an Operating System</i>	252
<i>Measuring System Performance</i>	253

Process Management	253
<i>Process Management in Early Systems</i>	253
<i>Multiprogramming</i>	255
<i>Multitasking</i>	258
<i>Multithreading</i>	258
<i>Multiprocessing</i>	259
<i>Time-sharing</i>	261
Memory Management	262
<i>Uniprogramming Memory Model</i>	262
<i>Multiprogramming Memory Models</i>	263
<i>Virtual Memory</i>	265
File Management	266
<i>File Access Methods</i>	267
<i>File Operations</i>	267
<i>File Naming</i>	268
Security	269
Command Interpretation	269
OS Capability Enhancement Software	270
<i>Translating Programs</i>	270
<i>Library Programs</i>	270
<i>Utility Programs</i>	271
Some Popular Operating Systems	272
<i>UNIX</i>	272
<i>MS-DOS</i>	272
<i>Microsoft Windows</i>	272
<i>Microsoft Windows NT</i>	273
<i>Linux</i>	273
Points to Remember	274
Questions	275
CHAPTER 15: APPLICATION SOFTWARE PACKAGES.....	278
Word-Processing Package	278
<i>What it is?</i>	278
<i>Commonly Supported Features</i>	279
Spreadsheet Package	285
<i>What it is?</i>	285
<i>Commonly Supported Features</i>	286
Graphics Package	289
<i>What it is?</i>	289
<i>Commonly Supported Features</i>	289
Personal Assistance Package	291
<i>What it is?</i>	291
<i>Commonly Supported Features</i>	291
Points to Remember	292
Questions	293

CHAPTER 16: BUSINESS DATA PROCESSING.....	295
What is Data Processing?.....	295
Data Storage Hierarchy.....	296
Standard Methods of Organizing Data.....	297
<i>File-oriented Approach</i>	297
<i>Database-oriented Approach</i>	298
File Management System.....	299
<i>File Types</i>	299
<i>File Organizations</i>	299
<i>File Utilities</i>	303
Database Management System	305
<i>Database Models</i>	305
<i>Main Components of a DBMS</i>	310
<i>Creating and Using a Database</i>	312
Points to Remember.....	317
Questions	318
CHAPTER 17: DATA COMMUNICATIONS AND COMPUTER NETWORKS	320
Basic Elements of a Communication System	321
Data Transmission Modes	321
Data Transmission Speed.....	322
Data Transmission Media.....	323
<i>Twisted-Pair Wire</i>	323
<i>Coaxial Cable</i>	323
<i>Microwave System</i>	324
<i>Communications Satellite</i>	324
<i>Optical Fibers</i>	324
Digital and Analog Data Transmission	32
<i>Modulation Techniques</i>	32
<i>Modems</i>	32
<i>Analog versus Digital Transmission</i>	32
Data Transmission Services.....	33
Multiplexing Techniques	33
Asynchronous and Synchronous Transmission	33
<i>Asynchronous Transmission</i>	33
<i>Synchronous Transmission</i>	33
Switching Techniques.....	33
<i>Circuit Switching</i>	33
<i>Message Switching</i>	33
<i>Packet Switching</i>	33
Routing Techniques.....	33
Network Topologies.....	33
<i>Star Network</i>	33
<i>Ring Network</i>	33
<i>Completely Connected Network</i>	33
<i>Multi-access Bus Network</i>	33
<i>Hybrid Network</i>	33
Network Types (LAN, WAN, and MAN).....	33

Communication Protocols	343
<i>Roles of a Communication Protocol</i>	343
<i>Concept of Layered Protocols in Network Design</i>	344
<i>Network Interface Cards</i>	344
<i>The OSI Model</i>	344
<i>Example of Message Transfer in the OSI Model</i>	347
Internet Tools	348
Wireless Networks	349
<i>Types of Wireless Computing Systems</i>	349
<i>Issues in Wireless Computing Systems</i>	350
<i>Wireless Applications</i>	351
<i>Wireless Technologies</i>	351
Distributed Computing Systems	352
Points to Remember	354
Questions	355
CHAPTER 18: THE INTERNET	358
Definition (What it is?)	358
Brief History	358
Its Basic Services	358
<i>Electronic Mail</i>	359
<i>File Transfer Protocol</i>	359
<i>Telnet</i>	360
<i>Usenet News</i>	360
<i>The World Wide Web</i>	361
WWW Browsers	362
Uses of the Internet	363
Points to Remember	364
Questions	364
CHAPTER 19: MULTIMEDIA	366
What is Multimedia?	366
What is a Multimedia Computer System?	367
Multimedia Components	367
Text	367
Graphics	368
Animation	371
Audio	372
Video	374
Multimedia Applications	375
Media Center Computer	376
<i>Media Center PC Features and Functionalities</i>	377
Points to Remember	378
Questions	379

CHAPTER 20: CLASSIFICATION OF COMPUTERS	381
Notebook Computers (laptops).....	381
Personal Computers (PCs)	382
Workstations	384
Mainframe Systems	384
Supercomputers	386
Client and Server Computers	388
Handheld Computers	389
Tablet PC	389
PDA/Pocket PC	390
Smartphone	390
Points to Remember	391
Questions	393
 CHAPTER 21: INTRODUCTION TO C PROGRAMMING LANGUAGE	 395
Introduction.....	395
Character Set, Constants, Variables, Keywords, and Comments.....	396
Character Set.....	396
Constants	396
Variables.....	398
Keywords	400
Comments	400
Operators	400
Statements	403
Performing Simple I/O Operations in C	403
Preprocessor Directives	405
Pointers, Arrays, and Strings.....	407
Pointers	407
Arrays	408
Strings	410
User Defined Data Types	411
Structure	411
Union	412
Control Structures.....	413
Loop Structures	415
Functions	416
Sample Programs	418
 Points to Remember	 421
Questions	423
 GLOSSARY.....	 425
INDEX.....	449