

# Table of Contents

<b>Preface</b> .....	<b>xxi</b>
<b>Chapter 1: Introduction to Python</b> .....	<b>1</b>
Python.....	2
Features of Python.....	3
Execution of a Python Program .....	7
Viewing the Byte Code .....	9
Flavors of Python.....	10
Python Virtual Machine (PVM).....	11
Frozen Binaries .....	12
Memory Management in Python .....	12
Garbage Collection in Python .....	14
Comparisons between C and Python .....	15
Comparisons between Java and Python.....	16
Points to Remember.....	17
<b>Chapter 2: Writing Our First Python Program</b> .....	<b>19</b>
Installing Python for Windows.....	19
Testing the Installation in Windows 8.....	23
Installing numpy .....	25
Setting the Path to Python .....	27
Writing Our First Python Program.....	30
Executing a Python Program .....	31
Using Python's Command Line Window .....	31
Using Python's IDLE Graphics Window .....	32
Running Directly from System Prompt .....	33
Getting Help in Python.....	36
Getting Python Documentation Help .....	39
Reopening the Python Program in IDLE.....	41
Points to Remember.....	43
<b>Chapter 3: Datatypes in Python</b> .....	<b>45</b>
Comments in Python .....	46
Single line comments .....	46
Multi line comments.....	46

Docstrings .....	47
How Python Sees Variables .....	49
Datatypes in Python .....	51
Built-in datatypes .....	51
The None Type .....	51
Numeric Types .....	52
Representing Binary, Octal and Hexadecimal Numbers .....	53
Converting the Datatypes Explicitly .....	53
bool Datatype .....	55
Sequences in Python.....	56
str Datatype .....	56
bytes Datatype .....	57
bytearray Datatype.....	58
list Datatype .....	59
tuple Datatype .....	59
range Datatype.....	60
Sets.....	61
set Datatype.....	61
frozenset Datatype .....	62
Mapping Types.....	62
Literals in Python .....	63
Numeric Literals.....	64
Boolean Literals .....	64
String Literals .....	64
Determining the Datatype of a Variable .....	65
What about Characters.....	66
User-defined Datatypes.....	67
Constants in Python .....	67
Identifiers and Reserved words.....	67
Naming Conventions in Python .....	68
Points to Remember.....	69
<b>Chapter 4: Operators in Python.....</b>	<b>71</b>
Operator.....	71
Arithmetic Operators .....	72
Using Python Interpreter as Calculator.....	73
Assignment Operators .....	73
Unary Minus Operator .....	75
Relational Operators .....	75

---

Logical Operators.....	76
Boolean Operators.....	77
Bitwise Operators.....	78
Bitwise Complement Operator ( ~ ).....	80
Bitwise AND Operator (&).....	80
Bitwise OR Operator (   ).....	81
Bitwise XOR Operator ( ^ ).....	81
Bitwise Left Shift Operator (<<).....	82
Bitwise Right Shift Operator (>>).....	82
Membership Operators.....	84
The in Operator.....	84
The not in Operator.....	84
Identity Operators.....	85
The is Operator.....	85
The is not Operator.....	86
Operator Precedence and Associativity.....	87
Mathematical Functions.....	88
Using IDLE Window.....	91
Using Command Line Window.....	92
Executing at System Prompt.....	92
Points to Remember.....	93
<b>Chapter 5: Input and Output.....</b>	<b>95</b>
Output statements.....	96
The print() Statement.....	96
The print("string") Statement.....	96
The print(variables list) Statement.....	97
The print(object) Statement.....	98
The print("string", variables list) Statement.....	98
The print(formatted string) Statement.....	99
Input Statements.....	101
Command Line Arguments.....	108
Parsing Command Line Arguments.....	110
Points to Remember.....	115
<b>Chapter 6: Control Statements.....</b>	<b>117</b>
Control Statements.....	118
The if Statement.....	118
A Word on Indentation.....	119

The if ... else Statement .....	121
The if ... elif ... else Statement .....	122
The while Loop .....	124
The for Loop .....	126
Infinite Loops.....	130
Nested Loops .....	131
The else Suite .....	136
The break Statement .....	137
The continue Statement.....	138
The pass Statement .....	139
The assert Statement .....	140
The return Statement .....	141
Points to Remember.....	149
<b>Chapter 7: Arrays in Python.....</b>	<b>151</b>
Array.....	151
Advantages of Arrays .....	152
Creating an Array .....	153
Importing the Array Module .....	154
Indexing and Slicing on Arrays.....	156
Processing the Arrays .....	159
Types of Arrays.....	166
Working with Arrays using numpy .....	167
Creating Arrays using array() .....	169
Creating Arrays using linspace.....	170
Creating Arrays using logspace .....	171
Creating Arrays using arange() Function .....	172
Creating Arrays using zeros() and ones() Functions.....	173
Mathematical Operations on Arrays .....	174
Comparing Arrays.....	176
Aliasing the Arrays .....	179
Viewing and Copying Arrays.....	180
Slicing and Indexing in numpy Arrays .....	182
Dimensions of Arrays.....	184
Attributes of an Array .....	186
The ndim Attribute.....	186
The shape Attribute.....	186
The size Attribute .....	187
The itemsize Attribute .....	187

---

The dtype Attribute .....	187
The nbytes Attribute.....	188
The reshape() Method .....	188
The flatten() Method.....	189
Working with Multi-dimensional Arrays .....	189
The array() Function.....	189
The ones() and zeros() Functions.....	190
The eye() Function.....	191
The reshape() Function.....	191
Indexing in Multi-dimensional Arrays.....	192
Slicing the Multi-dimensional Arrays.....	194
Matrices in numpy.....	196
Getting Diagonal Elements of a Matrix .....	197
Finding Maximum and Minimum Elements .....	198
Finding Sum and Average of Elements .....	198
Products of Elements .....	198
Sorting the Matrix.....	199
Transpose of a Matrix .....	200
Matrix Addition and Multiplication.....	201
Random Numbers.....	204
Points to Remember.....	205
<b>Chapter 8: Strings and Characters .....</b>	<b>207</b>
Creating Strings .....	207
Length of a String.....	209
Indexing in Strings .....	209
Slicing the Strings .....	211
Repeating the Strings.....	213
Concatenation of Strings.....	213
Checking Membership .....	214
Comparing Strings.....	214
Removing Spaces from a String.....	215
Finding Sub Strings.....	215
Counting Substrings in a String.....	218
Strings are Immutable .....	219
Replacing a String with another String.....	221
Splitting and Joining Strings.....	222
Changing Case of a String.....	223
Checking Starting and Ending of a String.....	224

String Testing Methods .....	224
Formatting the Strings .....	225
Working with Characters .....	228
Sorting Strings .....	229
Searching in the Strings .....	231
Finding Number of Characters and Words .....	232
Inserting Sub String into a String .....	233
Points to Remember .....	235
<b>Chapter 9: Functions .....</b>	<b>237</b>
Difference between a Function and a Method .....	238
Defining a Function .....	238
Calling a Function .....	239
Returning Results from a Function .....	240
Returning Multiple Values from a Function .....	245
Functions are First Class Objects .....	246
Pass by Object Reference .....	248
Formal and Actual Arguments .....	253
Positional Arguments .....	253
Keyword Arguments .....	254
Default Arguments .....	255
Variable Length Arguments .....	256
Local and Global Variables .....	257
The Global Keyword .....	258
Passing a Group of Elements to a Function .....	260
Recursive Functions .....	261
Anonymous Functions or Lambdas .....	265
Using Lambdas with filter() Function .....	266
Using Lambdas with map() Function .....	267
Using Lambdas with reduce() Function .....	269
Function Decorators .....	270
Generators .....	274
Structured Programming .....	276
Creating our Own Modules in Python .....	277
The Special Variable <code>__name__</code> .....	279
Points to Remember .....	280
<b>Chapter 10: Lists and Tuples .....</b>	<b>283</b>
List .....	283
Creating Lists using range() Function .....	285

---

Updating the Elements of a List .....	288
Concatenation of Two Lists .....	290
Repetition of Lists .....	291
Membership in Lists .....	291
Aliasing and Cloning Lists.....	291
Methods to Process Lists.....	293
Finding Biggest and Smallest Elements in a List.....	295
Sorting the List Elements.....	296
Number of Occurrences of an Element in the List .....	298
Finding Common Elements in Two Lists .....	299
Storing Different Types of Data in a List .....	300
Nested Lists.....	301
Nested Lists as Matrices .....	302
List Comprehensions .....	305
Tuples .....	307
Creating Tuples .....	307
Accessing the Tuple Elements .....	308
Basic Operations on Tuples .....	310
Functions to Process Tuples.....	311
Nested Tuples.....	314
Inserting Elements in a Tuple .....	315
Modifying Elements of a Tuple .....	317
Deleting Elements from a Tuple .....	318
Points to Remember.....	319
<b>Chapter 11: Dictionaries .....</b>	<b>321</b>
Operations on Dictionaries.....	322
Dictionary Methods.....	324
Using for Loop with Dictionaries.....	327
Sorting the Elements of a Dictionary using Lambdas .....	331
Converting Lists into Dictionary .....	332
Converting Strings into Dictionary .....	333
Passing Dictionaries to Functions .....	334
Ordered Dictionaries.....	335
Points to Remember.....	336
<b>Chapter 12: Introduction to Oops .....</b>	<b>337</b>
Problems in Procedure Oriented Approach.....	338
Specialty of Python Language.....	340
Features of Object Oriented Programming System (OOPS) .....	340

Classes and Objects .....	340
Encapsulation .....	343
Abstraction .....	344
Inheritance .....	347
Polymorphism .....	348
Points to Remember .....	349
<b>Chapter 13: Classes and Objects .....</b>	<b>351</b>
Creating a Class .....	351
The Self Variable.....	355
Constructor .....	355
Types of Variables.....	357
Namespaces .....	359
Types of Methods.....	361
Instance Methods.....	361
Class Methods.....	364
Static Methods .....	365
Passing Members of One Class to Another Class.....	367
Inner Classes.....	369
Points to Remember.....	371
<b>Chapter 14: Inheritance and Polymorphism .....</b>	<b>373</b>
Constructors in Inheritance .....	378
Overriding Super Class Constructors and Methods.....	379
The super() Method.....	380
Types of Inheritance .....	382
Single Inheritance .....	382
Multiple Inheritance .....	384
Method Resolution Order (MRO).....	388
Polymorphism .....	390
Duck Typing Philosophy of Python .....	391
Operator Overloading.....	395
Method Overloading.....	400
Method Overriding.....	401
Points to Remember.....	402
<b>Chapter 15: Abstract Classes and Interfaces .....</b>	<b>405</b>
Abstract Method and Abstract Class .....	407
Interfaces in Python.....	412



---

Abstract Classes vs. Interfaces .....	418
Points to Remember .....	419
<b>Chapter 16: Exceptions .....</b>	<b>421</b>
Errors in a Python Program .....	421
Compile-Time Errors .....	421
Runtime Errors .....	422
Logical Errors.....	423
Exceptions.....	425
Exception Handling .....	426
Types of Exceptions .....	429
The Except Block.....	432
The assert Statement.....	433
User-Defined Exceptions.....	434
Logging the Exceptions .....	436
Points to Remember.....	439
<b>Chapter 17: Files in Python .....</b>	<b>441</b>
Files .....	441
Types of Files in Python .....	442
Opening a File .....	443
Closing a File.....	444
Working with Text Files Containing Strings .....	446
Knowing Whether a File Exists or Not.....	449
Working with Binary Files .....	451
The with Statement.....	452
Pickle in Python.....	452
The seek() and tell() Methods.....	456
Random Accessing of Binary Files .....	457
Random Accessing of Binary Files using mmap .....	464
Zippping and Unzipping Files.....	467
Working with Directories.....	469
Running Other Programs from Python Program .....	474
Points to Remember.....	475
<b>Chapter 18: Regular Expressions in Python .....</b>	<b>477</b>
Regular Expressions .....	477
Sequence Characters in Regular Expressions .....	483
Quantifiers in Regular Expressions .....	487
Special Characters in Regular Expressions.....	489

Using Regular Expressions on Files.....	492
Retrieving Information from a HTML File .....	495
Points to Remember.....	497
<b>Chapter 19: Data Structures in Python .....</b>	<b>499</b>
Linked Lists.....	500
Stacks .....	503
Queues.....	507
Dequeues .....	510
Points to Remember.....	514
<b>Chapter 20: Date and Time .....</b>	<b>515</b>
The epoch.....	515
Date and Time Now.....	517
Combining Date and Time.....	519
Formatting Dates and Times .....	520
Finding Durations using ‘timedelta’.....	527
Comparing Two Dates .....	528
Sorting Dates.....	529
Stopping Execution Temporarily .....	530
Knowing the Time taken by a Program .....	531
Working with Calendar Module .....	532
Points to Remember.....	535
<b>Chapter 21: Threads.....</b>	<b>537</b>
Single Tasking .....	538
Multitasking .....	539
Differences between a Process and a Thread.....	541
Concurrent Programming and GIL .....	542
Uses of Threads .....	542
Creating Threads in Python.....	542
Creating a Thread without using a Class.....	543
Creating a Thread by Creating a Sub Class to Thread Class .....	544
Creating a Thread without Creating Sub Class to Thread Class .....	546
Thread Class Methods .....	547
Single Tasking using a Thread .....	548
Multitasking using Multiple Threads .....	549
Thread Synchronization .....	553
Locks .....	553
Semaphore.....	555

---

Deadlock of Threads .....	555
Avoiding Deadlocks in a Program .....	557
Communication between Threads .....	559
Thread Communication using notify() and wait() Methods .....	561
Thread Communication using a Queue .....	563
Daemon Threads .....	565
Points to Remember.....	567
<b>Chapter 22: Graphical User Interface .....</b>	<b>569</b>
GUI in Python.....	570
The Root Window.....	570
Fonts and Colors .....	572
Working with Containers .....	576
Canvas .....	576
Frame .....	584
Widgets .....	586
Button Widget .....	587
Arranging Widgets in the Frame .....	592
Label Widget.....	596
Message Widget .....	597
Text Widget .....	599
Scrollbar Widget .....	601
Checkbutton Widget .....	603
Radiobutton Widget .....	605
Entry Widget .....	607
Spinbox Widget.....	609
Listbox Widget .....	612
Menu Widget .....	614
Points to Remember.....	621
<b>Chapter 23: Networking in Python .....</b>	<b>623</b>
Protocol .....	624
TCP/IP Protocol.....	624
User Datagram Protocol (UDP) .....	626
Sockets .....	626
Knowing IP Address .....	628
URL.....	628
Reading the Source Code of a Web Page .....	630
Downloading a Web Page from Internet .....	631
Downloading an Image from Internet.....	632

A TCP/IP Server.....	634
A TCP/IP Client .....	635
A UDP Server.....	637
A UDP Client .....	638
File Server .....	640
File Client.....	641
Two-Way Communication between Server and Client.....	642
Sending a Simple Mail .....	644
Points to Remember.....	647
<b>Chapter 24: Python's Database Connectivity .....</b>	<b>649</b>
DBMS .....	649
Advantages of a DBMS over Files .....	649
Types of Databases Used with Python .....	650
Installation of MySQL Database Software .....	651
Setting the Path to MySQL Server .....	661
Verifying MySQL in the Windows Operating System.....	663
Installing MySQL Connector.....	663
Verifying the Connector Installation .....	666
Working with MySQL Database .....	666
Using MySQL from Python .....	668
Retrieving All Rows from a Table .....	669
Inserting Rows into a Table .....	672
Deleting Rows from a Table.....	675
Updating Rows in a Table .....	677
Creating Database Tables through Python.....	678
Installation of Oracle 11g.....	681
Verifying Oracle Installation in Windows Operating System .....	687
Installing Oracle Database Driver.....	687
Verifying the Driver Installation .....	690
Working with Oracle Database .....	690
Using Oracle Database from Python .....	693
Stored Procedures .....	695
Points to Remember.....	698
<b>Program Index .....</b>	<b>699</b>