

OK

(Time: 2½ hours)

Total Marks: 75

- N. B.: (1) All questions are compulsory.
 (2) Make suitable assumptions wherever necessary and state the assumptions made.
 (3) Answers to the same question must be written together.
 (4) Numbers to the right indicate marks.
 (5) Draw neat labeled diagrams wherever necessary.
 (6) Use of Non-programmable calculators is allowed.

1. Attempt any three of the following:

- a. What are the different ways to execute (run) a Python program?
 b. List and explain the data types of Python.
 c. Explain arithmetic operators of Python with suitable examples.
 d. Explain the following with examples:
 i) Functions for accepting and displaying data
 ii) Function to accept multiple values simultaneously
 iii) Change the continuation character (for multiple values displayed with multiple commands)
 iv) Change the separator (for multiple values displayed with a single command)
 v) Displaying a blank line
 e. Write a program in Python to accept a number from the user and check if the number is positive or negative or zero and display an appropriate message.
 f. Write a program in Python to accept a number from the user and count its divisors.

2. Attempt any three of the following:

- a. Write a program in Python that defines and calls functions
 i) without parameters and without return value
 ii) with parameters and without return value
 iii) with parameter and with return value
 b. Write a note on flow of execution. What will be the flow of execution of the following program?

```
def f1():
    print("Hello World")
def f2():
    f1()
    print("\nPython Programming")
print("\nBScIT")
for x in range(2):
    f1()
f2()
print("\nEnd of Program")
```


 c. Write a program in Python that accepts a number from the user and displays the reverse of the number using a function.
 d. Write program in Python to accept a sentence from the user and count the number of times letter 'a' appears in the sentence.
 e. Explain the following string functions with examples:
 i) endswith() ii) find() iii) isdigit() iv) lstrip() v) lower()
 f. Explain string operators and string comparison with examples.

3. Attempt any three of the following:

- What is a list? What are the different methods used to add and delete elements from a list?
- Write a Python program that defines a function histogram() that takes a list of integers and prints a histogram on the screen.
- How are the elements of a tuple assigned and accessed? Explain with examples.
- Explain the built-in dictionary methods.
- What are the different file access modes?
- Explain except block with multiple exceptions. Give a suitable example.

4. Attempt any three of the following:

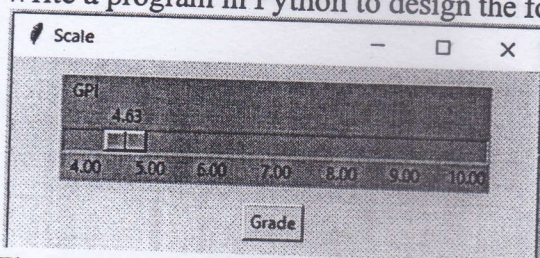
- Explain the following regular expression functions with examples:
i) end() ii) compile() iii) replace()
- Explain the following object-oriented concepts:
i) Data Members ii) Overloading iii) Encapsulation
- Write a program in Python to demonstrate class with parameterized constructor.
- Explain the methods of Thread Class.
- What is a module? Create a user-defined module "myModule.py" containing a variable, function and class. Demonstrate different ways of importing and implementing this module with a program in Python.
- Explain the number-theoretic and representation functions of math module in Python.

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5. Attempt any three of the following:

- What is pack layout? Explain the different pack options.
- How is Button widget created in Python? Explain any five properties of Button Widget.
- Write a program in Python to create a canvas with four lines – without arrows, with arrow at the beginning, at the end and at both the ends respectively. Change the color for all the four lines to blue. Change the color of the second line to red when the mouse pointer is over the line.
- Write a program in Python to design the following GUI:

15



The scale should have a minimum value of 4, maximum value: 10, increment: 0.01, labels at intervals of 1.

When user clicks on the Button Grade it should display the Grade as a showinfo messagebox based on GPI value:

10.00	O
9.00 – 9.99	A+
8.00 – 8.99	A
7.00 – 7.99	B+
6.00 – 6.99	B
5.00 – 5.99	C
4.00 – 4.99	D

- What are the stages of database communication with Python? Explain the different functions used in configuring MySQL Connection in Python.
- Write a program in Python to accept values for Employee ID, Name, Age and Department and add a record to the employee table (emp_id, emp_name, age, dept_name) in CLI mode.

COMPUTER NETWORKS

(Time: 2½ hours)

Total Marks: 75

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(4) Numbers to the **right** indicate **marks**.
(5) Draw **neat labeled diagrams** wherever **necessary**.
(6) Use of **Non-programmable** calculators is **allowed**.

1. Attempt **any three** of the following: 15
a. Explain Data Flow with Example.
b. Write a short note on WAN.
c. Explain Following layers of ISO/OSI layer
i) Session Layer ii) Transport Layer
d. Explain any 2 layers of Tcp/Ip layers.
e. Explain Digital Signal with suitable diagram.
f. Discuss parallel mode of transmission with suitable diagram.
2. Attempt **any three** of the following: 15
a. What is transmission media? Explain Fiber optic wire.
b. Discuss datagram packet switching networks.
c. Explain checksum concept with suitable example.
d. Write a short note on Coaxial wire.
e. Discuss Microwave transmission system.
f. Explain block diagram of Basic ARQ system with suitable theory.
3. Attempt **any three** of the following: 15
a. Discuss a simplex protocol for noisy channel with suitable theory.
b. Draw PPP frame format with suitable theory.
c. Explain following 2 concepts
i) BSS ii) ESS
d. Write a short note on CSMA/CD.
e. Write a short note on Bluetooth.
f. Write a short note on HDLC with its types of operation mode.
4. Attempt **any three** of the following: 15
a. Discuss implementation of connectionless services with suitable diagram.
b. Write a short note on flooding algorithm.
c. What is OSPF?
d. Discuss structure of IP frame header.
e. Explain advantages of IP6 protocol.
f. Discuss IP6 Address abbreviation concept with suitable example.
5. Attempt **any three** of the following: 15
a. Write a working of stop and wait ARQ for following scenario with suitable diagram.
i) Normal condition operation ii) Lost data frame
b. Write principle of Go-back-n ARQ technique.
c. Discuss TCP header format.
d. Write a short note on generic domain of DNS.
e. Explain Functions of transport layer.
f. Differentiate between TCP and UDP.

APPLIED MATHEMATICS

(Time: 2½ hours)

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1. Attempt any three of the following:

a. Show that $A = \begin{bmatrix} \cos\theta & 0 & \sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{bmatrix}$ is an orthogonal matrix.

b. Test the consistency of the equations and solve if consistent:
 $2x - y + z = 8; 3x - y + z = 6; 4x - y + 2z = 7; -x + y - z = 4$

c. Examine for non-trivial solution and solve them:
 $5x + 2y - 3z = 0; 3x + y + z = 0; 2x + y + 6z = 0$

d. If $(3 + i)x + (1 - i)y = 1 + 7i$, find x and y.

e. If $2 \cos\theta = x + \frac{1}{x}$ prove that $2 \cos r\theta = x^r + \frac{1}{x^r}$

f. Using Euler's formula prove that $\sin^2 \theta + \cos^2 \theta = 1$

2. Attempt any three of the following:

a. Solve $\frac{dy}{dx} = \tan\left(\frac{y}{x}\right) + \frac{y}{x}$

b. Solve $(x^4 + y^4)dx - xy^3 dy = 0$

c. Solve $x^3 \frac{dy}{dx} + 2x^2 y = y^3$

d. Solve $\frac{dy}{dx} + 2y \tan x = \sin x$

e. Solve $p^2 + p(x + y) + xy = 0$

f. Solve $(D^2 + 3D + 2)y = e^{e^x}$

3. Attempt any three of the following:

a. Find $L[(t^2 - 1) \sin 2t]$

b. Find Laplace transform of $\int_0^t te^{-t} \sin 2t dt$

c. Find Laplace transform of $\frac{d^2y}{dx^2} - 3 \frac{dy}{dx} = 9$ when $x = 0, y = 0$ and $\frac{dy}{dx} = 0$

d. Find inverse Laplace transform of $\tan^{-1}\left(\frac{1}{s}\right)$

e. Find inverse Laplace transform of $\frac{1}{s^3(s^2+1)}$

f. Find inverse Laplace transform by using convolution theorem $\frac{1}{(s+1)(s^2+1)}$

4. Attempt any three of the following:

15

a. Evaluate $\int_0^1 \int_0^1 \frac{dxdy}{\sqrt{(1-x^2)(1-y^2)}}$

b. Evaluate $\int_0^1 \int_0^{\sqrt{x-x^2}} \frac{4xy}{x^2+y^2} e^{-x^2-y^2} dx dy$

c. Evaluate $\int (x^2 - y^2) dA$ over the area of the triangle whose vertices are at the points A (0, 1), B (1, 1) & C (1, 2).

d. Evaluate $\iint y dx dy$ over the area bounded by $x = 0, y = x^2$ and $x + y = 2$ in the first quadrant.

e. Evaluate $\iint xy(x + y) dx dy$ over the area between curve $y = x^2$ & $y = x$.

f. Change the order of integration and evaluate $\int_0^a \int_{x/a}^{\sqrt{x/a}} (x^2 + y^2) dx dy$

5. Attempt any three of the following:

15

a. Evaluate $\int_0^\infty x^2 e^{-h^2x^2} dx$

b. Evaluate $\int_0^1 x^5 \sin^{-1} x dx$

c. Prove that: $\beta(m, n) = \beta(n, m)$.

d. Find $\frac{d}{dx} [\operatorname{erf}(x) + \operatorname{erfc}(ax)]$

e. Show that: $\operatorname{erfc}(-x) + \operatorname{erfc}(x) = 2$

f. Show that: $\int_0^\infty \frac{e^{-x}}{x} \cdot \left[a - \frac{1}{x} + \frac{1}{x} e^{-ax} \right] dx = (a + 1) \cdot \log(a + 1) - a$

DATABASE MANAGEMENT SYSTEMS

(Time: 2½ hours)

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(5) Draw neat labeled diagrams wherever necessary.
(6) Use of Non-programmable calculators is allowed.
1. Attempt any three of the following: 15
- What is a weak entity? Explain about generalization and specialization with example.
 - Draw and explain the ER diagram notations.
 - Explain the disadvantages of file processing system.
 - Explain Hierarchical Model with advantages
 - Write a short note on data abstraction.
 - Explain any 8 Codd's rules for relational database.
2. Attempt any three of the following: 15
- Write a short note on second normal form.
 - Explain rename and project operation in relational algebra with suitable example.
 - Explain union, intersect and difference operator in relational algebra with example.
 - Explain the terms: super key, candidate key, primary key, foreign key, and composite key.
 - Write a short note on domain relational calculus.
 - Explain the concept of relational database.
3. Attempt any three of the following: 15
- Explain order by and group by clause with example.
 - What is the use of joins? Mention its types and explain any two types with syntax and example.
 - What are constraints? Explain about UNIQUE and CHECK constraint with example.
 - What are views? List its types and explain any two types in detail.
 - Write the syntax for creating a table, inserting values, retrieving, updating and dropping a table.
 - What are triggers? Explain with example.
4. Attempt any three of the following: 15
- What is deadlock? Explain 2 different deadlock prevention schemes.
 - Explain different states of transaction with the help of a diagram.
 - Explain properties of transactions.
 - Explain conflict serializability in detail.
 - Explain Time Stamp Ordering Protocol.
 - Write a short note on 2 Phase Locking.
5. Attempt any three of the following: 15
- Explain PL/SQL Anonymous block structure with an example.
 - Write a short note on %TYPE attribute.
 - Write a PL/SQL block to print sum of two numbers accepted by user.
 - Explain in detail about explicit cursor.
 - Explain IF THEN ELSE statement with syntax and example.
 - What are exceptions? Explain about user defined exceptions.

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1 Attempt any three of the following:

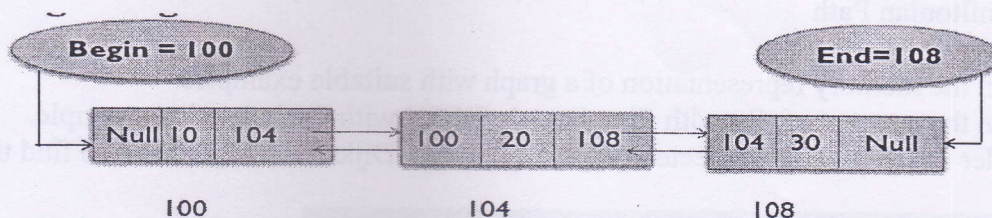
- a What is an Algorithm? What are the characteristics of an Algorithm?
- b What are the various operations performed on Data Structure?
- c How is 'Time Complexity' measured? Explain its three types.
- d Write an algorithm to traverse an Array 'S' and calculate and print the 'sum' of an elements of an array.

S	5	10	15	20	25
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- e Consider a three-dimensional array M (-2:1, 5:7, 3:4) which is the collection of 24 (4 x 3 x 2) elements. Assuming the base address of array is 1000 and each element of the array occupies two memory cells. Calculate the address of element M [1,6,4] if elements of array are stored in:
 - (i) Row major order
 - (ii) Column major order
- f Explain the 'Method of Vector Representation' in the memory in special kind of matrices along with an example.

2 Attempt any three of the following:

- a Write an algorithm to 'insert' a new element at the 'End of a One-way Linked List'.
- b Write an algorithm to 'delete' an element from the 'End of a Circular Linked List'.
- c Find position of element 10 by traversing a 'Two-way Linked list' from 'End to Begin'. Show dry run.



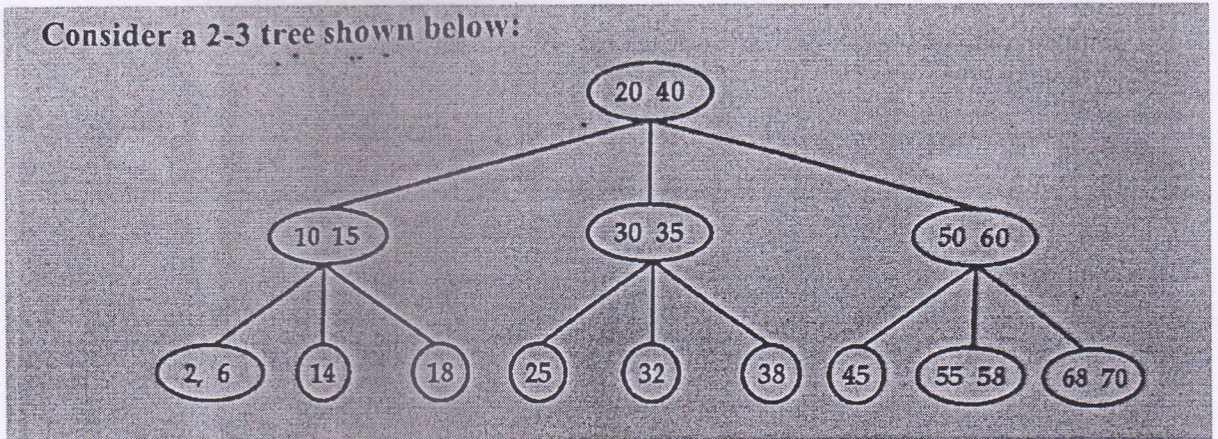
- d State the advantages and disadvantages of a 'One-way Linked List'.
- e What is a Header Linked List? Explain the four categories of Header Linked List.
- f Write an algorithm to 'search' the position of a given element in 'Two-way Linked List' from 'End to Begin'.

3 Attempt any three of the following:

- a Write an algorithm for 'Push operation' in Stack represented in memory using Array. Take an example and do dry run.
- b Convert the following Infix notation to 'Prefix Notation'
 - i) $(x-y) * ((z+v)/f)$
 - ii) $((a+b)/d^{(e-f)+g})$
- c Explain the concept of Recursion along with the help of an example.
- d What is a Queue? What are the operations performed on Queue? Explain.
- e What is a Priority Queue? Explain the concept of 'Priority Queue using Multiple Queues' with the help of your own example.
- f Write an algorithm to 'Insert' a new element in a 'Circular Queue'.

4 Attempt any three of the following:

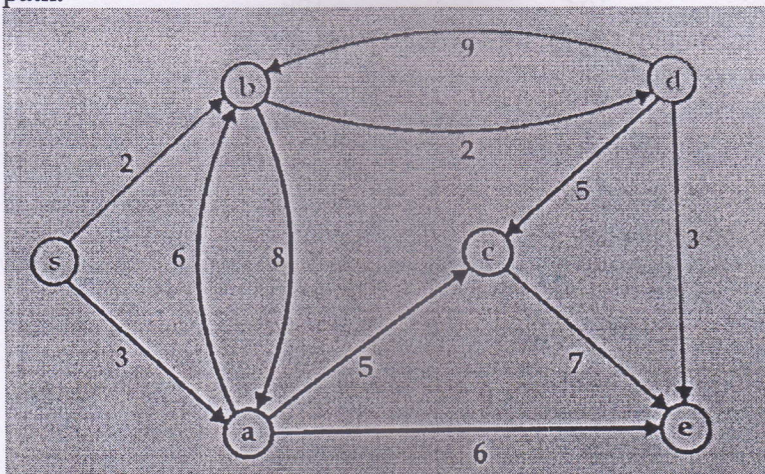
- a What is Selection Sort? Sort the following data items using Selection Sort
14,33,27,35,10.
- b Explain the following terms with the help of an example:
i) Length of a Path ii) Height of a node iii) Weight of a Tree.
- c Write an Algorithm to traverse a binary tree 'T' in the 'post-order' manner recursively. Explain with an example.
- d Create a Heap with the following elements : 15 7 10 2 20 15.
- e What is an AVL Tree? Create an AVL Tree with 5 elements as given below:
50, 100, 200, 35, 15
- f.



Delete the elements 58,60 and 30 in succession.

5 Attempt any three of the following:

- a What is a Hashing? Explain 'Division Remainder Method' and 'Folding Method' with the help of an example.
- b Consider a hash table of size 10. Insert the records with key values 33,10,193 using 'Quadratic Probing' Method. The values of C1 and C2 are taken as 3 and 1 respectively.
- c Explain the following Graph Terminologies with the help of a diagram:
i) Outdegree and Indegree
ii) Hamiltonian Path
iii) Cycle
- d Explain the memory representation of a graph with suitable examples.
- e Explain the concept of 'Breadth First Search (BFS)' with the help of an example.
- f. Consider the following connected graph G. Use the 'Dijkstra's Algorithm' to find the shortest path.



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