

S.Y.B.Sc.(I.T.) – Semester III (October 2023)
COMPUTER NETWORKS

(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 labelled diagrams** wherever **necessary**.
(6) Use of **Non-programmable** calculators is **allowed**.

1. **Attempt any three of the following:** 15
- a. What is data and information? Explain with suitable example.
 - b. Write a short note on following layers of ISO/OSI layer
 - 1. Data link layer
 - 2. Physical layer
 - c. Discuss Lan concept with suitable theory.
 - d. Discuss Router Concept with suitable theory.
 - e. What are the characteristics of Data communication?
 - f. Write a short note on Hub.
2. **Attempt any three of the following:** 15
- a. Discuss Analog signal with suitable theory.
 - b. Write a short note on Serial transmission mode.
 - c. Discuss data link layer design issue with suitable theory.
 - d. Explain following concept
 - 1. Single Error
 - 2. Burst Error
 - e. Write a short note ARQ.
 - f. Discuss Bluetooth technology.
3. **Attempt any three of the following:** 15
- a. What is meaning of IP? Explain Datagram concept with suitable diagram.
 - b. Discuss following field used in IP 4 datagram
 - 1. Fragmentation Offset
 - 2. Identification and Flag
 - c. Explain following concept
 - 1. Anycast address
 - 2. Multicast address
 - d. Discuss IP6 datagram with suitable diagram.
 - e. Write a short note on ICMP.
 - f. Discuss IP4 Addressing used for networking.
4. **Attempt any three of the following:** 15
- a. Write a short note on duties of transport layer.
 - b. Write a short note on UDP advantages.
 - c. Explain features of TCP protocol.
 - d. Explain user datagram format with neat diagram.
 - e. Write a difference between TCP/UDP
 - f. Explain socket address with diagram.
5. **Attempt any three of the following:** 15
- a. Discuss HTTP concept.
 - b. Discuss DHCP concept.
 - c. Explain FTP concept with suitable theory.
 - d. Discuss WWW concept.
 - e. Explain SMTP protocol.
 - f. Write a short note on DNS.

S.Y.B.Sc.(I.T.) – Semester III (October 2023)
DATA STRUCTURES

(Time: 2½ hours)

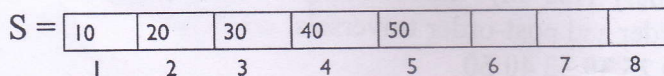
Total Marks: 75

- 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:

15

- a. What are the various operations performed on Data Structure?
- b. Explain in brief how the Complexity of an Algorithm is measured?
- c. Write an algorithm to Insert an element '25' at 3rd position in the below Array 'S'.

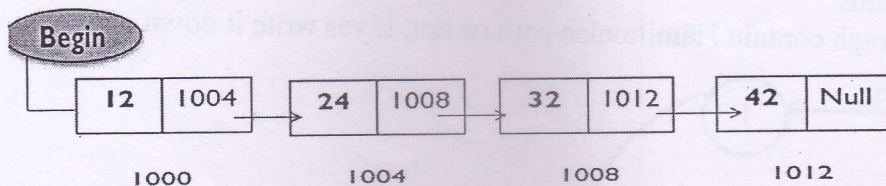


- d. Distinguish between Linear Search and Binary Search Algorithm.
- e. Consider a three-dimensional array M (-2:1, 5:7, 3:4) which is the collection of 24 (4 x 3 x 2) elements. Assuming the base address of array is 1500 and each element of the array occupies two memory cells. Calculate the address of element M [1,6,3] if elements of array are stored in:
 - (i) Row major order
 - (ii) Column major order
- f. Explain the following along with examples:
 - i) Diagonal Matrix
 - ii) Lower Triangular Matrix

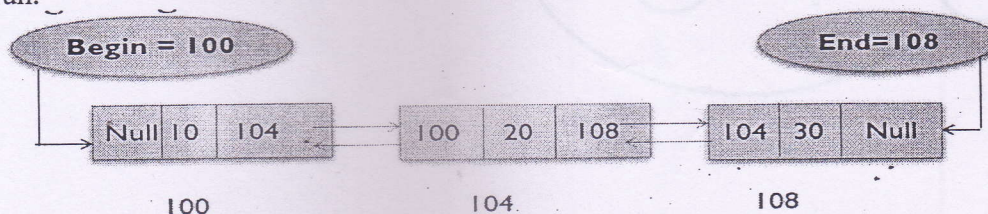
2. Attempt any three of the following:

15

- a. Write an algorithm to 'insert' an element at 'any position in Circular Linked List'.
- b. Find the location of a desired element '32' in a sorted (in ascending order) linked list. Show the dry run along with steps.



- c. What is a Header Linked List? Explain the four categories of Header Linked List
- d. Write a short note on 'Doubly Linked List' along with an example.
- e. Find position of element 30 by traversing a 'Two-way Linked list' from 'End to Begin'. Show dry run.



- f. Write an algorithm to 'delete' an element from beginning of a 'One-way Linked List.'

3. Attempt any three of the following:

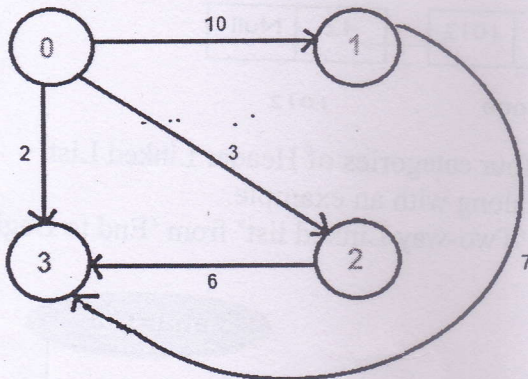
- What is a Stack? What are the operations performed on Stack? Explain.
- Convert the following Infix notation to 'Prefix Notation'
 - $(x-y) * ((z+v)/f)$
 - $((p+q)/r^{((s-t)+u))}$
- Explain the concept of Recursion along with the help of an example.
- Write an algorithm to 'Delete' an element from a 'Circular Queue'
- Evaluate the following 'Postfix Expression.' Explain step by step in tabular form.
 $P = 6 2 + 5 * 8 4 / -$
- State the applications of Queue.

4. Attempt any three of the following:

- What is Bubble Sort? Write an algorithm for Bubble Sort.
- Explain the following terms with the help of an example:
 - Similar Binary Tree
 - Complete Binary Tree
 - Almost Complete Binary Tree
- Construct the binary tree from its in-order and post-order traversals.
In-order Traversal: 5 10 12 15 18 20 25 30 35 40 50
Post-order Traversal: 5 12 18 15 10 25 35 50 40 30 20
- Write an algorithm to Insert a new element into Heap.
- Create a Red - Black Tree using the following elements:
150, 140, 130, 120, 125
- Create the B-Tree of order 3 using the following elements:
150 140 130 120 125 122 110 100 105.

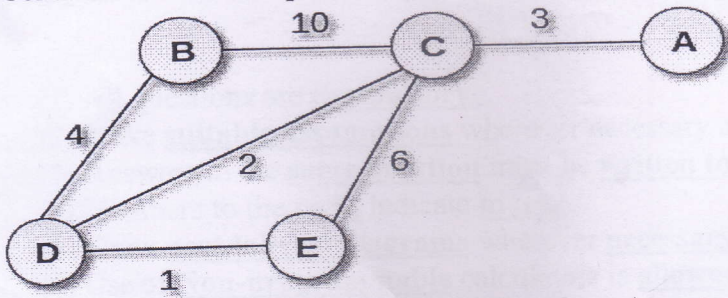
5. Attempt any three of the following:

- What is a Hash Function? Explain 'Mid-Square Method' and 'Folding Method' with the help of an example.
- Consider a hash table of size 10. Insert the records with key values 33,101,99,83 using 'Linear Probing' Method.
- Perform following operations on the given graph:
 - Find out outdegree and indegree of all vertices
 - List source and sink vertices
 - Write adjacent vertices of all vertices
 - Write any two paths
 - Check whether graph contain Hamiltonian path or not, if yes write it down



S.Y.B.Sc.(I.T.) – Semester III (October 2023)
DATA STRUCTURES

d. Construct Minimum Spanning Tree using 'Kruskal's Algorithm' of a given graph.



- e. Explain the memory representation of a graph with suitable examples.
f. Explain the concept of Breadth First Search (BFS) with the help of an example.

S.Y.B.Sc.(I.T.) – Semester III (October 2023)
APPLIED MATHEMATICS

(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:

15

a. If $A = \begin{bmatrix} 2 & 3 + 2i & -4 \\ 3 - 2i & 5 & 6i \\ -4 & -6i & 3 \end{bmatrix}$ then show that A is Hermitian and iA is Skew-Hermitian,

b. Find the inverse of the matrix: $A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$

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

d. Express in polar form: $-\frac{1}{2} + \frac{\sqrt{3}}{2}i$

e. Using De-Moivre's theorem prove that $(1 + i)^8 + (1 - i)^8 = 32$

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

2. Attempt any three of the following:

15

- a. Find the Laplace transform of $f(t) = t^n$
b. Find the Laplace transform of $y'' + 4y = \sin 3t$; $y(0) = y'(0) = 0$
c. Find inverse Laplace transform of $\cot^{-1}(s)$
d. Solve the exact D.E $(x^4 + y^4) dx - xy^3 dy = 0$
e. Solve $\frac{dy}{dx} + 2y \tan x = \sin x$
f. Explain Clairaut's equation.

3. Attempt any three of the following:

15

- a. Find the Laplace Transform: $f(t) = 1$ & $f(t) = e^{at}$
b. Find the Laplace transform of $\frac{dy}{dx} + 3y(t) + 2 \int_0^t y(t) dt = t$; given $y(0) = 0$
c. Find inverse Laplace transform of $\tan^{-1}(s)$
d. Find the Laplace transform of $f(t) = \int_0^\infty \frac{e^{-at} - e^{-bt}}{t} dt$
e. Find the Laplace transform of $f(t) = \frac{1 - \cos t}{t}$
f. Find $L^{-1} \left[\log \left(\frac{s^2 - 1}{s^2} \right) \right]$

4. Attempt any three of the following:

- a. Evaluate $\int_0^a \int_{\sqrt{ax-x^2}}^{\sqrt{a^2-x^2}} \frac{1}{\sqrt{a^2-x^2-y^2}} dx dy$
- b. Evaluate $\int \int \int (x + y + z) dx dy dz$ over the tetrahedron bounded by the planes $x=0$, $y=0$, $z=0$ and $x+y+z=1$.
- c. Evaluate $\int \int y dx dy$ over the area bounded by $x = 0$, $y = x^2$ and $x + y = 2$ in the first quadrant.
- d. Evaluate $\int \int xy(x + y) dx dy$ over the area between curve $y = x^2$ and the line $y = x$.
- e. Find the volume of the region bounded by surfaces $y = x^2$, $x = y^2$ and the planes $z=0$, $z=3$.
- f. Evaluate $\int_0^1 \int_0^1 \frac{dx dy}{\sqrt{(1-x^2)(1-y^2)}}$

5. Attempt any three of the following:

- a. Prove that $\Gamma(n + 1) = n\Gamma n = n!$
- b. Prove that $\beta(m, n) = \beta(n, m)$
- c. Evaluate $\int_0^\infty \sqrt{x} e^{-x^3} dx$
- d. Show that $\operatorname{erfc}(-x) + \operatorname{erfc}(x) = 2$
- e. Show that $\operatorname{erf}(\infty) = 1$
- f. Show that: $\int_0^\infty \frac{1-e^{-ax}}{x} e^{-x} dx = \log(a+1)$

S.Y.B.Sc.(I.T.) – Semester III (October 2023)
PYTHON PROGRAMMING

(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:

15

- a. What are keywords? List and explain any eight keywords in Python.
- b. What are natural and formal languages? What is the difference between the two?
- c. Explain assignment operators of Python with suitable examples.
- d. i) What is range() function? Explain the different ways of implementing range() function with examples.
ii) Explain the use of else with Loops in Python.
- e. How can a loop be terminated? Explain with syntax and flow diagram.
- f. Write a program that asks the user to enter a character and checks whether it is an uppercase letter, lowercase letter, digit or special symbol.

2. Attempt any three of the following:

15

- a. How are functions defined and called in Python?
- b. What is composition? Explain the different forms of composition used in the following program:
from math import sqrt, pow
def f1():
 print("Hello World")
def f2():
 f1()
 f2()
n1 = int(input("Enter Value 1:"))
n2 = int(input("Enter Value 2:"))
p = pow(sqrt(n1), sqrt(n2))
print("\n Square Root of ", n1, "raised to Square Root of ", n2, " = ", p)
- c. What is Recursion? Write a program in Python that displays sum of natural numbers using recursive function.
- d. Write a program in Python that accepts a string from the user and checks whether it is a palindrome or not, using a function.
- e. Explain the following concepts with suitable examples:
i) String Traversal ii) String Immutability
- f. Explain the functions used for following tasks with suitable examples:
i) String begins and ends with specified string.
ii) Returns the index value of the string where substring is found between begin index and end index.

3. Attempt any three of the following:

- a. Write a program in Python that accepts two lists and returns True if they have at least one common element.
- b. What is Tuple? How are values assigned to a Tuple? What are the advantages of Tuple over a List?
- c. Write a short note on Dictionary? How are values accessed from a Dictionary?
- d. Explain the following file functions with syntax:
i) open() ii) tell() iii) readline()
- e. Write a program in Python to merge two files into a single file.
- f. Write a program in Python to demonstrate nested Exception Handling.

4. Attempt any three of the following:

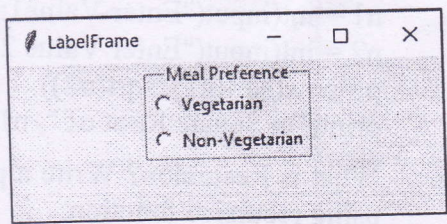
- a. Which special characters are used in Python Regular Expressions?
- b. Explain the match() and groups() function with syntax.
What will be the output of the following? Explain the working of the output.

```
import re
s = "Semester Examination - Python Programming"
m = re.match("[A-Z]([a-z]*)\s([A-Z])([a-z]*)", s)
print(m.groups())
for i in m.groups():
    print(i)
```

- c. How is inheritance implemented in Python? What are the different types of inheritance?
- d. Write a program in Python to demonstrate Method Overriding.
- e. Write a program in Python to implement Multi-threaded Programming.
- f. Explain the localtime() function. What are the elements of Time Tuple?

5. Attempt any three of the following:

- a. What are pack, grid and place layouts? List and explain the options of place layout.
- b. Write a program in Python to create the following GUI:



- c. How is a Listbox widget created in Python? Explain any five properties of the Listbox Widget.
- d. Write a program in Python to create a window with a Menubutton – File. When user clicks on Menubutton File display File Menu with options New and Exit. Open a new window when user clicks on New and close the main window when user clicks on Exit.
- e. What is a cursor object? What are the different ways of retrieving rows in Python?
- f. Write a program in Python to accept Employee ID from the user and delete the record of the employee from the employee table (emp_id, emp_name, age, dept_name) in CLI mode.

S.Y.B.Sc.(I.T.) – Semester III (October 2023)
OPERATING SYSTEMS

(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: 15
- Define Operating System. List the key functions of an operating system (OS).
 - Write a short note on Time sharing system.
 - Define Fault. List the categories of Fault.
 - Define the term process and explain the relationship between processes and process control blocks.
 - Discuss the state transitions the processes undergo.
 - What is the difference between a mode switch and a process switch?

2. Attempt any three of the following: 15
- Explain the difference between user-level threads and kernel-level threads.
 - Explain types of multi-threading model.
 - Explain Peterson's algorithm.
 - What are the requirements for Mutual Exclusion?
 - Explain Readers-Writer's problem and its solution using semaphores.
 - Explain how message passing can be used to enforce mutual exclusion.

3. Attempt any three of the following: 15
- Describe Resource Allocation Graph?
 - With deadlock
 - With a cycle but no deadlock.
 - Consider the following snapshot of a system

	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P0	0	0	2	0	0	4	1	0	2
P1	1	0	0	2	0	1			
P2	1	3	5	1	3	7			
P3	6	3	2	8	4	2			
P4	1	4	3	1	5	7			

- Find the need matrix and calculate safe sequence using Banker's algorithm. Mention the above system is safe or not safe.
- Explain Fixed Partitioning
 - Explain Simple Segmentation
 - For the following page reference string 1,2,3,4,1,2,5,1,2,3,4,5. Calculate the page faults using LRU using 3 frames.
 - Analyze the problem in simple paging technique and show how TLB is used to solve the problem.

S.Y.B.Sc.(I.T.) – Semester III (October 2023)
OPERATING SYSTEMS

4. Attempt any three of the following:

15

- a. If purely priority-based scheduling is used in a system, what are the problems that the system will face?
- b. Show the working of round-robin scheduling with help of example.
- c. Draw Gantt chart, calculate the average waiting time & average turn-around time if the processes are scheduled using SRT algorithm (preemptive)

Process	Arrival Time	Burst Time
P1	0	7
P2	1	5
P3	2	3
P4	3	1
P5	4	2
P6	5	1

- d. List and briefly define five different categories of synchronization granularity.
- e. List and briefly define characteristics of Real-Time Operating Systems.
- f. Discuss three interrelated issues involved in Scheduling on a multiprocessor.

5. Attempt any three of the following:

15

- a. Write a short note on Direct Memory Access.
- b. What is total head movement for FCFS scheduling for given I/O blocks 98, 183, 37, 122, 14, 124, 65, 67 where head is initially at cylinder 53.
- c. List five file organization. Explain any one with advantages and disadvantages.
- d. What is B-tree? List down few characteristics of B-tree.
- e. List and briefly define three classes of intruders.
- f. Explain RBAC.

Process	Arrival Time	Burst Time
P1	0	7
P2	1	5
P3	2	3
P4	3	1
P5	4	2
P6	5	1