



Cochin University of Science and Technology
Department of Computer Science

Third Semester Five-Year Integrated M.Sc. Degree in Computer Science (Artificial Intelligence & Data Science)

First Series Examination - September 2025

24-813-0301 Data Structures

Duration: 1 hour


Maximum Marks: 15

Answer all questions.

1. Suggest the most suitable data structure for managing the "*Recently Played*" list in Music Apps. Give reason(s). [1 mark][CO2, DL-1, BTL-3]
2. What is the best-case complexity of *Insertion Sort*? [1 mark][CO1, DL-1, BTL-1]
3. State True or False : $T(n) = 5n^2 + 26n + 11$ is $O(n^3)$ [1 mark][CO1, DL-2, BTL-2]
4. Arrange the following functions according to the increasing order of their growth rate: $n!$, $n \log(n)$, n , $\log(n)$, n^2 , n^3 , $25n$, 12 [1 mark][CO1, DL-2, BTL-2]
5. The array $A = [40, 80, 35, 90, 10, 15, 70]$ is to be sorted in ascending order using the *Quick Sort* algorithm. The first element is chosen as the pivot. Show the state of the array after the first and second partitioning steps. [2 marks][CO3, DL-2, BTL-2]
6. Write a recursive algorithm to print the first n natural even numbers in ascending order. [2 marks][CO1, DL-2, BTL-3]
7. Give an algorithm to merge two already sorted arrays of size n into a single sorted array that runs in $O(n)$ time complexity. [3 marks][CO1, DL-2, BTL-3]
8. Analyze the time complexity of the following code in terms of Big-Oh notation, using the step count method. [4 marks][CO1, DL-2, BTL-3]

```
a) int i, j, k = 0;
   for (i = n / 2; i <= n; i++) {
       for (j = 2; j <= n; j = j * 2) {
           k = k + n / 2;
       }
   }
```

```
b) int x = 0;
   for (int i = 0; i < n; i++) {
       for (int j = 0; j < 5; j++) {
           x = x + 1;
       }
   }
```

 COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY DEPARTMENT OF COMPUTER SCIENCE			
Programme: III Semester CS Minor -DSC Course Code & Title: 24-813-0301: Data Structures (Minor)			
Name of Examination: Series I		Max. Marks: 20	Semester: III
Batch: 2024-29	Duration: 1 Hours	Date: 17.09.2025	Time: 2.00 PM – 3:00 PM

Answer All questions

- Explain the importance of documentation in programming methodology.
 - Describe the various types of documentation with example.

(2marks) [CO1, DL-1, BTL-2]

- Explain linear search.
 - Explain binary search.

(4 marks) [CO3, DL-2, BTL-3]

- Explain the types of data structure with example.
 - Explain data structure operations.

(2 marks) [CO1, DL-1, BTL-2]

- Compare structured approach and object-oriented approach.

(4 marks) [CO1, DL-2, BTL-3]

- Explain bubble sort.
 - Explain selection sort.

(4marks) [CO3, DL-2, BTL-3]

- Explain string handling functions with example.
 - Write a C program to check a string is palindrome or not.

(4 marks) [CO2, DL-2, BTL-3]



COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE

Programme: Five Year Integrated MSc Computer Science (Artificial Intelligence & Data Science)

Course Code & Title: 24-813-0302 Computer Fundamentals 2 (DSC B)

Name of Examination: Series I

Max. Marks: 20

Semester: III

Batch: 2024-29

Duration: 2 Hours

Date: 11.09.2024

Time: 11:00 AM – 01:00 PM

Answer all questions

1. Perform the following number conversions:
 - a) Convert the decimal number 142.34 to binary, octal and hexadecimal
 - b) Convert the following numbers to decimal
 - (i) binary number 1000.1111
 - (ii) the octal number 1725.43
 - (iii) the hexadecimal 08B.FCD
 - c) Convert the octal number 427.63 to binary and binary number 1101.100 to hexadecimal
 - d) Convert the octal number 423.32 to hexadecimal number and hexadecimal decimal number A14D.2B to octal number (5 marks) [CO1, DL-2, BTL-3]
2. Draw the circuit diagram for the expression $X = AC + BC' + A'BC$ (1 mark) [CO1, DL-1, BTL-2]
3. Simplify the expression $X = (M+N)(M'+P)(N'+P')$ (1 mark) [CO1, DL-1, BTL-2]
4. Differentiate XOR gate and XNOR gate with the help of truth tables. (1 mark) [CO1, DL-1, BTL-4]
5. Explain why NAND gate and NOR gate are called Universal Gates. Implement all basic gates using either NAND or NOT gates. (2 marks) [CO1, DL-2, BTL-2]
6. Consider four processes arriving as shown below. Perform SRTF, Priority Scheduling without preemption and RR (with quantum=3). Find average turn-round time and average waiting time for each cases.

Process	Arrival (ms)	Burst (ms)	Priority
P1	0	8	2
P2	1	4	1
P3	2	9	4
P4	3	5	3

(3 marks) [CO3, DL-3, BTL-3]

7. List out any 4 functions of Operating System.

(1 mark) [CO3, DL-1, BTL-1]

8. Differentiate between multiprogramming Operating system and Timesharing Operating System.
(2 marks) [CO3, DL-2, BTL-4]
9. What is a process. Draw the diagram that represents state of a process. List out the information in Program Control Block.
(2 marks) [CO3, DL-2, BTL-1]
10. Describe the necessary conditions for deadlock. List out the methods for handling deadlock.
(2 marks) [CO3, DL-2, BTL-2]

SFI-DCS



COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE

Programme: III Semester CS MDC

Course Code & Title: 24-813-0303 : Fundamentals of Data Structures

Name of Examination: Series I	Max. Marks: 20	Semester: III
Batch: 2024-29	Duration: 1 Hour	Date: 10.09.2025
		Time: 2:00 PM - 3:00 PM

PART- A (ANSWER ALL QUESTIONS) (4 X 2=8)

(2 Marks) [CO1, DL-1, BTL-3]

1 Predict the output

```
#include <iostream>
using namespace std;
int main() {
    int arr[5];
    for (int i = 0; i < 5; i++) {
        arr[i] = i * 2;
    }
    cout << arr[4] << endl;
    return 0;
}
```

2 A scientist is developing a climate simulation that models a 50x100 grid of the Earth's surface. The data for this grid is stored in a single-dimensional array in **row-major order** starting at memory address **1000**. Each data point (e.g., temperature) is stored as a 4-byte integer. The scientist wants to access a specific grid point at Grid[25][75]. What is the effective memory address of Grid[25][75]? Show your work using the row-major formula.

(2 Marks) [CO2, DL-2, BTL-5]

3 What will the state of the array be after three passes of bubble sort.
Initial Array: [15, 8, 5, 11, 30, 12, 21, 25]

(2 Marks) [CO3, DL-2, BTL-3]

4 You are designing the data structure for an online shopping cart. Customers can add or remove items at any time, and there is no fixed limit on how many items they can have. The order of the items matters for display purposes. Why is a linked list a suitable data structure for this shopping cart, particularly when compared to a traditional, static array

(2 Marks) [CO1, DL-1, BTL-4]

PART-B (ANSWER ANY THREE QUESTIONS) (3 X 4=12)

6 Write a C or C++ program to implement deletion operation on a linear array.

(4 Marks) [CO2, DL-3, BTL-3]

7 Prepare a note in details on the topic 'classification of Data structure'.

(4 Marks) [CO1, DL-1, BTL-2]

8 Write a C or C++ program to count and display the number of nodes in a linked list.

(4 Marks) [CO2, DL-3, BTL-3]

9 a. Write binary search algorithm

(3 Marks) [CO3, DL-2, BTL-3]

b. Recall the two ways of implementing binary search algorithm

(1 Marks) [CO3, DL-1, BTL-1]



**COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE**

**Programme: III Semester CS Minor -DSC
Course Code & Title: 24-813-0301: Data Structures (Minor)**

Name of Examination: Series II	Max. Marks: 20	Semester: III
Batch: 2024-29	Duration: 1 Hours	Date: 05.11.2025
		Time: 2.00 PM – 3:00 PM

Answer All questions

1. Write a C program to create a singly linked list and display the nodes.
(4marks) [CO2, DL-3, BTL-3]
2. Compare stack and queue.
(4 marks) [CO2, DL-1, BTL-4]
3. Explain contiguous memory allocation, non-contiguous memory allocation and virtual memory concept.
(4 marks) [CO4, DL-2, BTL-2]
4. What is the difference between binary tree and binary search tree?
(4 marks) [CO2, DL-2, BTL-2]
5. (a) Explain time complexity of an algorithm with an example.
(b) what is Big-O notation?

(4marks) [CO1, DL-2, BTL-3]