

**Code: AC64/AT64/ AC115/AT115**  
**Subject: DESIGN & ANALYSIS OF ALGORITHMS**

**AMIETE – CS/IT (Current & New Scheme)**

Time: 3 Hours

June 2019

Max. Marks: 100

**PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.**

**NOTE: There are 9 Questions in all.**

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

**Q.1 Choose the correct or the best alternative in the following: (2×10)**

a. A data structure where elements can be added or removed at either end but not in the middle

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|------------------|-------------|
| (A) Linked Lists | (B) Stacks  |
| (C) Queues       | (D) Dequeue |

b. What is the worst case complexity of selection sort?

- |                   |              |
|-------------------|--------------|
| (A) $O(n \log n)$ | (B) $O(n)$   |
| (C) $O(\log n)$   | (D) $O(n^2)$ |

c. Which of the following is correct recurrence for worst case of Binary Search?

- (A)  $T(n) = 2T(n/2) + O(1)$  and  $T(1) = T(0) = O(1)$
- (B)  $T(n) = T(n-1) + O(1)$  and  $T(1) = T(0) = O(1)$
- (C)  $T(n) = T(n/2) + O(1)$  and  $T(1) = T(0) = O(1)$
- (D)  $T(n) = T(n-2) + O(1)$  and  $T(1) = T(0) = O(1)$

d. Consider a situation where swap operation is very costly. Which of the following sorting algorithms should be preferred so that the number of swap operations are minimized in general?

- |                    |                    |
|--------------------|--------------------|
| (A) Heap Sort      | (B) Selection Sort |
| (C) Insertion Sort | (D) Merge Sort     |

e. A priority queue is implemented as a Max-Heap. Initially, it has 5 elements. The level-order traversal of the heap is: 10, 8, 5, 3, 2. Two new elements 1 and 7 are inserted into the heap in that order. The level-order traversal of the heap after the insertion of the elements is:

- |                    |                    |
|--------------------|--------------------|
| (A) 10,8,7,3,2,1,5 | (B) 10,8,7,2,3,1,5 |
| (C) 10,8,7,1,2,3,5 | (D) 10,8,7,5,3,2,1 |

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- f. In an unweighted, undirected connected graph, the shortest path from a node S to every other node is computed most efficiently, in terms of time complexity by  
 (A) Dijkstra's algorithm starting from S  
 (B) Warshall's algorithm  
 (C) Performing a DFS starting from S  
 (D) Performing a BFS starting from S
- g. The order of an internal node in a B+ tree index is the maximum number of children it can have. Suppose that a child pointer takes 6 bytes, the search field value takes 14 bytes, and the block size is 512 bytes. What is the order of the internal node?  
 (A) 24 (B) 25  
 (C) 26 (D) 27
- h. Given the following input (4322, 1334, 1471, 9679, 1989, 6171, 6173, 4199) and the hash function  $x \text{ mod } 10$ , which of the following statements are true?  
 (i) 9679, 1989, 4199 hash to the same value  
 (ii) 1471, 6171 has to the same value  
 (iii) All elements hash to the same value  
 (iv) Each element hashes to a different value  
 (A) (i) only (B) (ii) only  
 (C) (i) and (ii) only (D) (iii) or (iv)
- i. Let X be a problem that belongs to the class NP. Then which one of the following is TRUE?  
 (A) There is no polynomial time algorithm for X.  
 (B) If X can be solved deterministically in polynomial time, then  $P = NP$   
 (C) If X is NP-hard, then it is NP-complete  
 (D) X may be undecidable
- j. Which of the following is not a backtracking algorithm?  
 (A) Knight tour problem (B) N queen problem  
 (C) Tower of Hanoi (D) M coloring problem

**Answer any FIVE Questions out of EIGHT Questions.**  
**Each question carries 16 marks.**

- Q.2** a. Briefly discuss the important problem types. (8)  
 b. Discuss various steps in algorithmic problem solving technique. (8)
- Q.3** a. How to analyze the time efficiency of non-recursive algorithms? Explain with examples. (10)  
 b. Write short notes on asymptotic notations. (6)

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- Q.4** Explain the quick sort algorithm with example. (16)
- Q.5** Explain topological sorting in detail. (16)
- Q.6** Define heap. Explain the properties of heap and write a simple example to explain heap sort algorithm. (16)
- Q.7** Explain kruskal's algorithm for finding minimum spanning tree with an example. (16)
- Q.8** Describe various hashing techniques. Give examples. (16)
- Q.9** Discuss branch and bound method with a suitable example. (16)