

KATHMANDU UNIVERSITY  
End Semester Examination  
March, 2025

Marks Scored:

Level : B.Sc.  
Year : II

Course : BICP 201  
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 07 MAR 2025

SECTION "A"

[20 Q. × 0.5 = 10 marks]

**Choose and Mark [X] in the most appropriate option from each set of choices**

1. Which of the following is NOT an Asymptotic Notation?  
 Big-O (O)       Theta ( $\Theta$ )       Omega ( $\Omega$ )       Sigma ( $\Sigma$ )
2. Which of the following is NOT a characteristic of an algorithm?  
 Finiteness       Infinite loop       Input and Output       Definiteness
3. The infix expression  $(A + B) * (C - D)$  is converted into which postfix notation?  
 AB+CD-\*       ABCD+ -\*       A+BC-D\*       \*AB+CD-
4. What is the operation that adds an element to the top of a Stack called?  
 POP       PEEK       PUSH       ENQUEUE
5. What is the time complexity of the PUSH operation in a stack implemented using an array?  
  $O(n)$         $O(1)$         $O(\log n)$         $O(n^2)$
6. What is the operation that adds an element to the rear of a Queue called?  
 POP       DEQUEUE       PUSH       ENQUEUE
7. What happens when you try to DEQUEUE from an empty queue?  
 Queue overflow       Queue underflow  
 Front pointer moves to the rear       Rear pointer moves to the front
8. What is the purpose of the "head" pointer in a linked list?  
 To point to the last node       To point to the first node  
 To point to the middle node       To store the size of the list
9. What is the term for a linked list with nodes containing pointers to both the next and previous nodes?  
 Singly linked list       Circular linked list  
 Doubly linked list       Linear linked list
10. In a singly linked list, how do you delete a node at the beginning?  
 Update the head pointer to the next node  
 Delete the last node  
 Swap the head with the last node  
 Traverse the entire list before deleting

11. What is the order of nodes visited in pre-order traversal?  
 Left → Root → Right                       Right → Root → Left  
 Root → Left → Right                       Left → Right → Root
12. What is the balance factor in an AVL tree?  
 Difference between the number of nodes in left and right subtrees  
 Difference between the heights of left and right subtrees  
 The sum of all node values in the tree  
 The height of the root node
13. What is a leaf node in a tree?  
 A node with children                       A node with no children  
 The root node                       A node with only one child
14. What is the best-case time complexity of Insertion Sort?  
  $O(n^2)$                         $O(n \log n)$                         $O(\log n)$                         $O(n)$
15. Which sorting algorithm uses a "divide and conquer" strategy by recursively dividing the array into two halves?  
 Insertion Sort     Selection Sort     Bubble Sort     Merge Sort
16. What is the primary advantage of external sorting?  
 Faster sorting speed  
 Ability to sort datasets larger than available memory  
 Simpler implementation  
 Lower memory usage
17. What is the basic principle of a Sequential Search?  
 It divides the search space in half repeatedly.  
 It traverses a tree structure.  
 It compares each element with the target sequentially.  
 It uses a hash function to locate the element.
18. What is a collision resolution technique that allows multiple elements at the same index using linked lists?  
 Linear Probing                       Double Hashing  
 Quadratic Probing                       Separate Chaining
19. What is the fundamental principle of Greedy Algorithms?  
 To make the locally optimal choice at each step.  
 To explore all possible solutions. itself.  
 To divide the problem into smaller subproblems.  
 To backtrack when a solution is not found.
20. What is the primary difference between a Tree and a Graph?  
 A Tree is a special type of Graph with cycles  
 A Graph must be connected, but a Tree does not  
 A Tree is a connected Graph with no cycles  
 A Graph has exactly  $N-1$  edges

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07 MAR 2025

SECTION "B"

[6 Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. What do you mean by Data Structure? Explain its types. Describe the key characteristics of an algorithm. [2+2]
2. What is Stack? Explain the difference between push() and pop() operations in a stack. Convert  $A + (B * C - (D / E - F) * G) * H$  into postfix from showing stack status after every step in tabular form. [1+1+2]
3. What is a queue in data structures? Describe the Enqueue and Dequeue operations in a queue. [1+3]
4. What is a Singly Linked List? How can you insert a node in the middle of a Singly Linked List? Please provide the algorithms for both operations along with examples. [1+3]
5. Define a binary tree? Can you explain what an almost complete binary tree is and how it differs from a complete binary tree? Please include an example.
6. What distinguishes internal sorting from external sorting? Explain Merge Sort algorithm with an example. [2+2]
7. What is sequential search, and how does it work? What are the commonly used collision resolution techniques in hash tables? Explain briefly. [2+2]

SECTION "C"

[2 Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8.
  - a. Given the preorder and inorder traversals below, construct the binary tree step by step and draw the final structure.  
Inorder: E A C K F H D B G  
Preorder: F A E K C D H G B [4]
  - b. Define AVL trees and illustrate the different rotation types used for balancing with examples. [4]
9. What is hashing and hash function? What are the key differences and similarities between a Singly Linked List and a Doubly Linked List? Explain how Insertion Sort works using the following example: 25, 15, 9, 20, 26. [2+3+3]

**P.T.O.**

10. What is a greedy algorithm? How does Depth-First Search (DFS) work? Given the following weighted graph, use Kruskal's and Prim's Algorithms to find the Minimum Spanning Tree (MST) and Cost of Minimum Spanning Tree. [1+1+6]

