

KATHMANDU UNIVERSITY
End Semester Examination
July/August 2024

Level : B.Sc.
Year : II
Time : 2 hrs. 30mins.

15 JUL 2024

Course : BICP 201
Semester : I
F. M. : 40

SECTION "B"

[6 Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. How do you find Complexity of Algorithms? Explain. [4]
2. Define Queue. What are different applications of queue in Bioinformatics field? Explain. [1+3]
3. Evaluate the expression PQRS-*+ using stack where P= 5, Q= 4, R= 3 and S= 7. [4]
4. Write an algorithm that creates a singly linked list to store nucleotides 'A', 'T', 'G', and 'C', then traverse through it and display the nucleotides in order. [4]
5. Write an algorithm to count the frequency of each nucleotide ('A', 'C', 'G', 'T') in a given DNA sequence. [4]
6. What is the difference between directed and undirected graph? Create an undirected graph representing protein-protein interactions. Include proteins 'GAB1', 'EGF', 'EGFR', 'DCN', and 'CBL'. [2+2]
7. Explain the algorithm to find the shortest path between any two vertices. [4]

SECTION "C"

[2 Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Define a hash table class capable of handling collisions. Describe algorithms of insertion operations for gene names 'BRCA1', 'TP53', 'EGFR', 'MYC', 'ACRB1', and 'KRAS'. Also, provide functionality to display all genes stored in the hash table. [2+6]
9. What is Binary Search Tree? Explain the Insertion, deletion and Traverse algorithms in Binary Search Tree. [2+6]
10. Write Short notes with example. [4+4]
 - a. Binary searching
 - b. Quick Sort



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Marks Scored:

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Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date 15 JUL 2024

SECTION "A"

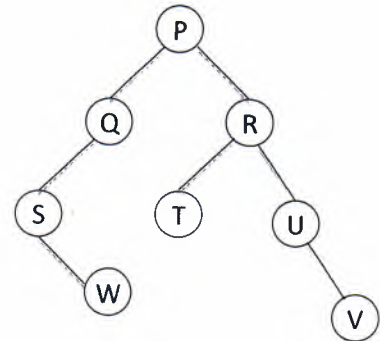
[20Q. \times 0.5 = 10 marks]

Choose and mark [X] encircle the most appropriate option from each set of choices

1. What is the complexity of merge sort algorithm?
 $O(n)$ $O(n \log n)$ $O(n^2)$ $O(\log n)$
2. The postfix expression for the infix expression $A+B*(C+D)/F+D*E$ is
 $AB+ CD+ *F/D+E*$ $ABCD+ *F/+ DE*+$
 $A*B+ CD/F*DE++$ $A+*BCD/F*DE++$
3. When the Average case occurs in linear search algorithm?
 When Item is not in the array at all
 When Item is somewhere in the middle of the array
 When Item is the last element in the array
 When Item is the last element in the array or is not there at all
4. A Type of linear list in which each node has pointers to point to the predecessor and successors nodes is known as _____
 Singly Linked List Circular Linked List
 Circular Doubly Linked List Doubly Linked List
5. Which of the following data structure is non-linear?
 Array Linked List Tree Stack
6. In which case does the worst-case time complexity of Quick Sort occur?
 When the pivot is always the smallest element
 When the pivot is always the largest element
 When all elements are the same
 When the input array is already sorted
7. What is the main advantage of using a graph-based approach for modeling protein-protein interaction networks?
 It guarantees faster computation of shortest paths.
 It reduces the overall data storage requirement.
 It simplifies the implementation of dynamic programming algorithms.
 It allows for the visualization of complex interaction networks.
8. Which algorithm design paradigm does the Merge Sort algorithm follow?
 Dynamic Programming Divide and Conquer
 Greedy Algorithm Backtracking

9. What is the purpose of DFS in graph theory?
 To find the minimum spanning tree
 To sort the vertices
 To visit all the nodes in deathward motion
 To find the shortest path
10. What is the time complexity of searching for a specific gene sequence using a suffix tree (m is length of sequence being searched and n is the level of tree)?
 O(n) O(log n) O(m) O(n log n)
11. In a phylogenetic tree, what is the primary data structure used to represent the evolutionary relationships between species?
 Graph Binary Search Tree Stack Linked List
12. Which of the following data structures is most suitable for representing sparse matrices, those used in gene expression data?
 Linked List Hash Table Stack Heap
13. In a bioinformatics application, which algorithm would you use to find the shortest path in a metabolic network?
 Bellman-Ford Algorithm Floyd-Warshall Algorithm
 Dijkstra's Algorithm Kruskal's Algorithm

14. What is the breadth First Traversal of the following tree?
 PQSWRTUV
 PQRSTUWV
 WSQTVURP
 SWQPTRUV



15. In a priority queue, insertion and deletion takes place at _____
 front, rear end only at rear end only at front end any position
16. A balance factor in AVL tree is used to check _____
 what rotation to make. if all child nodes are at same level.
 if the tree is unbalanced. when the last rotation occur.
17. Which of the following conditions must be satisfied for complete binary tree?
 All leaf nodes are at the same depth and All non-leaf nodes have two children.
 Root node has two children.
 All leaf nodes are at the different depth and All non-leaf nodes have two children.
 All nodes have degree 2.
18. The following Python code represents the _____ operation.

```

Class Queue:
def __init__(self):
self.queue = []
def enqueue(self, item):
self.queue.append(item)
def dequeue(self):
if len(self.queue)<1:
return None
Return self.queue.pop(0)

```

 Enqueue Dequeue
 Enqueue and Dequeue Traverse

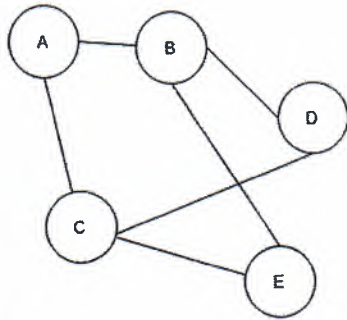
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19. Which of the operation is represented by following Python Function?

```
def insert(root, key):  
    if root is None: return Node(key)  
    if root.val == key: return root  
    if root.val < key : root.right = insert(root.right, key)  
    else root.left = insert(root.left, key)  
    return root
```

- Insertion of a new node in Binary Search Tree.
- Insertion of new node as root node.
- Insertions of new node as leaf node.
- Insertion of new node as intermediate node.

20. For the given graph (G), which of the following statements is true?



- The vertex connectivity of the graph is 2.
- The edge connectivity of the graph is 1
- G is a complete graph.
- G is not a connected graph.

