

KATHMANDU UNIVERSITY
End Semester Examination [C]
November/December, 2023

Marks Scored:

Level : B.E./B.Sc.

Year : III

Course : COMP 314

Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date 26 NOV 2023

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Encircle the most appropriate option among the given choices.

- BFS traversal of graph has complexity of _____.
a. $O(V.E)$ b. $O(V+E)$ c. $O(V)$ d. $O(V\log E)$
- Child nodes of 5th node of Heap has index value of _____.
a. 11 and 12 b. 9 and 10 c. 10 and 11 d. 6 and 7
- In a Heap tree,
a. values in a node is greater than every value in children of it
b. values in a node is greater than every value in left subtree and smaller than right subtree
c. both values in a node is greater than every value in children of it and values in a node is greater than every value in left subtree and smaller than right subtree
d. none of above
- LCS between *strata* and *astra* is _____.
a. Astra b. stra c. asta d. staa
- Most optimal way of parenthesization in matrix chain multiplication of $A_{2 \times 3} \cdot B_{3 \times 4} \cdot C_{4 \times 2} \cdot D_{2 \times 3} \cdot E_{3 \times 1}$ is _____.
a. $((A_{2 \times 3} \cdot B_{3 \times 4}) \cdot (C_{4 \times 2} \cdot D_{2 \times 3})) \cdot E_{3 \times 1}$ b. $(A_{2 \times 3} \cdot (B_{3 \times 4} \cdot (C_{4 \times 2} \cdot D_{2 \times 3}))) \cdot E_{3 \times 1}$
c. $((A_{2 \times 3} \cdot B_{3 \times 4}) \cdot C_{4 \times 2}) \cdot D_{2 \times 3} \cdot E_{3 \times 1}$ d. $(A_{2 \times 3} \cdot B_{3 \times 4}) \cdot ((C_{4 \times 2} \cdot D_{2 \times 3}) \cdot E_{3 \times 1})$
- NP hard problem is a NP Complete problem if
a. The problem can be transformed to polynomial time complexity with polynomial work on it.
b. The problem can be transformed to NP problem by doing polynomial time work on it.
c. The problem can be transformed to NP complete by doing polynomial time work on it.
d. The problem can be transformed to exponential complexity by doing polynomial time work on it.
- The following values are inserted, in the given order, in a hash table of size 7 that uses linear probing and the hash function $h(k) = k \bmod 7$: 4, 11, 5, 12, 6. In which entry of the table is the key 6 stored?
a. 0 b. 1 c. 5 d. 6
- The optimal profit for items (x_1, x_2, x_3 and x_4 respectively) of price Rs. 20, Rs. 35, Rs. 25, Rs. 45 having weight of 2kg, 4kg, 3kg and 7kg respectively and weight limit of 11kg. is
a. x_1, x_3 , and x_4 b. x_1 and x_4 c. x_2 and x_4 d. x_3, x_2 and x_1

9. The post order traversal of a binary tree is 452631. Find out the pre order traversal.
 a. 126345 b. 142653 c. 124356 d. 124536
10. Which of the following has minimal average time complexity?
 a. Radix Sort b. Quick Sort c. Selection Sort d. Insertion Sort
11. Which of the following operations is performed more efficiently by doubly linked list than by singly linked list?
 a. Deleting a node whose location is given
 b. Searching of an unsorted list for a given item
 c. Inverting a node after the node with given location
 d. Traversing a list to process each node
12. What will be the running-time of Dijkstra's single source shortest path algorithm, if the graph $G(V,E)$ is stored in the form of an adjacency list and binary heap is used.
 a. $O(|V|^2)$ b. $O(|V| \log |V|)$ c. $O(|E| + |V| \log |V|)$ d. None of these
13. Divide and conquer approach has drawbacks of _____ over iterative counterparts.
 a. Algorithmic clarity b. time consumption
 c. space consumption d. both time and space consumption
14. If $f(n)=2n+3$, $g(n)=n$. In what condition can we write $f(n)=\Omega(g(n))$?
 a. $c=4$, n less than equals to 3 b. $c=2$, n less than equals to 3
 c. $c=3$, n less than equals to 3 d. $c=2$, $n=0$
15. Which of the following is NOT a feature of an algorithm?
 a. Finiteness b. Input and Output c. Effectiveness d. Time Efficient
16. Finding out the successor of a node in BST takes _____.
 a. $O(\text{height of tree})$
 b. $O(\text{total no. of nodes})$
 c. $O(\text{total number of nodes greater than given node})$
 d. $O(n \log n)$
17. Ford Fulkerson algorithm has complexity of _____, where E =edges, V =vertices, F =max flow
 a. $O(V.E)$ b. $O(V.F)$ c. $O(E.F)$ d. $O(V^3)$
18. NP problems has
 a. Non polynomial time complexity b. Non deterministic polynomial time complexity
 c. Exponential complexity d. Very high polynomial time complexity
19. Random algorithm is applicable when
 a. Its deterministic version is too complex.
 b. Quick solution is desirable.
 c. Implementation of the primality test is required.
 d. Converting Non-deterministic to deterministic algorithms.
20. Which of the followings has maximum complexity?
 a. $O(n^{45})$ b. $O(\sqrt{n})$ c. $O(\log n)$ d. $O(10)$

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F. M. : 40

SECTION "B"
[6Q × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Write a pseudo code for implementing quick sort. Explain in brief about the correctness of the pseudocode.
2. Write pseudo code for building a heap tree. Prove that tighter bound for building heap takes $\Theta(n)$.
3. Use recurrence tree to analyze following recurrence relation:
$$f(x) = 3f(x/3) + x$$
4. List out the properties of Red black tree and and apply insertion of red black tree in following sequence node values: 5 6 3 4 1 12 11 2
5. How can a greedy approach solve the Activity Selection problem? Apply Activity Selection problem in following list of activities:

Activities	A1	A2	A3	A4	A5	A6
Start Time	2	1	0	1	3	4
End Time	5	3	3	2	6	7

6. Find the optimal solution using Branch and bound for 0/1 Knapsack problem, for items of price Rs. 15, Rs. 25, Rs. 35, Rs. 20 having weight of 4kg, 3kg, 4kg and 2kg respectively and weight limit of 11kg. Explain the intermediate steps in brief.
7. Write Short notes on: [2 + 2]
 - a. NP complete
 - b. Optimal Subproblem

SECTION "C"
[2 Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. a. Mention in brief about representations of generalized recurrence equations. Write the rules of Master's Theorem. [2+3]
b. What will be the efficient way of representing a sparse graph? Explain in brief. [3]
9. Mention the mathematical representation for solving Matrix Chain Multiplication using Dynamic Programming. Simulate and analyze the complexity for solving Matrix Chain Multiplication in a given matrix chain. $A_{1 \times 3}, A_{3 \times 4}, A_{4 \times 2}, A_{2 \times 3}, A_{3 \times 7}, A_{7 \times 4}, A_{4 \times 1}, A_{1 \times 5}$ [3+5]
10. Discuss in brief about Fermat's Little Theorem. Simulate to check the primality of number 27 and 29 using the theorem. [4+4]