KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2019

Marks Scored:

Level : B.Sc.
Year : III

Course : COMP 314
Semester: II

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Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date 13 MAR 2019

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Circle the most appropriate answer.

1. What is the time complexity of the following code?

```
for(i=0;i<n-1;i++){
    for(j=0;j<n-1;j++){
        printf("%c",'A');
    }
}
```

a) $O(n^2)$ b) O(n log n) c) O(n) d) O(1)

2. Which of the following represents the fastest running time complexity?
a) $O(n^2)$ b) O(n) c) O(n logn) d) $O(2^n)$

3. Which of the following case does not exist in complexity theory?
a) Average Case b) Worst Case c) Best Case d) Null Case

4. The complexity of a naive algorithm to generate Fibonacci series is _____
a) O(n-1) b) O(n+2) c) O(n) d) $O(2^n)$

5. What is recurrence for worst case of Quick Sort and what is the time complexity in Worst case?
a) Recurrence is $T(n) = T(n-2) + O(n)$ and time complexity is $O(n^2)$
b) Recurrence is $T(n) = T(n-1) + O(n)$ and time complexity is $O(n^2)$
c) Recurrence is $T(n) = 2T(n/2) + O(n)$ and time complexity is O(nlogn)
d) Recurrence is $T(n) = T(n/10) + T(9n/10)O(n)$ and time complexity is O(nlogn)

6. Merge sort algorithm follows _____ technique.
a) greedy b) dynamic programming
c) divide and conquer d) brute force

7. Suppose we are sorting an array of eight integers using some quadratic sorting algorithm. After four iterations of the algorithm's main loop, the array elements are ordered as shown here:

21 33 44 56 19 20 71 50

(Note: Our selection sort picks smallest items first.)
a) The algorithm might be either selection sort or insertion sort.
b) The algorithm is neither selection sort nor insertion sort.
c) The algorithm is selection sort but not insertion sort.
d) The algorithm is insertion sort but not selection sort.

8. What are the correct intermediate steps of the following data set when it is being sorted with the Selection sort in ascending? 15,20,10,18
   a) 10, 20,15,18 -- 10,15,20,18 – 10,15,18,20
   b) 15,20,10,18 -- 15,10,20,18 -- 10,15,20,18 – 10,15,18,20
   c) 15,18,10,20 -- 10,18,15,20 -- 10,15,18,20 – 10,15,18,20
   d) 15,10,20,18 -- 15,10,18,20 -- 10,15,18,20

9. What is the time complexity to extract a vertex from the priority queue in Prim's algorithm?
   a) O(log |V|) b) O(V.V) c) O(E.E) d) O(log |E|)f

10. Which is true statement in the following?
   a) Kruskal algorithm is multiple source technique for finding MST.
   b) Kruskal's algorithm is used to find minimum spanning tree of a graph, time complexity of this algorithm is O(E.V)
   c) Both a and b
   d) Kruskal's algorithm is better than Prim's when the graph has relatively few edges

11. Consider an algorithm for solving activity selection problem. Assume that there are 6 activities with following start time and finish time.
   S = {5, 2, 1, 3, 1, 4}
   F = {9, 5, 8, 6, 4, 7}
   Which of the following statements is FALSE?
   a) 1^{st} activity is not in solution set. b) 2^{nd} activity is not in solution set.
   c) 4^{th} activity is not in solution set. d) 6^{th} activity is not in solution set.

12. Which of the following is TRUE about Huffman Coding?
   a) It may become lossy in some cases.
   b) It may not be optimal lossless codes in some cases.
   c) In Huffman coding, no code is prefix of any other code.
   d) All of the above.

13. What is the complexity of binary search algorithm?
   a) O(log n) b) O(n) c) O(n log n) d) O(1)

14. Time complexity of an algorithm to generate Fibonacci series using dynamic programming is ____ .
   a) O(n) b) O(log n) c) O(n log n) d) $O(2^n)$

15. Consider two strings X= "B,D,C,A,B,A" and Y="A,B,C,D,A,B". Generate a table for solving a longest common subsequence problem. Assume that the table[0,...] = 0 and table[..., 0] = 0, what is the value of table[3, 5]? Put X as column and Y as row.
   a) 1 b) 2 c) 3 d) 4

16. What is the complexity of dynamic programming algorithm to solve matrix chain multiplication?
   a) $O(4/3n^2)$ b) O(n) c) $O(n^2)$ d) $O(n^3)$

17. Which of the following algorithms finds the shortest path from a source vertex to every other vertex in weighted directed graph?
    a) Prim's algorithm's
    b) Kruskal's algorithm
    c) Dijkstra's algorithm's
    d) Huffman algorithm

18. What is TRUE about Greedy Algorithm?
    a) The complexity of greedy algorithm is O(log n).
    b) Overlapping sub-problem is the element of greedy algorithm.
    c) Greedy choice property is the element of greedy algorithm.
    d) All of the above

19. Which of the following can be solved using dynamic programming?
    a) To generate Fibonacci series.
    b) To solve 0-1 knapsack problem.
    c) To solve matrix chain multiplication problem.
    d) All of the above

20. Algorithms like merge sort, quick sort and binary search are based on _____.
    a) dynamic programming
    b) divide and conquer
    c) greedy technique
    d) brute force

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SECTION "B"
[6 Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. What do you mean by analysis of algorithms? Discuss at least three different asymptotic notations. [1+3]

2. Simulate insertion sorting algorithm int the following set of numbers.
56, 76, 12, 46, 83, 20, 44, 51

3. State activity selection problem. Write an algorithm to solve activity selection problem using greedy algorithm. [1+3]

4. Demonstrate how quick sort algorithm works?

5. Describe divide and conquer technique of solving a problem. Write an algorithm to find minimum and maximum elements from an array using divide and conquer technique. [2+2]

6. State Longest Common Subsequence problem. How does dynamic programming algorithm can be used to solve this problem? Illustrate with an example. [1+3]

7. The character encoding induced by the binary tree is shown below where again, 0 is used for left edges and 1 for right edges.

char	binary
g	00
m	01
p	1110
h	1101
e	101
r	1111
s	1100
t	100

Draw a binary tree such that it generates given binary codes.

SECTION "C"

[2 Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Consider the matrices A_1, A_2, A_3, and A_4 with following dimensions.

Matrix	Dimensions
A_1	4 x 2
A_2	2 x 3
A_3	3 x 1
A_4	1 x 5

Use dynamic programming to fill up m-table and s-table. Find the optimal parenthesization of above matrices.

9. Simulate the heap sort algorithm with following set of numbers.

45 21 78 23 55 61 15 32

10. Consider a following graph. Simulate Dijkstra's algorithm step-by-step and find out the shortest path starting from source node 1.