KATHMANDU UNIVERSITY
End Semester Examination
May/June, 2022

Level : B.E./B.Sc.
Year : III
Time : 2 hrs. 30 minutes

Course : COMP 314
Semester : II
F.M. : 40

SECTION "B"

[6Q × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Explain in brief about the importance of rate of growth in algorithm analysis. Explain it with different mathematical functions.

2. Compare the complexity of representing data with hash table and linked list having recurring data items.

3. Write a pseudo code for insertion sort. Analyze and verify the correctness of the algorithm. [2+2]

4. Simulate heapify in min heap construct and simulate heap sorting in following order of array elements.
   5 6 8 2 1 3
   Explain in brief about the complexity of heap sort. [2+2]

5. Analyze the complexity of given pseudo code: (where n is number of input) [2+2]

   a.
   ```
   for(i=0;i<n/2;i++)
       for(j=1;j<n;j=j*4)
           Statements
   ```

   b.
   ```
   x=1
   while (x<n)
       Statements
       x+=x
   end while
   ```

6. Mathematically represent the solution of 0/1 Knapsack problem using branch and bound technique. Find the optimal solution using Branch and bound 0/1 Knapsack problem, for items of price Rs. 45, Rs. 25, Rs. 35, Rs. 20 having weight of 7kg,3kg,4kg and 2kg respectively and weight limit of 11kg. Explain the intermediate steps in brief. [1.5+2.5]

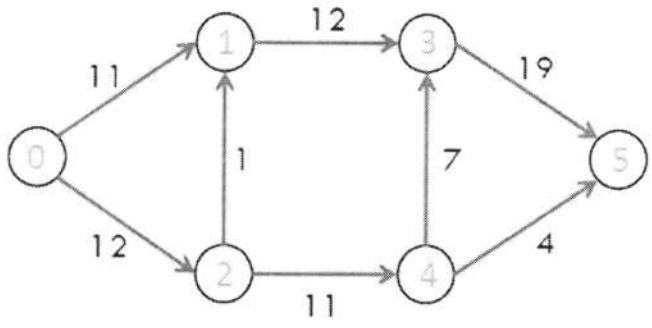
7. Explain in brief about the graph representation techniques appropriate for sparse and dense graphs.

SECTION "B"

[2Q × 8 = 16 marks]

Attempt *ALL* questions.

8. Implement Ford Fulkerson's method to find max flow from source 0 to sink 5 in the following graph. Discuss intermediate residual graphs including at least one case of non-zero backward edge. Discuss the complexity of the method in brief. [6+2]



9. Write in brief about components of Dynamic Programming. Discuss the complexity of finding Longest Common Subsequence between two strings using brute force approach. How dynamic programming implementation to solve LCS improves the complexity? Implement Dynamic programming to find LCS between "speculate" and "splatula". Briefly explain intermediate steps. [2+2+4]

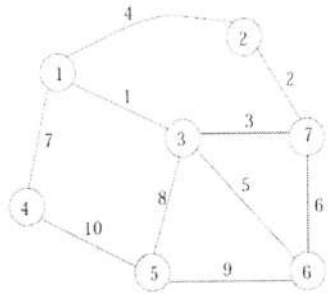
KATHMANDU UNIVERSITY
End Semester Examination
May/June, 2022

Mark 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 :

SECTION "A"
[20 Q × 0.5 = 10 marks]

Encircle the most appropriate answer. Symbols have their own meanings.



1. Consider the following graph. Which edges, and in which order, are selected by Kruskal's algorithm if it stars at vertex 1?
   a. (1,3), (3,7), (2,7), (7,6), (1,4), (3,5)
   b. (1,3), (2,7), (3,7), (3,5), (7,6), (1,4)
   c. (1,3), (3,7), (2,7), (3,6), (1,4), (3,5)
   d. (1,3), (3,7), (2,7), (3,5), (7,6), (1,4)

2. Let A be an adjacency matrix of a graph G. The ij^{th} entry in the matrix A, gives ____.
   a. the number of paths from vertex Vi to vertex Vj.
   b. the weight of edge from vertex Vi to vertex Vj.
   c. length of a Eulerian path from vertex Vi to vertex Vj.
   d. length of a Hamiltonian cycle from vertex Vi to vertex Vj.

3. There are nodes in a tree such that, y is right child of x, B is left child of y and C is right child of y, A is left child of x. After left-rotation on T.x
   a. B becomes right child of x
   b. B becomes left child of x
   c. B becomes left child of y
   d. B becomes right child of y

4. 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(V3)

5. The optimal profit for items (x1,x2,x3 and x4 respectively) of price Rs. 45, Rs. 25, Rs. 35, Rs. 20 having weight of 7kg,3kg,4kg and 2kg respectively and weight limit of 11kg. is
   a. x1, x3, and x4
   b. x1 and x4
   c. x2 and x4
   d. x2 , x3 and x4

6. Residual capacity of a path at the beginning is ___.
   a. total capacity of the path
   b. minimum capacity of the path
   c. total capacity that has flowed
   d. empty

7. The depth of a complete binary tree is given by ___.
   a. $Nlog_2 n$
   b. $Nlog_2 n + 1$
   c. $Log_2(n+1)$
   d. $\log_2 n$

8. Most optimal way of parenthesization in matrix chain multiplication of A2x3.B3x4.C4x2.D2x3.E3x1 is
   a. ((A2x3.B3x4).(C4x2.D2x3)).E3x1
   b. (A2x3.(B3x4.(C4x2.D2x3))).E3x1
   c. ((A2x3.B3x4).C4x2.)D2x3).E3x1
   d. (A2x3.B3x4).((C4x2.D2x3).E3x1)

9. The post order traversal of a binary tree is DEBFCA. Find out the pre order traversal.
   a. ABFCDE b. ADBFEC c. ABDCEF d. ABDECF

10. Which of the following has minimal Worst Case Time Complexity?
   a. Merge Sort b. Quick Sort c. Selection Sort d. Insertion Sort

11. Finding out the successor of a node in BST takes _____.
   a. O(height of tree)
   b. O(total no. of nodes)
   c. O(total number of nodes greater than given node)
   d. O(nlogn)

12. NP problems has ___.
   a. non polynomial time complexity
   b. non deterministic polynomial time complexity
   c. exponential complexity
   d. very high polynomial time complexity

13. 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.

14. LCS between 11010101101 and 1010101110 is ___.
   a. 10101010 b. 101010111 c. 1010100 d. 1101010110

15. In a graph if e=[A,B], then A and B are called ___.
   a. End points of e b. Adjacent nodes c. Neighbours d. All of the above

16. The recurrence relation g(n) = g(n-1) + 2n -1, g(0) = 0 defines the function,
   a. $f(n)=n^2$ b. f(n)= n/2 c. f(n)=n(n-1) d. f(n)=n-1

17. The approach to algorithm design that addresses combinatorial problems in the most straightforward way is _____.
   a. divide and conquer b. dynamic programming
   c. brute force d. greedy

18. The following loop pseudo code has complexity of ___ . (where n is number of input)
for(i=n;i>1;i=i/2)
   a. O(logn) b. O(√n) c. O(n/2) d. O(n)

19. Branch and Bound is used for solving ____
   a. finding any possible solution. b. backtracking problems.
   c. brute force problems. d. optimization problem.

20. Complexity of Heap Sort in best case scenario is:
   a. O(logn) b. O(√n) c. O(nlogn) d. O(n)