Bangladesh Army University of Science and Technology

Department of Computer Science and Engineering

Referred/Improvement/Backlog Examination, Fall 2018 — **Level-2 Term-II**
Course Code: CSE 2201 — **Course Title: Algorithms**
Time: 03 (Three) hours — **Full Marks: 210**

N.B. (i) Answer any three questions from each PART (ii) Use separate answer script for each PART
(iii) Marks allotted are indicated in the margin (iv) Symbols have their usual meanings

PART A

(Answer any **three** questions)

1. a) Define algorithm. What is the complexity of an algorithm? Write a simple code segment that has cubic complexity. 15

   b) Briefly describe Best Case, Worst Case and Average Case complexity of an algorithm. 10

   c) Give an algorithm for merging two sorted lists in O(n) time. You need to prove the time complexity of your algorithm. 10

2. a) What is "recurrence"? Name three methods for solving recurrence. By using any one of them, prove that, the complexity of merge sort is O(nlogn). 20

   b) Write down the pseudo code of Quicksort algorithm. In quicksort, what is the best case partitioning and the worst case partitioning? By considering your algorithm, give one sample input for each case. 15

3. a) The 'LCS problem' is defined as follows. Given two sequences, find the length of longest common subsequence. A subsequence is a sequence that appears in the same relative order, but not necessarily contiguous. Now, answer the following questions. 20

      i) Design an algorithm to solve this problem.

      ii) Construct an iterative table using your algorithm to find LCS between two sequences "BAUSTIAN" and "BANGLADEH"

   b) What is dynamic programming? Compare top-down and bottom-up approach in dynamic programming. In top-down approach (recursive) how do you handle overlapping sub-problem? 15

4. a) What is spanning tree? Write Prim's algorithm that computes a minimum spanning tree of a graph. Analyze the time-complexity of the algorithm. 15

   b) What is Topological sort? Perform topological sort on graph G given in figure 1. You should mention every step. 8

      [whenever there is a choice of vertices, always use numeric order]

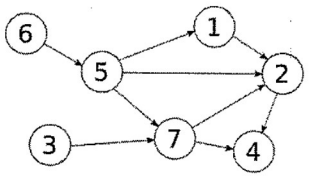


Figure 1: Graph G

   c) What do you understated by strongly connected graph? Write an algorithm that determine whether a graph is strongly connected or not. By using your algorithm prove that the graph G shown in figure 1 is not a strongly connected graph. 12

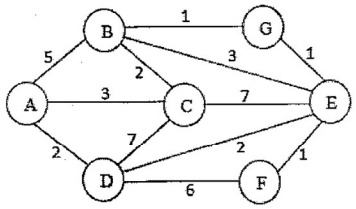
PART B

(Answer any **three** questions)

5. a) Write down the differences between BFS and DFS algorithm. 10

   b) What is DAG? Give a simple example. 5

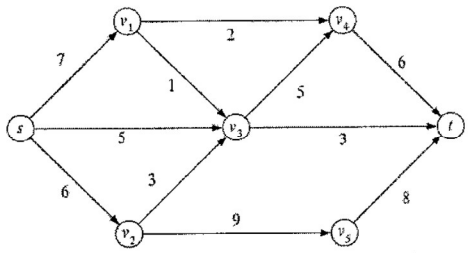
c) Find the shortest path of following graph using Dijkstra single source shortest path algorithm. Here starting/source vertex is A. Draw each step separately. 20



6. a) What is flow network? Prove that, if f is a flow of a flow network then $|f| = (V, t)$. 15

b) Consider the flow network G given in Figure 6.b. Does it have maximum flow? If not find the maximum flow. 20

[Hint: Residual network and augmenting path]



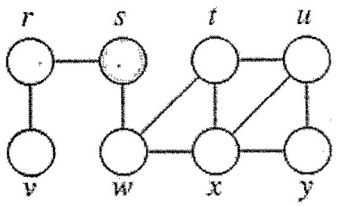
7. a) Give an approximation algorithm for the vertex cover problem. Analyze the approximation ratio of your algorithm. 15

b) What is state-space-tree? Solve the given instance of the 0/1 knapsack problem using the branch-and-bound approach with a state-space-tree. Assume the knapsack capacity is 15. 20

Item	Weight	Value
1	7	140
2	6	132
4	3	140

8. a) Compare backtracking, and branch-and-bound techniques. 5

b) Show the operation of Breath–First Search on the following graph starting from source vertex S. Show the QUEUE of each step including their distance and parents. 20



c) By using decision tree show that, the lower bound for comparison based sorting is $O(nlogn)$. 10