Roll No : _____

Amrita Vishwa Vidyapeetham
Amrita School of Engineering, Amritapuri Campus
Second Periodical Examination, October 2018
I SEMESTER M.Tech. CSN
18SN601 - Practical Algorithms for Programmers

Time: 2 Hours **Max. Marks: 50**

Part A- Theory (25 marks)

1. Given an adjacency-list representation of a directed graph, what is the time complexity to compute the out-degree of **every** vertex? How long does it take to compute the in-degrees? (3 marks)

2. Suppose we want to find a shortest path from *s* to *w* in a graph G where the length of a path is simply the number of edges in the path (e.g. to plan an airline trip with the fewest stops). Which of the algorithms or traversal strategies would you use? Why? (2 marks)

3. Let P be a shortest path from vertex *s* to some other vertex *t* in the graph. If the weight of each edge in the graph is increased by one, does P remain the shortest path from *s* to *t*. (3 marks)

4. Say true or false: (3 marks)
   a) If a topological sort exists for the vertices in a directed graph, then a DFS on the graph will produce no back edges.
   b) Every directed acyclic graph has exactly one topological ordering
   c) Given an undirected graph, it can be tested to determine whether or not it is a tree in O(V+E) time

5. Show the steps in multiplying the integers 2135 and 4014 using the divide and conquer long integer multiplication method. Compare the number of multiplications required in computing this product using the above method and the naïve approach. (7 marks)

6. Here are the adjacency lists (with edge weights in parentheses) for a digraph
   A: B(4), F(2)
   B: A(1), C(3), D(4)
   C: A(6),B(3), D(7)
   D: A(6), E(2)
   E: D(5)
   F: D(2), E(3)

   The digraph has 3 shortest paths from C to E (i.e all with the same total weight).Which of these paths is the one that would be found by Dijkstra's shortest path algorithm? (show the main steps of the algorithm) . (7 marks)

Part B – Lab (25 marks)

7. Given a undirected graph, check whether the graph contains a cycle or not. Return true if the given graph contains at least one cycle, else return false.