Birla Institute of Technology and Science-Pilani, Hyderabad Campus
First Semester 2020-2021
Lab Sheet-5
CS G526: Advanced Algorithms and Complexity
Date: 25/11/20

General Instructions: Argue logically. Write it in a manner that explains your logic very clearly. Do not miss steps in between.

Problem-1: **[30 pts]** Suppose you are given two jugs, one is m litre and another in n litre. Can you measure X litre of water using these two jugs? Your program should print the configuration at each state. A configuration is a pair (A, B) where A is the amount of water in the m-litre jug and B is the amount of water in the n-litre jug. Final configuration should satisfy $A = x$ or $B = x$. The jugs do not have any marking, so you can not get partial measurement using a jug.

Problem-2: **[30 pts]** Suppose you are given an undirected graph without any cycle. Can you write a program to find the size of the largest path in the graph in $O(m + n)$ time where m and n are number of edges and the number of vertices in the graph? You should print the path as well.

Problem-3: **[10 pts]** A sink vertex in a directed graph is a vertex that does not have any outgoing edges. Given a directed graph, can you count the number of sink vertices? Suppose you are given the graph in a edge list format where (u, v) indicates an edge from u to v?

Problem-4: **[30 pts]** Given a directed graph and a pair of nodes s and t, print all possible paths from s to t. You can assume that the graph is given in the edge list format.