

# Assignment 12

## Module: Graphs

### Instructions:

- HONOR CODE: WORK ON THIS ASSIGNMENT WITH AT MOST ONE PARTNER. BETWEEN DIFFERENT TEAMS, COLLABORATION IS AT LEVEL 1 [VERBAL COLLABORATION ONLY]
  - Write each problem on a separate page; If a problem has multiple parts, you can write all parts on the same page, as long as you leave space in between them.
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1. Suppose the degree requirements for a computer science major are organized as a *DAG* (directed acyclic graph), where vertices are required courses and an edge  $(x, y)$  means course  $x$  must be completed prior to beginning course  $y$ . Make the following assumptions:
  - You must take **all** CS classes listed in the requirements
  - All prerequisites must be obeyed.
  - There is a course, CPS1, that must be taken before any other course.
  - Every course is offered every semester (unlike our department).
  - There is no limit to the number of courses you can take in one semester, and, you are guaranteed to get into any CS course you register for (again, unlike our department).

Describe an efficient algorithm to compute the minimum number of semesters required to complete the degree and analyze its running time.

2. We are given a directed graph  $G = (V, E)$  on which each edge  $(u, v)$  has an associated value  $r(u, v)$ , which is a real number in the range  $[0, 1]$  that represents the reliability of a communication channel from vertex  $u$  to vertex  $v$ . We interpret  $r(u, v)$  as the probability that the channel from  $u$  to  $v$  will not fail, and we assume that these probabilities are independent. Give an efficient algorithm to find the most reliable path between two given vertices.