

# CSci 231 Homework 10 \*

## Graph Algorithms

CLRS Chapter 24, 25

1. (CLRS 25.2-4) 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.
2. (CLRS 26.1-3) What does the matrix  $D^{(0)}$  correspond to in regular matrix multiplication?
3. (CLRS 26.1-4) Show how to express the SSSP problem as a product of matrices and a vector. Describe how evaluating this product corresponds to a Bellman-Ford-like algorithm.
4. (CLRS 24.1-1) Let  $(u, v)$  be a minimum-weight edge in a graph  $G$ . Show that  $(u, v)$  belongs to some minimum spanning tree of  $G$ .
5. (CLRS 24.2-4) Suppose that all edge weights in a graph are integers in the range from 1 to  $|V|$ . How fast can you make Kruskal's algorithm run? What if the edge weights are integers from 1 to  $W$  for some constant  $W$ ?
6. (CLRS 24.2-5) Suppose that all edge weights in a graph are integers in the range from 1 to  $|V|$ . How fast can you make Prim's algorithm run? What if the edge weights are integers from 1 to  $W$  for some constant  $W$ ?

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\*Collaboration is allowed and encouraged, if it is constructive and helps you study better. Remember, exams will be individual. Write the solutions individually, and list the names of the collaborators along with the solutions.