

Luis Gascon, Ethan Webb, Femi Dosumu  
COSC 336  
April 30, 2023

## Assignment 8

### Exercise 1.

Describe in plain English (a short paragraph with at most 5-6 lines should be enough) an algorithm for the following task:

*Input:* A directed graph  $G = (V, E)$ , and a node  $u \in V$ .

*Goal:* Output 1 if there is a path from every  $v \in G$  to  $u$  (so if  $u$  is reachable from any other node), and output 0 otherwise.

Your algorithm should have runtime  $O(n + m)$ . (Hint: Use an idea that we have seen for similar connectivity problems in directed graphs.)

### Exercise 2.

We have seen that Dijkstra's algorithm can be implemented in two ways: Variant (a) uses an array to store the  $dist[]$  values of the unknown nodes, and Variant (b) uses a MIN-HEAP to store these values.

(a) Suppose in your application  $m \leq 3n$ . Which variant gives a faster runtime? Justify your answer.

(b) Suppose in your application  $m \geq n^2/3$ . Which variant gives a faster runtime? Justify your answer.