CS3000: Algorithms & Data — Summer 2025 — Laney Strange

Recitation 4 Date: June 3rd, 2025

Name:

- Recitation problems are for practice only. We'll go over the solutions during your scheduled recitation on Tuesday!
- We will provide .tex starter files for recitations, just as we do for homeworks. For most recitations, we encourage you to work out your solution in LAT_EX to practice with typesetting.
- Collaboration is strongly encouraged during recitation!

Problem 1. Graph Representation



(a) How would you represent the graph above using an adjacency matrix? (We've started the table for you.

vertex	A	B	C	D	E	F	G
A	0	0	0	1	1	0	0
В							
C							
D							
E							
F							
G							

Solution:

(b) In pseudocode, we use G.A[v][u] to index into the adjacency matrix. For the example above, give a short pseudocode snippet that would print out all of E's neighbors.

Solution:

Problem 2. Counting Degrees

In a directed graph, the *out-degree* of a vertex is its total outgoing edges, and the *in-degree* of a vertex is its total incoming edges. (For this problem, note that G.adj[v] is the notation we use to access the adjacency list of vertex v.)

(a) Describe (in English) how you would count the out-degree of every vertex in a directed graph, given an adjacency-list representation. What would be the run-time?

Solution:

(b) Give pseudocode for an algorithm that would compute the in-degree of every vertex for a directed graph, given an adjacency-list representation. Your algorithm should take G as its only parameter, and assume every vertex v has an attribute v.indeg.

Solution:

Problem 3. Sinks

In a directed, unweighted graph, a vertex k is a "universal sink" if and only if k has in-degree |G.V| - 1 and out-degree 0. Can k be a universal sink if...

(a) ... for any vertex $i \neq k, G.A[k][i] == 1$?

Solution:

(b) ...G.A[k][k] == 1?

Solution:

(c) ... for all vertices $i \neq k, G.A[i][k] == 1$?

Solution:

(d) ... for any vertices $i \neq k$, G.A[i][k] == 0?

Solution: