AUBURN UNIVERSITY

CPSC 3283 M1-Homework

Questions and Exercises to work out and turn in:

Grading Guidelines:

- A right answer will get full credit when:

1. It is right (worth 25%)
2. It is right **AND** neatly presented making it easy and pleasant to read. (worth an **extra** 15%)
3. There is an **obvious and clear link** between 1) the information provided in the exercise and in class and 2) the final answer. A clear link is built by properly writing, justifying, and documenting an answer (worth an **extra** 60%).
4. Calculation mistakes will be minimally penalized (2 to 5% of full credit) while errors on units will be more heavily penalized.

You are welcome/encouraged to discuss exercises with other students or the instructor. But, ultimately, **personal** writing is expected.

- USE THIS FILE AS THE STARTING DOCUMENT YOU WILL TURN IN. **DO NOT DELETE ANYTHING FROM THIS FILE:** JUST **INSERT** YOUR ANSWERS.

- IF USING HAND WRITING (STRONGLY DISCOURAGED), **USE THIS FILE** BY CREATING SUFFICIENT SPACE AND WRITE IN YOUR ANSWERS.

- FAILING TO FOLLOW TURN IN DIRECTIONS /GUIDELINES WILL COST **A 30% PENALTY.**

Objectives of this assignment:

- to use and manipulate the concepts presented in this module
- to propose and write algorithms in pseudocode
- to analyze the time complexity of algorithms
- to analyze the space complexity of algorithms
- to learn autonomously new concepts

What you need to do:

Answer the questions and/or solve the exercises described below.

Questions (5 points):

Research online what *out-degree* and *in-degree* of a vertex v means. Use then your own words to explain the definition of *out-degree* and *in-degree.*

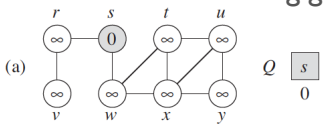
Exercise 1 (15 points)

Consider an adjacency-list representation of a directed graph G=(V,E).

a) Propose in pseudocode an algorithm A to compute the in-degree of each vertex in V.
b) What is the time complexity of A?
c) Propose in pseudocode an algorithm B to compute the out-degree of each vertex in V.
d) What is the time complexity of B?

Exercise 2 (35 points) Breadth-First Search

Consider the following graph G=(V,E):



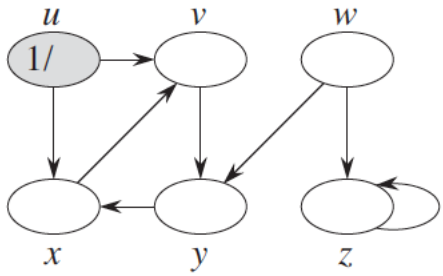
a) Complete V= {y, x, ….} (Fill in the blanks. Sort V **reverse** alphabetically z→a)
b) Complete E = {(y,x), …} (**Pay attention**: G is undirected)
c) Complete the adjacency list as a table {sort Adj[u] **reverse** alphabetically z→a}

Vertices u	Adj[u]
y	{x, ..}
x	
..	

d) Execute Breadth-First Search (**BFS(G,v)**) on Graph G with taking Vertex ***v*** as the source. **Respect** the order of the adjacency list as completed in the previous question. Show all figures (a) through (i) just like Figure 22.3 in the textbook. The number of figures may differ.

Exercise 3 (35 points) Depth-First Search

Consider the following graph G=(V,E):



(a)

a) Complete V= {z, ….} (Fill in the blanks. Sort V alphabetically **in reverse z→a**)
b) Complete E = {(z,z), …}
c) Complete the adjacency list as a table {sort Adj[u] alphabetically **in reverse z→a**}

Vertices u	Adj[u]
z	{z, ..}
y	
x	

d) Execute Depth-First Search (**DFS(G)**) on Graph G. **Respect** the order of the adjacency list as completed in the previous question. Show all figures (a) through (p) just like Figure 22.4 in the textbook. The number of figures may differ.

Exercise 4 (10 points) Topological Sort

Consider the following graph G=(V,E):

Vertices u	Adj[u]
u	{v, x}
v	{y}
w	{y, z}
x	
y	{x}
z	

a) Execute Topological Sort on Graph G. **Respect** the order of the adjacency list above. Make sure to collect the finish times and report them. No need to draw all intermediary steps.

Vertices r	u	v	w	x	y	z
Finish time r.f						

b) List the linear ordering.

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What you need to turn in:

- Electronic copy of this file (including your answers) (standalone). Submit the file as a Microsoft Word or PDF file.
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- Recall that answers must be well written, documented, justified, and presented to get full credit.
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- How this assignment will be graded:
- A right answer will get full credit when:
- It is right (worth 25%)
- It is right AND neatly presented making it easy and pleasant to read. (worth 15%)
- There is an obvious and clear link between 1) the information provided in the exercise and in class and 2) the final answer. A clear link is built by properly writing, justifying, and documenting an answer (worth 60%).
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