

**Collaboration Policy:** You are encouraged to collaborate with up to 4 other students, but all work submitted must be your own *independently* written solution. List the computing ids of all of your collaborators in the `collabs` command at the top of the tex file. Do not share written notes, documents (including Google docs, Overleaf docs, discussion notes, PDFs), or code. Do not seek published or online solutions for any assignments. If you use any published or online resources (which may not include solutions) when completing this assignment, be sure to cite them. Do not submit a solution that you are unable to explain orally to a member of the course staff. Any solutions that share similar text/code will be considered in breach of this policy. Please refer to the syllabus for a complete description of the collaboration policy.

**Collaborators:** collaborators

**Sources:** sources

### PROBLEM 1 *Proving Complexity*

Given the following functions,  $f(n) = n^2 + 6n + 20$  and  $g(n) = n^2$ .

1. Show that  $f(n) = \Theta(g(n))$  using a direct proof. Choose integer values for  $n_0$  and  $c$  that are low, or about as low, as possible.

**Solution:**

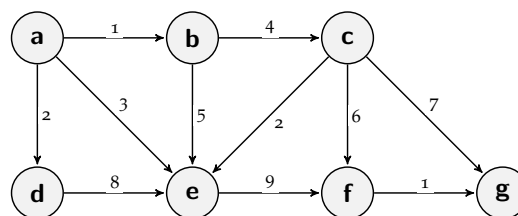
2. Show that  $f(n) = \Theta(g(n))$  using a limit definition. Explain your answer.

**Solution:**

$$\lim_{n \rightarrow \infty} \frac{f(n)}{g(n)} = \dots$$

### PROBLEM 2 *Graph Representations*

Consider the following weighted digraph:



Graph G

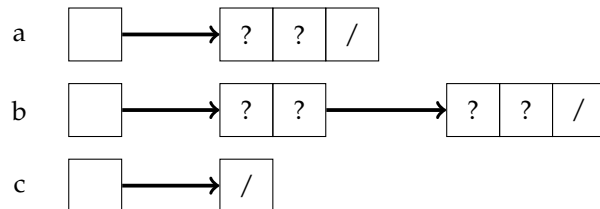
1. Show a representation of this graph using an adjacency matrix. Your representation should look similar in format to the adjacency matrix shown in class (see slide #12 from "graphs"). The format of a graph is given to you as a starting point. If no edge exists, leave the cell blank. The number "2025" has been placed in the first cell just to show you where to modify cell values. Remove it and either leave it blank or replace it with a value if appropriate.

**Solution:**

	a	b	c	d	e	f	g
a	2025						
b							
c							
d							
e							
f							
g							

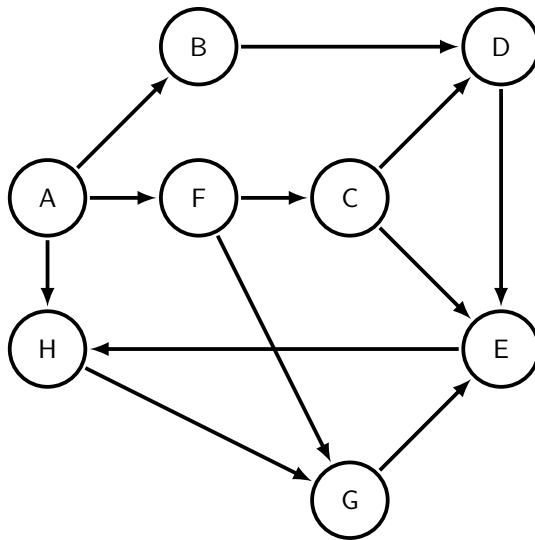
2. Show a representation of this graph using an adjacency list. Your representation should look similar in format to the adjacency list shown in class (see slide #12 from "graphs"). Example formatting is given to you below.

**Solution:**



**PROBLEM 3** *BFS vs. DFS*

Given the following unweighted digraph:



1. Perform a breadth first search starting with node A. List the nodes visited in order of when they are first visited. Note: When multiple nodes could be chosen at a given step, pick the one that comes first alphabetically (i.e. If either node F or node H could follow node C, choose node F because F is alphabetically before H).

**Solution:**

2. Perform a depth first search starting with node A. List the nodes visited in order of when they are first visited. Note: When multiple nodes could be chosen at a given step, pick the one that comes first alphabetically (i.e. If either node F or node H could follow node C, choose node F because F is alphabetically before H).

**Solution:**