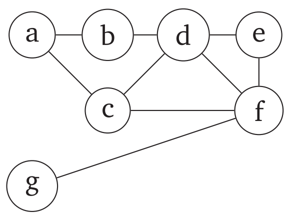
Name ____

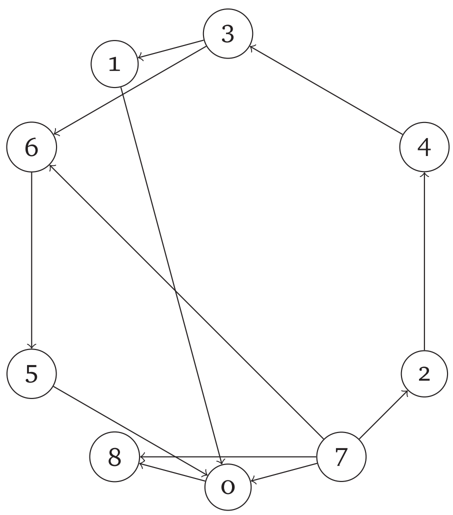
CSCI 332, Fall 2025
Quiz 4

1. (3 points) What are the layers produced by BFS on the following graph starting from node c? If a layer is not present, leave it blank.



$L_0 = \{ \qquad \qquad \}$
$L_1 = \{ \qquad \qquad \}$
$L_2 = \{ \qquad \qquad \}$
$L_3 = \{ \qquad \qquad \}$

2. (3 points) For each of the following orderings of the vertices of the graph below, indicate whether or not it is a valid topological ordering.



   (a) $0, 1, 2, 3, 4, 5, 6, 7, 8$. Yes or no?

   (b) $7, 2, 4, 3, 1, 6, 5, 0, 8$. Yes or no?

   (c) $7, 2, 4, 3, 6, 5, 1, 0, 8$. Yes or no?

3. (4 points) Order the following statements from 1 to 9 to produce a proof of the following statement: *If G is a DAG, then G has a node with no incoming edges.*

   __ Because there is a cycle in G, we have a contradiction with the assumption that G is a DAG.
   __ Since v_0 has an entering edge, we can follow it backwards to v_1.
   __ Let G be such a DAG where every node has at least one incoming edge.
   __ Start at any node v_0 in G.
   __ Since v_1 has an entering edge, we can follow it backwards to v_2.
   __ Since there are only n nodes, after $n+1$ steps we must have visited a node more than once.
   __ Since every node has an entering edge, we can follow this process indefinitely.
   __ For the sake of contradiction, assume that not every DAG has a node with no incoming edge.
   __ This produces a cycle.