	ay, July 30, 2019 1:06 PM		
	CS 61BL Lab 16 Summer 2019 July 30, 2019		
	Name: SID: Please complete this worksheet during your lab, and turn it in to your TA by the end of your section. You are encouraged to work with your neighbors collaboratively. Section Number: (1) (2) (03) (04) (05) (06) (07) (08) (09) (10) (11) (12)	C und rector	
1.1	 Edge vs. Vertex Counts Suppose that G is a directed graph with N vertices. What's the maximum number of edges that G can have? Assume that a vertex cannot have an edge pointing to itself, and that for each vertex u and v, there is at most one edge (u, v). 	N = 1 + N + 2 + N + 3	N-1 -1)
	$ N(N-1) $ $ O \frac{N(N-1)}{2} $ $ N^{-1} + N^{-1} $	2++2+(+0	
1.2	 assume that no vertex is adjacent to itself, and at most one edge connects any pair of vertices. What's the maximum number of edges that G can have compared to the directed graph of G? half as many edges the same number of edges twice as many edges 		
1.3	 What's the minimum number of edges that a connected undirected graph with N vertices can have? N-1 N 		
	$O = N^{2}$ $O = N(N-1)$ $O = \frac{N(N-1)}{2}$		

2 Lab 16 Worksheet

2 Trade Offs

 1. Which is most space-efficient is your graph? Adjacency matrix Adjacency lists It depends They are the same 2. Which is most space-efficient is your graph? Adjacency matrix Adjac	2.1 Sp	pace		
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 3. Which is most time-efficient for adding an edge if you have a lot of edges in your graph? 6. Which is most time-efficient for returning a list of edges from one node if you have a lot of edges in your graph? 6. Adjacency matrix 6. Adjacency matrix 6. Which is most time-efficient for returning a list of edges from one node if you have a lot of edges in your graph? 6. Adjacency matrix 7. Adjacency lists 8. Adjacency lists 9. Adjacency lists 9. It depends 9. It depends 		\bigcirc It depends	\bigcirc It depends 2	1-720)
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		\bigcirc They are the same	\bigcirc They are the same	

Lab 16 Worksheet 3

N

N²

rz

- 2.2 Runtime
 - 1. Using an adjacency matrix, how long in the worst case does it take to determine if vertex v is adjacent to vertex w? (Assume vertices are represented by integers.)
 - 🍅 constant time
 - \bigcirc time proportional to the number of neighbors of vertex v
 - \bigcirc time proportional to the number of vertices in the graph
 - \bigcirc time proportional to the number of edges in the graph
 - 2. Using an array of adjacency lists, how long in the worst case does it take to determine if vertex v is adjacent to vertex w? (Assume vertices are represented by integers.)
 - ⊖ constant time
 - fine proportional to the number of neighbors of vertex v
 - \bigcirc time proportional to the number of vertices in the graph
 - $\bigcirc\,$ time proportional to the number of edges in the graph

3 Memory Use

 $\fbox{3.1} Suppose we are representing a graph with N vertices and E edges. There are$ Suppose we are representing a graph N^2 booleans stored in an adjacency matrix, so the memory required to store an Nadjacency matrix is N^2 times the memory required to store a boolean value. Assume that references and integers each use 1 unit of memory. The amount of memory required to represent the graph as an array of adjacency lists is proportional to what? Ē

N

D

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2

3

 $\bigcirc NE$

 $\bigcirc E^2$

 $\bigcirc N + E$ $\bigcirc E$

 $\mathcal{G}(N+E)$

4 Lab 16 Worksheet

4 Topological Sorting

[4.1] Give a valid topological sort of the graph below. For your reference, some orderings of the graph are provided below the graph.

E G B (A)Ć D ſ (7

DFS preorder: ABCFDE (G) DFS postorder: FCBEDA (G) BFS: ABDCEF (G)

GADEBCF