Week 4 Quiz [Fall 2019]

Due Sep 20 at 11:59pm **Points** 25 **Questions** 25 **Time Limit** None

Instructions

Submission Guidelines

This assignment has multiple-choice and numeric response questions. Only one submission is allowed, however as long as the quiz is not submitted, it is automatically saved and can be resumed.

Upon submission, make sure you have a record of the submission (with timestamp) on the assignment/quiz page on Canvas. If we do not have your submission in Canvas, you will **not** receive credit.

It is essential to follow these instructions to provide answers for this assignment. **Students who do not follow these guidelines will lose points.**

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	51 minutes	20 out of 25

Correct answers are hidden.

Score for this quiz: **20** out of 25
Submitted Sep 18 at 1:59pm
This attempt took 51 minutes.

Incorrect

Question 1

0 / 1 pts

True or False: Given any two nodes in a tree, there exists exactly one path between those two nodes that can be taken without backtracking (by backtracking, I mean going from node A to B, then back to A, for example).

- ○ True
- ● False

Question 2

1 / 1 pts

Consider an undirected, connected graph with N nodes. What is the **maximum** number of edges that graph can have?

- 1
- N-1
- N
- N (N - 1) / 2
- N (N - 1)
- N^2

Question 3

1 / 1 pts

If we do not require that the graph from the previous question be connected, does this change the **maximum** number of edges possible?

- Yes
- No

Question 4

1 / 1 pts

Again consider an undirected, connected graph with N nodes. What is the

minimum number of edges that graph can have?

- 1
- N - 1
- N
- N (N - 1) / 2
- N (N - 1)
- N^2

Question 5

1 / 1 pts

If we do not require the graph from the previous question be connected, does this change the **minimum** number of edges possible?

- Yes
- No

Question 6

1 / 1 pts

Now consider a **bipartite** graph of N nodes, N_1 nodes of type 1 and N_2 nodes of type 2 (so that N_1 + N_2 = N). What is that **maximum** number of edges in this graph?

- N - 1
- N_1 + N_2

- N_1 * N_2
- N (N - 1) / 2
- N ^ 2

Question 7

1 / 1 pts

Consider this adjacency matrix to answer the following questions. It may help if you print this out and/or draw a network diagram so you can refer to it without scrolling up.

An entry in the i^{th} row and j^{th} column indicates the weight of the edge from node *i* to node *j*. For instance, the entry in the 2^{nd} row and 3^{rd} column is 2, meaning the weight of the edge *from* node B *to* node C is 2.

	A	B	C	D	E	F
A	0	1	0	0	0	0
B	1	0	2	0	0	0
C	0	0	0	0	0	0
D	0	5	0	0	1	0
E	0	0	0	0	0	1
F	2	1	3	1	1	0

What kind of graph does this matrix define?

- Directed, weighted
- Directed, unweighted

Undirected, weighted

Undirected, Unweighted

Question 8

1 / 1 pts

Consider the graph defined by the adjacency matrix in the previos question. How many nodes are in this graph?

6

Incorrect

Question 9

0 / 1 pts

Consider the graph defined by the adjacency matrix in the first question. How many edges are in this graph?

12

Question 10

1 / 1 pts

Consider the graph defined by the adjacency matrix above. Are there any cycles in this network?

Yes

No

Question 11

1 / 1 pts

Consider the graph defined by the adjacency matrix above. Are there any self-loops in this network?

- ○ Yes
- ◉ No

Question 12

1 / 1 pts

Consider the graph defined by the adjacency matrix above. Is this graph **strongly** connected?

- ○ Yes
- ◉ No

Question 13

1 / 1 pts

Consider the graph defined by the adjacency matrix above. Is this a graph **weakly** connected?

- ◉ Yes
- ○ No

Question 14

1 / 1 pts

Consider the graph defined by the adjacency matrix above. Are there any hubs with outgoing links to every other node? Select any nodes with this property, or else select "none of the above."

- [ ] A
- [ ] B
- [ ] C
- [ ] D
- [ ] E
- [x] F
- [ ] None of the above

Question 15

1 / 1 pts

Consider the graph defined by the adjacency matrix above. Are there any nodes with incoming links from every other node? Select any nodes with this property, or else select "none of the above."

- [ ] A
- [ ] B
- [ ] C
- [ ] D

- [ ] E
- [ ] F
- [x] None of the above

Incorrect

Question 16

0 / 1 pts

Consider the graph defined by the adjacency matrix above. A *source* is defined as a node with out-links but no in-links. Select any nodes with this property, or else select "none of the above."

- [ ] A
- [ ] B
- [ ] C
- [ ] D
- [ ] E
- [x] F
- [ ] None of the above

Question 17

1 / 1 pts

Consider the graph defined by the adjacency matrix above. A *sink* is defined as a node with in-links but no out-links. Select any nodes with this property, or else select "none of the above."

- [ ] A
- [ ] B
- [x] C
- [ ] D
- [ ] E
- [ ] F
- [ ] None of the above

Question 18

1 / 1 pts

Consider the graph defined by the adjacency matrix above. What is the **in-strength** of node F?

1

Question 19

1 / 1 pts

Consider the graph defined by the adjacency matrix above. What is the **out-strength** of node F?

8

Question 20

1 / 1 pts

Assume the edge weights represent distances. How long is the (weighted) shortest path from D to A?

4

Question 21

1 / 1 pts

Consider a directed network of N nodes. Now consider the total indegree, i.e. the sum of the indegree over all nodes in the network. Compare this to the analogous total outdegree. Which of the following must hold true for any such network?

- (•) Total indegree must be equal to total outdegree
- ( ) Total indegree must be less than total outdegree
- ( ) Total indegree must be greater than total outdegree
- ( ) None hold true in all instances

Incorrect

Question 22

0 / 1 pts

Consider a bipartite graph of N nodes, N_1 nodes of type 1 and N_2 nodes of type 2 (so that N_1 + N_2 = N).

What is that maximum number of edges in this graph?

- ( ) N_1 * N_2

- N - 1
- N
- N
- N_1 * N_2
- N ^2

Question 23

1 / 1 pts

Assume N is an integer > 2.

Given a complete graph A with N nodes, and a bipartite graph B also with N nodes, which of the following holds true for any such N:

- Graph A has more edges than graph B
- Graph A has fewer edges than graph B
- Graph A has the same number of edges as graph B
- None of these hold true for all such N > 3

Incorrect

Question 24

0 / 1 pts

Consider a streaming company (Such as Netflix) keeps data on customer preferences using a big bipartite network connecting users to titles they have watched and/or rated. The service's content library contains approximately 100k titles, and they currently have about 33 million users.

Assume the average user's degree in this network is 1000. Approximately how many edges are in this network?

Note: If it's easier, you can enter numbers with scientific notation. Canvas will treat 6.7e3, 67e2, and 6700 all as equivalent.

33,000,000,000

Question 25

1 / 1 pts

Consider the streaming service usertitle network from the previous question. Would this be considered a dense or sparse network?

- (•) Sparse
- ( ) Dense
- ( )
- ( )

Quiz Score: **20** out of 25