CSC303 Practice Midterm, Winter 2023

Practice

Released Feb 27, 2023

Before the test begins, please read the front page carefully and fill out your name and student number below. Please do not turn the page until the test begins.

Student Number: _____

Given Name(s): _____

Family Name(s): _____

The only resource you are allowed to consult is a handwritten aid sheet, letter size (8.5 × 11 inches), double-sided.

If you have a question then please raise your hand; the TA invigilator will acknowledge and fetch the instructor to answer your question.

You will receive 20% of the points for any (sub)problem for which you write "I do not know" You will receive 0% if you leave a question blank. If instead you submit irrelevant or erroneous answers, you will receive 0 points. You may receive partial credit if you explain why you can't answer a question, and the explanation shows some understanding of course material. You will receive partial credit for the work that is clearly "on the right track."

This test is 9 pages, and 6 questions; when the test begins, please check that they are all present.

Note that the actual midterm will have only 5 questions, and is thus a little shorter.

Please do not write on the back of pages, as those will not be scanned! If you need more space, then pages 2 and 8 are blank and will be scanned. Note that all the questions have fairly short answers, so you shouldn't need to use page 2 or 8.

Remember, you are far more than just a grade, and you have already shown yourself to be a wonderful, talented, and intelligent human being just by making it this far. Whatever happens can never change that.
Good luck! :-)

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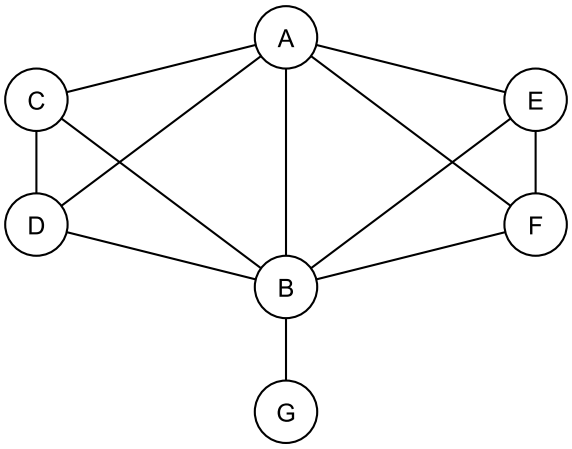
Question 1: For the given diagram, compute the values stated:

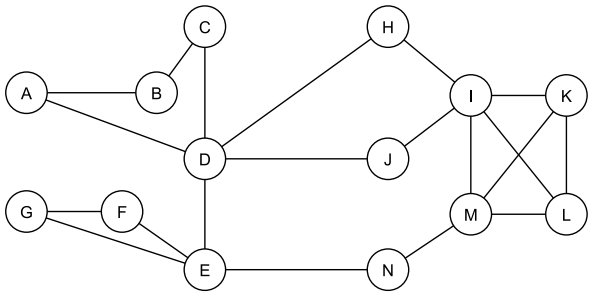


(a) Dispersion and embeddedness of the edge (A, B)

(b) Clustering coefficient of the node B

(c) List all local bridges

Question 2:



(a) In this network, what is an example of a node with bridging capital? Briefly justify.

(b) In class, we saw the graph structures in a social network that can correspond to bridging or bonding capital. Assume that we are now considering a social affiliation network – suggest a high-level structure that may be indicative of a type of capital other than bonding or bridging capital. You are allowed to choose the foci in the social affiliation network. This problem has many possible solutions – get creative! :)

Question 3: Draw an example of a social-affiliation network where an edge may form in the future due to at least 2 different types of closure. Briefly explain.

Question 4: Draw a connected signed network G that satisfies the following:

- G cannot be completed to a strongly balanced network.
- G can be completed if two edge signs are changed. Specify the edges.
- G cannot be completed if any single edge sign is changed.

Question 5:

(a) In the small-world model, we often describe the random, long-distance edges as "weak" edges. Why is this?

(b) Briefly explain whether it is possible to have a graph G such that the shortest paths between nodes is short, but decentralized search is inefficient.

Question 6: You have a randomized search algorithm, A. The time that A takes to finish execution is a random variable. At any time, you can re-start your algorithm and hope that the new random choices made by A will result in faster execution. Assuming that executing A without restarts takes μ minutes on average, and that μ is quite large, then: in general, would restarting more often be more beneficial if A's runtime follows an approximately normal distribution (you can assume you'll never sample a negative value), or a power-law? Briefly explain why.

END OF MIDTERM :)

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