

(PRINT) Name: _____ Student No.: _____

Signature: _____ Total Mark: _____ /30

CSC 200—Social and Economic Networks

Quiz 1, October 2, 2015 (SOLUTIONS)

Answer all questions on this paper (use back of page if necessary). You are allowed to use one, two-sided 8.5" by 11" sheet of *handwritten* notes. No other materials or aids of any type are permitted.

Time: 15 minutes; Total Marks: 30

Bob works at a large relatively impersonal corporation where he just has 5 friends. Bob feels that the best way to advance his career is to understand his local neighbourhood. In particular, Bob would like to know if he or one of his friends could be at the end of a local bridge. Understandably, he does not have a full picture of the corporation social network but he knows the network satisfies the strong triadic closure property, and he has compiled the following information about his local neighbourhood:

Connection	Embeddedness	Network Overlap	Tie Strength
(Bob,Mary)	4	0.5	W
(Bob,Steve)	3	0.25	S
(Bob,Allan)	2	0.2	S
(Bob,Jon)	1	0.2	W
(Bob,Sue)	2	0.5	W

Recall that the definition of neighbourhood overlap of an edge (A, B) is :

$$\frac{\text{number of nodes adjacent to both } A \text{ and } B}{\text{number of nodes } C \neq A, B \text{ adjacent to at least one of } A \text{ or } B}$$

where the numerator is the embeddedness of edge (A, B) .

Answer the following:

- [5 pts] Is Bob at the end of a local bridge? Explain.
ANSWER: Since an edge is a local bridge if and only if it has embeddedness 0, Bob cannot be at the end of a local bridge.
- [10 pts] Which of Bob's friends can possibly be at the end of a local bridge? Explain.
ANSWER: For each of Bob's neighbouring nodes, we can determine from the neighbourhood overlap whether or not that node has edges that go outside of Bob's local neighbourhood. If there are any such edges, they could possibly be local bridges. If all of the nodes edges are within the local neighbourhood, then that node cannot be a local bridge. Sue is the only node in Bob's local neighbourhood that does not have any edges leaving the local neighbourhood and hence cannot be at the end of a local bridge.

- [15 pts] Specify which friendships must occur and which cannot occur amongst Bob's friends.
ANSWER: We know from the embeddedness that there is an edge between Mary and all of the other 4 nodes in Bob's local neighbourhood. Since the (Bob,Jon) embeddedness is 1 and he must be connected to Mary, there are no other edges adjacent to Jon in the local neighbourhood. By the strong triadic closure property, there is an edge between Allan and Steve. And since there is also an edge between Allan and Mary, that is all the edges adjacent to Allan. Since the (Bob,Steve) embeddedness is 3, he must also be adjacent to Sue (as he cannot be adjacent to Jon). And that leaves Sue with edges to Steve and Mary from what has already been deduced and hence no other adjacent edges since (Bob,Sue) has embeddedness 2.