gradiance

Gradiance Online Accelerated Learning

Robert

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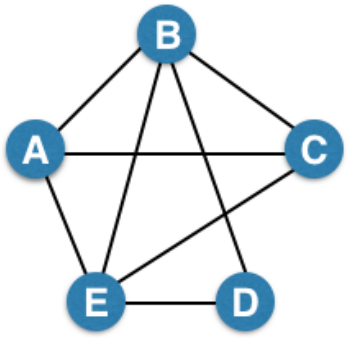
Help

06: Analysis of Graphs

Number of questions:	4
Positive points per question:	3.0
Negative points per question:	1.0

Gradiance quiz on Graph Analysis. You can attempt to answer the questions as many times as you like. Questions get randomly regenerated each time. The score of the *last* submission gets saved into our records (that is, once you get a perfect score, don't submit again with a bad one).

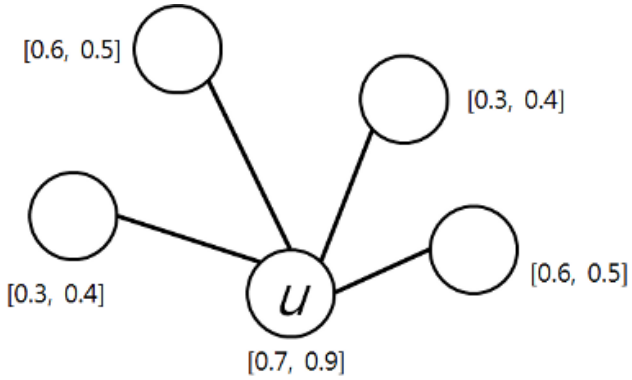
1. Consider the following undirected graph (i.e., edges may be considered bidirectional):



Run the "trawling" algorithm for finding dense communities on this graph and find all complete bipartite subgraphs of types $K_{3,2}$ and $K_{2,2}$. Note: In the case of $K_{2,2}$, we consider {{W, X}, {Y, Z}} and {{Y, Z}, {W, X}} to be identical.

- a) There are 5 instances of $K_{2,2}$.
- b) There are 6 instances of $K_{2,2}$.
- c) There are at least 2 instances of $K_{3,2}$.
- d) {{A, B}, {D, E}} is an instance of $K_{2,2}$.

2. You are running BigCLAM on a network of 1 billion nodes to detect two communities in the following way. At each iteration, you choose a node u and update community membership factor F_u of the node. Due to memory limit, you can query the information only for the neighbors of node u (not all the other nodes in the network). Imagine that you are looking at the following node u who has four neighbors:



Numbers in the bracket denote the value of community membership factors of each node. You are also given that the sum of F for all the nodes in the entire network (including the nodes not shown in the above figure) is [100.0, 1000.0]. Now, you want to compute likelihood l(u) at the current values of F:

$$l(u) = \sum_{v \in N(u)} \log(p(u,v)) + \sum_{v \notin N(u)} \log(1 - p(u,v))$$

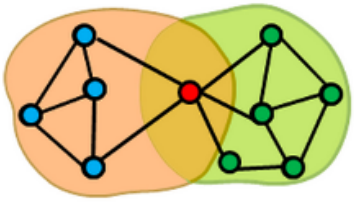
where p(u, v) is the BigCLAM edge probability and N(u) is the set of neighbors of node u. Since the first term can be trivially computed from the information shown in the figure, we are interested in computing the second term, namely l'(u):

$$l'(u) = \sum_{v \notin N(u)} \log(1 - p(u,v))$$

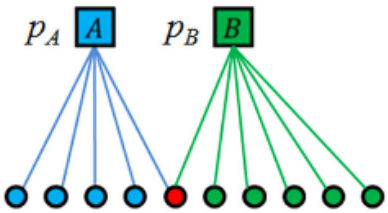
Compute the value of l'(u).

- a) -965.82
- b) -97.56
- c) -43.54
- d) -857.54

3. We fit AGM to the network on the left, and found the parameters on the right:



Network



Learned AGM parameters

Find the optimal values for p_A and p_B.

- a) $p_A = 0.8$
- b) $p_A = 0.7$
- c) $p_B = 0.5$
- d) $p_B = 0.3$

4. A bipartite graph has nodes a_i and b_i for i = 0, 1,..., 5. There is an edge between a_i and b_j if i-j is divisible by 2 or 3. For example, a_0 is connected to b_0, b_2, b_3, and b_4. Also, a_3 is connected to b_0, b_1, b_3, and b_5. Another way to understand this graph is to realize that a_i is connected to b_j unless j = i+i or j = i-1, where arithmetic is modulo 6.

Say a complete bipartite subgraph is *maximal* if no nodes can be added to it and the "complete" property be maintained. Which of the following instances of $K_{2,2}$ is NOT maximal?

- a) $\{a_2, a_5, b_2, b_5\}$
- b) $\{a_0, a_3, b_0, b_3\}$
- c) $\{a_1, a_3, b_3, b_5\}$
- d) $\{a_2, a_3, b_0, b_5\}$