Quiz 7 Solution

**For this quiz, calculation results won't be necessary as long as the math formulas are correct. If formula is not provided, your final result should match the solution for full credit.*

Q1

Edge betweenness: Number of shortest paths passing over the edge

Betweenness of edge (a, b): number of pairs of nodes x and y -> x, y $\in C$, edge (a, b) lies on the shortest path between x and y

Q2

- Start from node B, level 1 (node A, C, D), level 2 (node G, F, E).
- Since A, C is leaf node, and B is the only parent, so edge(A, B) = 1, edge(C, B) = 1.
- E, F, G is leaf node, and D is the only parent, so edge(D, G) = 1, edge(D, F) = 1, edge(D, E) = 1.
- D is not a leaf node, so it get credit 1+ sum of credits of edge from D to level below, which is 1 + edge(D, G) + edge(D, F) + edge(D, E) = 4. B is D's only parent, so edge(B, D) = 4.

Q3 (3pt)

Affiliation-Graph Model (AGM) is used to detect communities in the graph.

Generative model B(*V, C, M*, {p_c}) for graphs:

- (1pt) Nodes V, Communities C, Memberships M
- (1pt) Each community c has a single probability p_c

** Illustration with graph showing Community, Membership, Node and probability of community is also correct.*

(1pt) Relaxation technique: Memberships have strengths (avoid discrete membership changes)

F_{uA}: The membership strength of node u to community A (> 0) ($F_{uA} = 0$: no membership)

Q4

Given coin fips X = [1, 0, 0, 0, 1, 0, 0, 1]. f(1) = Θ

$P_f(X|\ \Theta) = \Theta * (1-\Theta) * (1-\Theta) * (1-\Theta) * \Theta * (1-\Theta) * (1-\Theta) * \Theta = \Theta^3(1-\Theta)^5$