1. (10 points) Identify all of the following statements that are true. Where the statement is about a paper, please specify the corroborating part of the paper (e.g., "page 32, second para").

   A. As described by Jeffrey Travers and Stanley Milgram, the Rapoport and Horvath study involved first developing a social graph and then analyzing it for connectivity$_{\text{Text}}$

   > **Solution:** True: Rapoport and Horvath obtained data about a social graph on page 427.

   B. As described by Jeffrey Travers and Stanley Milgram, their own study involved first developing a social graph and then analyzing it for connectivity

   > **Solution:** False: Travers and Milgram generate acquaintance chains without first building out a social graph (page 428, Section on Procedure)

   C. Mark Granovetter defines tie strength between two individuals in terms (not exclusively) of the time they commit to each other

   > **Solution:** True: On page 1361, Granovetter lists various factors, including time spent; on page 1362 top, he mentions the time element again

   D. Mark Granovetter's definition of the degree of a local bridge equals the number of hops the bridge saves minus one

   > **Solution:** False: The degree is the number of hops in the next longer path (page 1365), so it would be the number of hops the bridge saves plus one

   E. Mark Granovetter suggests that central figures in a social network are more likely to adopt innovations

   > **Solution:** False: On page 1367 (top), Granovetter suggests that adoption by central figures is dependent upon whether the innovation in question is considered safe and uncontroversial or not

2. (20 points) Of the following statements, identify all that are true.

   For the problems that mention the number of items being auctioned, the number of items equals M, the number of sell bids. (Each bidder bids on one unit.) These problems are for uniform-price auctions meaning that any parties that trade pay or receive the same price.

   A. Incentive compatibility is an important criterion when serious goods such as wheat are being traded, not for frivolous good such as music (which you can usually get for free)

   > **Solution:** False: Incentive compatibility has to do with valuations, not with seriousness or frivolity

   B. Prices work in markets under the assumption that each agent values a larger amount of money no less than a smaller amount of money

   > **Solution:** True: Valuation of money is monotonic

   C. If Alice values a book she owns at $50 and Bob values the same book at $60 and doesn't own it, then if Alice sells the book to Bob for $51, the result is Pareto optimal

Solution: True: No more gains from trade are possible

D. If Alice values a book she owns at \$50 and Bob values the same book at \$60 and doesn't own it, then if Alice's parents make her sell the book to Bob for \$15, the result is not Pareto optimal

Solution: False: No more gains from trade are possible; the fact that Alice was coerced into selling the book at a lower price than she would have liked is irrelevant: we only look at this state of affairs not any previous state of affairs

E. Given lotteries L_1, L_2, and L_3, any rational agent (in the sense of traditional economics) who prefers L_1 to L_2 and is indifferent between L_2 and L_3, necessarily prefers L_1 to L_3

Solution: True: This is one of the properties of preference and indifference we assume for rational agents

F. The Mth price is the highest price that ensures equilibrium

Solution: True:

G. The third-price auction for a single item would be incentive compatible for buyers

Solution: True: because the winning buyer's price would not depend on his or her bid

H. The third-price auction for two items would guarantee efficiency and be incentive compatible for buyers

Solution: True: because this an equilibrium price (hence efficient) and is not based on the winning bids (hence incentive compatible). Note that M=2, and so the third price is the (M+1)st price

I. The first-price auction for two or more items would not be incentive compatible for buyers

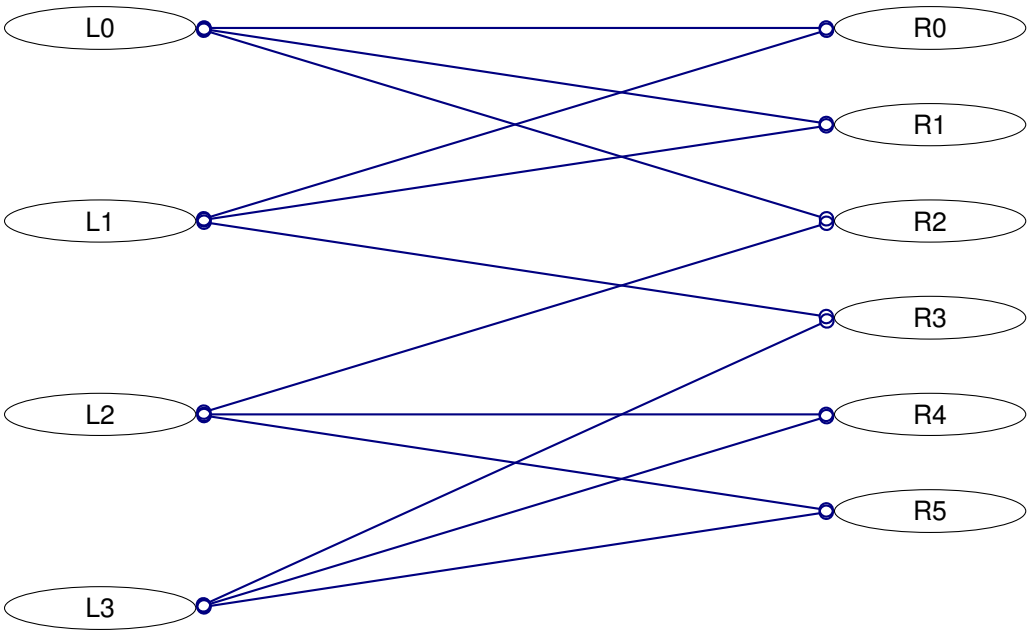
Solution: True: because a winning buyer may be the one who places the highest bid

J. The first-price auction for two or more items would not be efficient

Solution: True: because the first price is possibly higher than the equilibrium price range, which recall is from the Mth to the (M+1)st price. Specifically, the second highest buyer may be excluded. For example, if there are buy bids of \$9 and \$8 and sell bids of \$6 and \$5, at the first price of \$9, only the first buyer will trade although the second buyer would have accepted a price such as \$7, which both sellers would have accepted as well

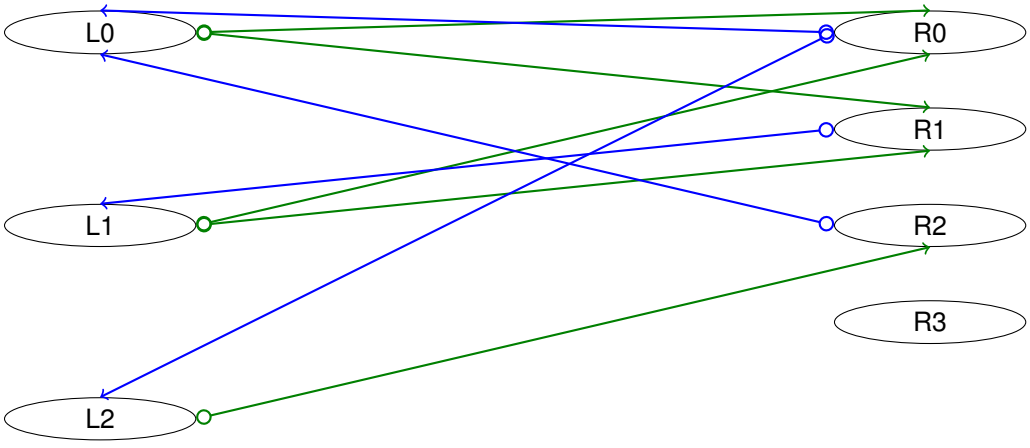
3. This problem concerns social networks that have a bipartite structure involving two subpopulations, Left and Right.

   (a) (5 points) Consider the network as the following undirected graph. Calculate the clustering coefficient (as defined by Watts and Strogatz) of any one member of Left.



Solution: The clustering coefficient is zero since the neighbors of a vertex are never connected to each other (on account of the network being a bipartite graph).

(b) (15 points) Treating the network as the following directed graph, *approximately* calculate the PageRank of R1. For concreteness, apply the method outlined by Yolum (page 404, right column). Specifically, begin by assigning the same PageRank to all vertices and applying the iteration two times. Show the values as initialized and then resulting from the first and the second iterations. To simplify the computation, disregard the normalization and choose the parameter d and the initial values in any way that helps (not necessarily those in the paper).



Solution: Without any normalization, set $d = 1$ and initialize each vertex to 1. (This is the better solution for our present purposes since it keeps the arithmetic calculations simple.)

Vertex	Initial	Iteration 1	Iteration 2
L_0	1	1.5	1.5
L_1	1	1	1
L_2	1	0.5	0.5
R_0	1	1	1.25
R_1	1	1	1.25
R_2	1	1	0.5
R_3	1	0	0

Without any normalization, set $d = 0.85$ and initialize each vertex to 0.85.

Vertex	Initial	Iteration 1	Iteration 2
L_0	0.15	0.34125	0.5038125
L_1	0.15	0.2775	0.385875
L_2	0.15	0.21375	0.2679375
R_0	0.15	0.2775	0.57253125
R_1	0.15	0.2775	0.57253125
R_2	0.15	0.2775	0.3316875
R_3	0.15	0.15	0.15

4. (10 points) Analyze a beauty contest game under the following conditions.

   - Each participant may propose a natural number between 0 and 100.
   - The winning condition is being closest to 60% of the mean.
   - We define a Level n thinker as follows.
     - A Level 0 thinker does not think about others.
     - A Level 1 thinker assumes everyone else is a Level 0 thinker.
     - A Level n thinker (for $n \geq 2$) thinks that the remaining population is split equally between Level $(n-1)$ and Level $(n-2)$ thinkers.
   - Feel free to consult the early part of the Camerer article, although the Step k definition in Camerer's article is different from Level k as defined above.

   What number will a Level 3 thinker propose?

   Solution: Level 0: Uniform distribution over [0, 100], with a mean of 50.

   Level 1: 60% of the mean of the Level 0 distribution = 30.

   Level 2: 60% of the mean of the means of the Level 0 and Level 1 distributions = 60% of 40 = 24.

   Level 3: 60% of the mean of the means of the Level 1 and Level 2 distributions = 60% of 27 = 16.20. Therefore, a Level 3 thinker will propose 16, the closest integer to 16.20.

5. (10 points) Consider McCulloh's discussion of transitivity (page 117). Discuss transitivity in connection with Pickard et al.'s reward mechanism for social mobilization in the balloon hunt setting.

   Use about 30–50 words.

Solution: McCulloh relates transitivity to three underlying properties: homophily, proximity, and brokered social relations. Pickard et al.'s reward mechanism is an example of brokered relationship. Mobilization goes against the grain of homophily and proximity since mobilization is most effective when people mobilize dissimilar and nonproximal others.

The idea of diminishing marginal return in the utility of additional shared transitive links appears realistic is reflected in the geometrically decaying rewards in Pickard et al.'s reward mechanism.

6. Consider an enterprise crowdsourcing setting wherein you seek to query the staff of an enterprise to determine whether and how much to bid on a large project. For specificity, assume the project is to build a healthcare IT system for Iceland and it involves software development based on legal regulations and user needs, deployment, day-to-day operations, and maintenance in light of revised regulations.

   The idea would be obtain information from the staff and to aggregate it so as to make a decision based on the best of what the enterprise's knowledge is.

   (a) (5 points) Building on the discussions between Galton and those who responded to his articles (such as Hooker), describe one possible objection to the results you find from querying enterprise staff.

   Use about 15–30 words.

   Solution: The choice of the statistic used for aggregating results is not trivial, as the debate about mean versus median indicates.

   (b) (15 points) From a reading of Tverksy & Kahneman's Heuristics and Biases paper, describe two possible ways in which enterprise staff may produce biased information.

   Use about 15–30 words per objection.

   Solution: The estimates produced by the enterprise staff may be biased in various ways, including

   - Representativeness (insensitivity to prior probabilities of healthcare IT projects or projects in Iceland): Bias because of the lack of probability that most IT projects suffer cost and time overruns.
   - Availability (biases due to retrievability of instances): Bias because of a few expensive or poorly managed healthcare IT projects being prominent in their minds.
   - Anchoring (insufficient adjustment): Bias because of remaining attached to the cost and time estimate for a project recently discussed and bid upon.

   (c) (10 points) Building on the discussions between Tverksy & Kahneman and Gigerenzer, describe one possible rephrasing or reframing that would characterize Gigerenzer's response to any one of the previous biases.

   Use about 30–60 words for this part.

   Solution: Gigerenzer would suggest querying the staff in such a way as to encourage them to think of frequencies instead of probabilities. For example, the staff could be queried about several specific instances of IT projects (for healthcare or in Iceland) before being asked to offer their assessments for the proposed IT project.