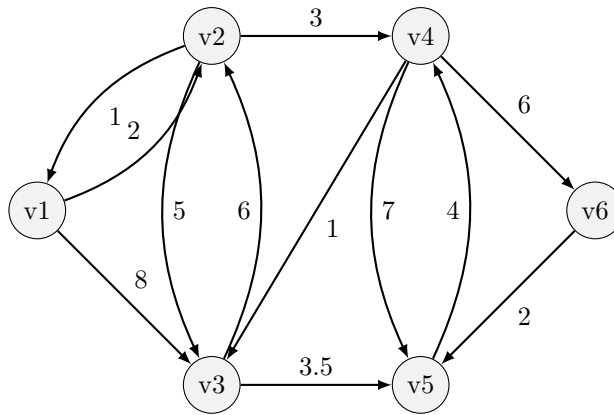# IEOR 151 – Service Operations Design and Analysis

## Homework 2 (Due 10/16/2015)

### October 5, 2015

1. Consider the following graph representation of a kidney exchange. Find the social welfare maximizaing exchange under the constraint that all cycles can have length less than or equal to L = 3. (5 points)



2. Consider the following graph representation of a kidney exchange. Find the social welfare maximizaing exchange under the constraint that all cycles can have length less than or equal to L = 3. (5 points)
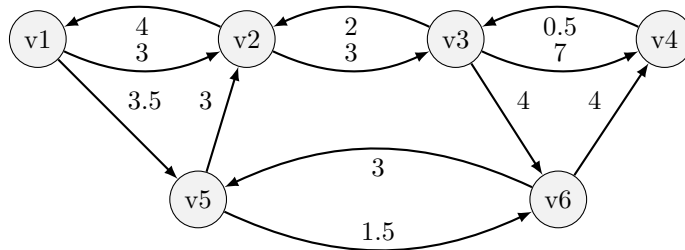
3. Match the applicants to the residency programs, and show intermediate steps of the algorithm. (5 points)

   For this problem, suppose the applicant's preferences are given by:

   | Manu | Tony | Tim | Boris |
   |---|---|---|---|
   | General | Hopkins | Temple | General |
   | Hopkins | General | Hopkins | Temple |
   | Temple | Temple | General | Hopkins |

   Suppose that each residency program has only 1 open position, and that the program's preferences are given by:

   | General | Hopkins | Temple |
   |---|---|---|
   | Boris | Manu | Boris |
   | Manu | Tony | Manu |
   | Tony | Tim | Tony |
   | Tim | Boris | Tim |

4. Suppose Apple, Inc would like to purchase processors from Samsug Electronics Co. Apple's utility for the processors is given by $S(q) = 550 \ln(1+q)$. The fixed costs for Samsung Electronics Co. are \$5,000, and if Samsung is inefficeint (efficient) then its marginal costs are 0.25 (0.20). Assume that Apple, Inc believes that there is a 40% chance that Samsung Electronics Co. is efficient.

   (a) What are the first-best production levels? (2 points)

   (b) What are the contracts to implement the first-best production levels? (2 points)

   (c) How much profit would Samsung Electronics Co. make if Apple, Inc offers a menu of contracts $\{(q_1^I, t_1^I), (q_1^E, t_1^E)\}$ (1 point)

   (d) What are the second-best production levels? (2 points)

   (e) What is the menu of contracts for the second-best production levels? (2 points)

   (f) What is the information rent of an efficient Samsung Electronics Co. for the menu of contracts for the second-best production levels? Is this higher or lower than the profit gained for the menu of contracts for the first-best production levels? (2 points)

5. Suppose a restaurant would like to purchase marinated steak from a meat distributor. The restaurant's utility for the steaks is given by $S(q) = 15\sqrt{q}$. The fixed costs for the distributors are \$35, and if the distributor is inefficeint (efficient) then its marginal costs are 0.35 (0.25). Assume that the restaurant believes that there is a 30% chance that the distributor is efficient.

   (a) What are the first-best production levels? (2 points)

   (b) What are the contracts to implement the first-best production levels? (2 points)

   (c) How much profit would the meat distributor make if the restaurant offers a menu of contracts $\{(q_1^I, t_1^I), (q_1^E, t_1^E)\}$ (1 point)

   (d) What are the second-best production levels? (2 points)

   (e) What is the menu of contracts for the second-best production levels? (2 points)

   (f) What is the information rent of an efficient distributor for the menu of contracts for the second-best production levels? Is this higher or lower than the profit gained for the menu of contracts for the first-best production levels? (2 points)