

## CS423: Networks

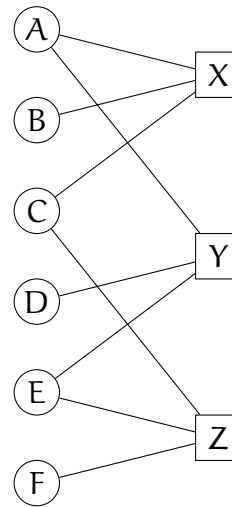
# Assignment 2

Answer all 5 questions, each is worth 1 point. A maximum of 5 points can be earned from this assignment.

**Deadline** for submission: Thursday, **March 4 at 5pm**.

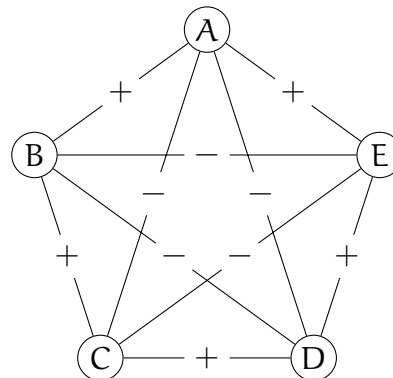
1. Consider the affiliation network on the right, with six people labelled A-F, and three foci labelled X, Y, and Z.

- (a) Draw the **projected graph** on just the people, in which two people are joined when they have a focus in common.
- (b) In the resulting network of people, can you identify a sense in which the triangle on the nodes A, C, and E has a qualitatively different meaning than the other triangles that appear in the network? Explain your answer.



2. In the network on the right, an edge exists between any pair of nodes, five edges corresponding to positive relationships, and five edges corresponding to negative relationships.

Each edge in this network participates in three triangles. How many of these triangles are balanced, and how many are unbalanced? (Taking the symmetry of the network into account, how many different cases do need to be considered?)



3. For each of the following 2-player games, find all (pure and mixed) Nash equilibria. The rows here correspond to player A's strategies, and the columns to player B's strategies. The first entry in each box is player A's payoff and the second entry is player B's payoff.

(a)

	L	R
U	8, 4	5, 5
D	3, 3	4, 8

(b)

	L	R
U	0, 0	-1, 1
D	-1, 1	2, -2

4. Two identical firms, Firm 1 and Firm 2, must decide simultaneously and independently whether to enter a new market and what product to produce then. Each firm, if it enters, can develop and produce either product A or product B. If both firms enter and produce product A they each lose ten million dollars. If both firms enter produce product B, they each make a profit of five million dollars. If both enter and one produces A while the other produces B, then they each make a profit of ten million dollars. Any firm that does not enter makes a profit of zero. Finally, if one firm does not enter and the other firm produces A it makes a profit of fifteen million dollars, while if the single entering firm produces B it makes a profit of thirty million dollars. You are the manager of firm 1 and you have to choose a strategy for your firm.

- Set this situation up as a game with two players, Firms 1 and 2, and three strategies for each firm: produce A, produce B, or do not enter.
- One of your employees argues that you should enter the market (although he is not sure what product you should produce) because no matter what Firm 2 does, entering and producing product B is better than not entering. Evaluate this argument.
- Another employee agrees with the person in part (b) and argues that as strategy A could result in a loss (if the other firm also produces A) you should enter and produce B. If both firms reason this way, and thus enter and produce product B, will their play of the game form a Nash equilibrium? Explain.
- Find all the pure-strategy Nash equilibria of this game.
- Another employee of your firm suggests merging the two firms and deciding cooperatively on strategies so as to maximize the sum of profits. Ignoring whether this merger would be allowed by the regulators, do you think its a good idea? Explain.

5. Read Chapter 7 of the Book: Evolutionary Game Theory. Write a short (2 pages) summary, with a view of explaining the concept of an **evolutionary stable strategy**.