**SI 301**
**Assignment 4**
**Due in class on Tue October 3th**

Reading: Sections 5.1 – 5.4 of textbook.

1. Problems 1,2,3,4 in section 5.6 of textbook.

2. Prove that a complete balanced network cannot contain a 4-node cycle with an odd number of negative edges.

3. A,B,C,D,E,F are six small countries in a relatively isolated part of the world. Tensions among the countries are high at present due to the discovery of a large mineral deposit in an area along the disputed common borders of the countries. International relations experts are speculating about the alliances that the countries may form to potentially seize the deposit. They have come up with a network of the state of diplomatic positive and negative relationships between the countries (shown on Figure 1).

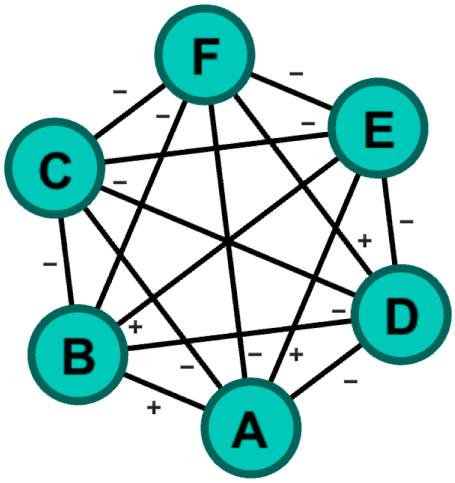

*Figure 1*

   a) Is this network balanced? Explain.
   b) Is the network weakly balanced? Explain.
   c) How many different groups of allies are likely to form to contest the ownership of the mineral deposit? What are the groups? Explain.
   d) Despite prior poor relations, one of the countries is secretly conducting negotiations with a different group. If the negotiations are successful, the resulting network will be balanced. Redraw the network such that *the minimum possible number of edge signs in the network are changed* to reflect a scenario that matches this description.

4. Write a Python function that takes as input a complete network with the edge attribute "sign" that is either positive ('+') or negative ('-') and returns True if the network is balanced and False if the network is not balanced.

   Test your function with three different inputs:
   a) A balanced network with at least 5 nodes and all positive edges.
   b) A balanced network with at least 5 nodes and at least one negative edge.
   c) An unbalanced network with at least 5 nodes.

   Print and turn in your code and output on a Jupyter Notebook.