POLYTECHNIQUE MONTRÉAL

LE GÉNIE EN PREMIÈRE CLASSE

INF6805E: Swarm Intelligence
Winter-Term 2022
Homework 2

Last modification: January 17, 2022

Rules

This assignment is due on **Jan 28, 2022**.

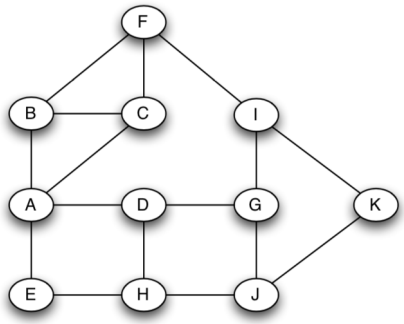
Check the syllabus for more information on late penalties and academic honesty.

Exercise 1 (Self-Organization) [10 point]

Do you think car traffic is self-organized? Why?

Exercise 2 (Betweenness) [20 point]

Consider the graph example we saw in class:

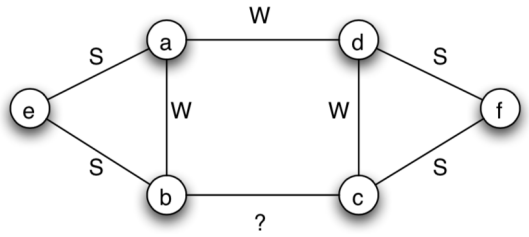


We saw in class how to calculate the flow that originates at a single node and reaches every other node. Using the same procedure, calculate the flow originating from E to all the other nodes.

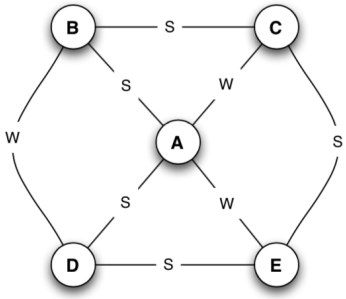
Exercise 3 (Strong/Weak Ties) [20 points]

1. Consider the graph below, in which each edge—except the edge connecting b and c—is labeled as a strong tie (S) or a weak tie (W).

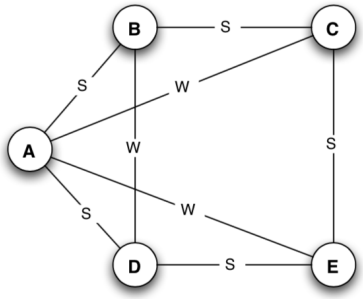
   According to the theory of strong and weak ties, with the Strong Triadic Closure assumption, how would you expect the edge connecting b and c to be labeled? Give a brief (1–3 sentence) explanation for your answer.



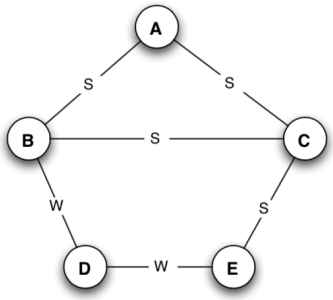
2. In the network below, which nodes satisfy the Strong Triadic Closure Property, and which do not? Provide an explanation for your answer.



3. In the network below, which two nodes violate the Strong Triadic Closure Property? Provide an explanation for your answer.



4. In the network below, which nodes satisfy the Strong Triadic Closure Property, and which do not? Provide an explanation for your answer.



Exercise 4 (The Schelling Model) [50 points]

Make program that performs a simulation of the Schelling Model. You can use your favorite programming language.

- The world is a 40×40 grid, for a total of $G = 1600$ cells
- The population P is expressed as a fraction of the cells. Consider $P = 0.9$.
- The agents are always 50% `X` and 50% `O`.
- The satisfaction threshold is set to $t = \{3, 4\}$.
- Agents are updated according to the cell they occupy, left-to-right, top-to-bottom. Start at the top-left corner in the grid, move left-to-right along the first row, and update all the agents you encounter. Once done with the row, move down to the leftmost cell of the second row, and repeat the above steps.
- Unsatisfied agents move to the closest cell that makes them satisfied. Use an 8-Chebyshev distance to find the closest cell. If no satisfactory cell is found in an 8-Chebyshev distance radius, you can move the agent to a randomly selected empty cell in the grid.

If you find online sources for your code, **cite them in your report**. We know they exist!

Deliverables

- A PDF document in which you report, for the two combinations of the parameters P and t: 4 intermediate grid printouts and the final result;
- The complete code in a compilable/executable form, along with instructions to execute it.

Deliverables

Create an archive called `LastnameFirstname.zip` structured as follows:

```
LastnameFirstname/
   ex123.pdf
   ex4/
     ex4.pdf
     README
     <your code>
```

The file `ex123.pdf` contains your answers to Exercises 1–3. The file `ex4.pdf` is the document describing your findings for Exercise 4. The `README` file contains instructions on how to execute your code. The rest of the files contains your code.

Make sure to **follow these guidelines accurately**: any mistake will entail a **10% penalty** on the final score. Example mistakes: the files are not named as requested; the archive is not a `zip`, but some other format; the structure in the archive is incorrect…