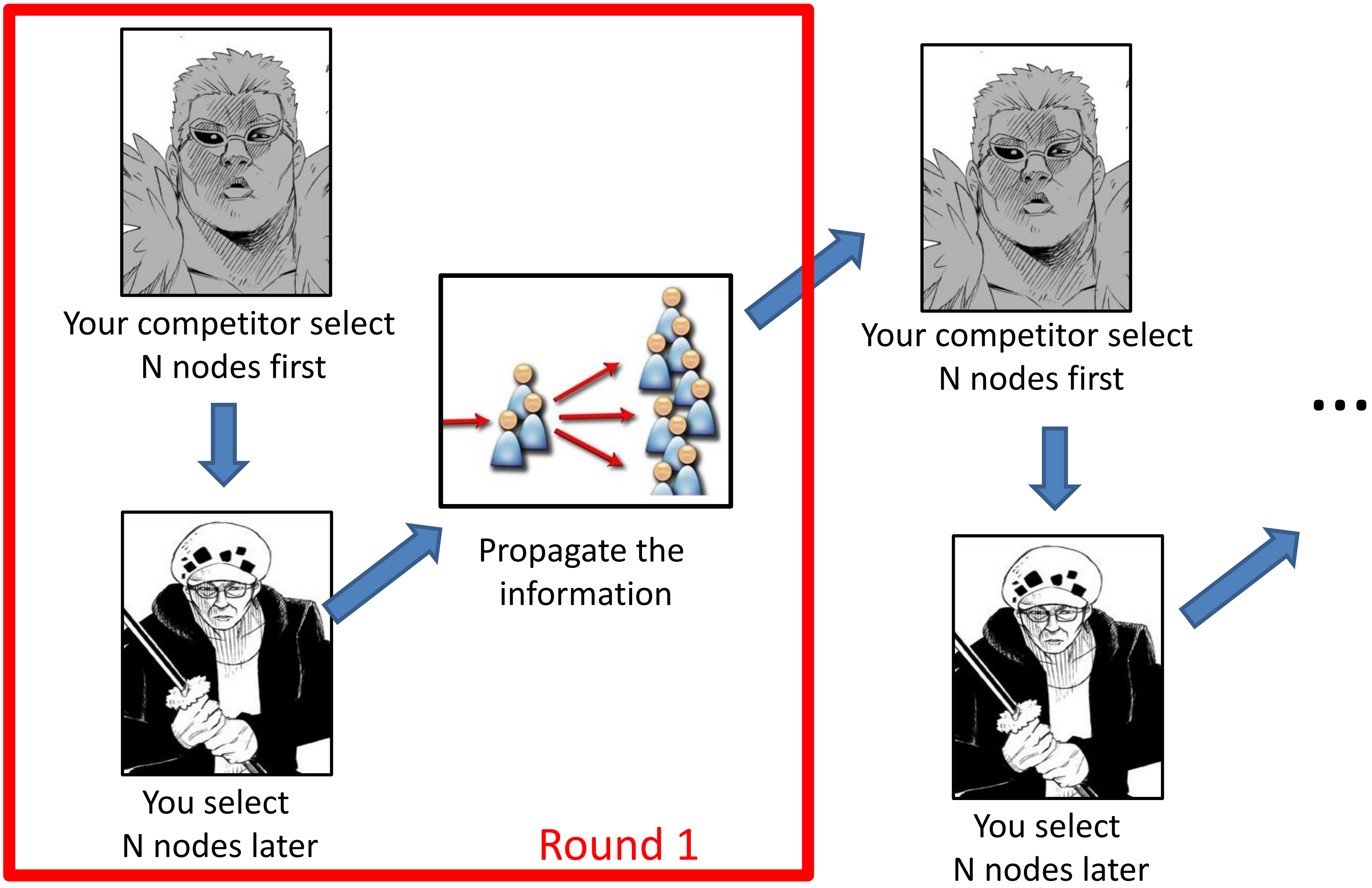
SNA HW1
Multi-Party Influence Maximization Game

2014/10/2

Scenario

- Now you are one of the candidates of the mayor. Try your best to persuade the people to be your supporters.
  - The voters can vote for only one candidate
  - The voters try to persuade their social neighbors

Influence Maximization Game



Your competitor select N nodes first

You select N nodes later

Propagate the information

Round 1

Your competitor select N nodes first

You select N nodes later

…

Game Rule

Multi-party Linear Threshold Model rules:

- There are three status for each node, which are $activated$, $inactivated$ and $selected$.
- A node can only be activated by one player
- A node can only be selected by one player
- Each player accumulates his/her own influence value.
- If a node is going to be activated by 2 players(the sums of incoming influence are both higher than the threshold), then the player with higher sum of incoming influence activates the node. If the sum of incoming influence are equal, then the node will be activated by the 2st player.

Each round follows the procedure:

- 1. Player 1 chooses N nodes first (within L secs)
- 2. Player 2 choose other N nodes (within L secs)
- 3. Propagate the information by Multi-party Linear Threshold Model

N=10 nodes, $L_1 = 300$secs, $L_2 = L_3 = \ldots = 60$secs, Number of rounds = 10 in our game setting, where L_i denote the time limit of i-th round.

Your competitor strategies

- We’ll implement 2 heuristic strategies as your competitors.
  - (S1)Max_weight
  - (S2)Greedy
- (S3) You will need to compete with your classmates

Fixed strategies (S1 and S2)

- Let S denote the set of selected and activated nodes in that round, then for each round:
- (S1)Max_weight:

For i = 1 to N:

$$\mathrm{S} = \mathrm{S} \cup \left\{\arg\max_{i \in V \setminus \mathrm{S}} \left(\sum_{j \in successor(i)} weight[i][j] \right)\right\}$$

- (S2)Greedy :

For i = 1 to N:

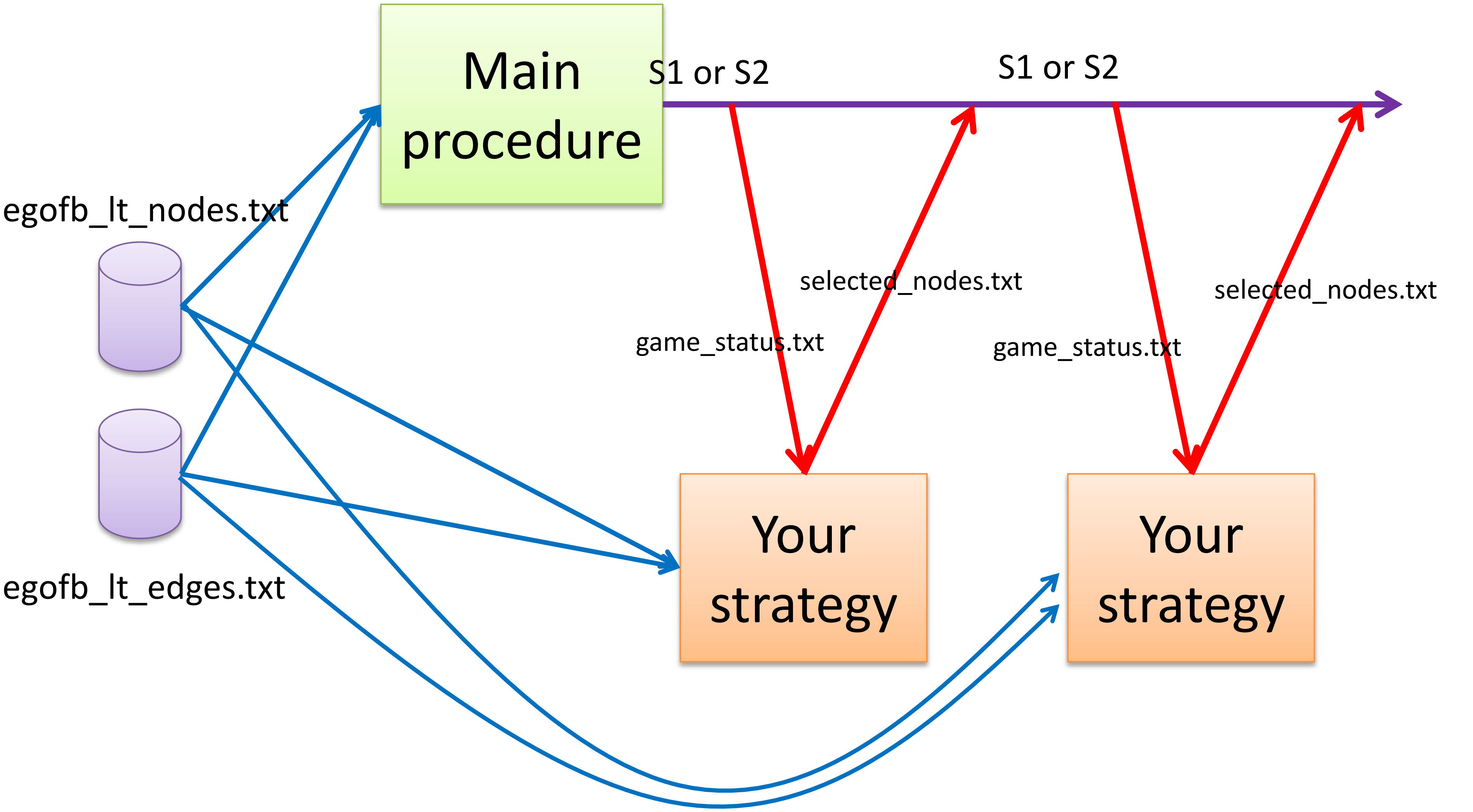
$$\mathrm{S} = \mathrm{S} \cup \left\{\arg\max_{i \in V \setminus \mathrm{S}} (LTsimulate(\mathrm{S} \cup \{i\}) - LTsimulate(S))\right\}$$

where $LTsimulate(\mathrm{S})$ denote the number of activated nodes when S is the set of seed nodes. So, $LTsimulate(\mathrm{S} \cup \{i\}) - LTsimulate(S)$ is the marginal gain of activated nodes number when node i is added as new seed.

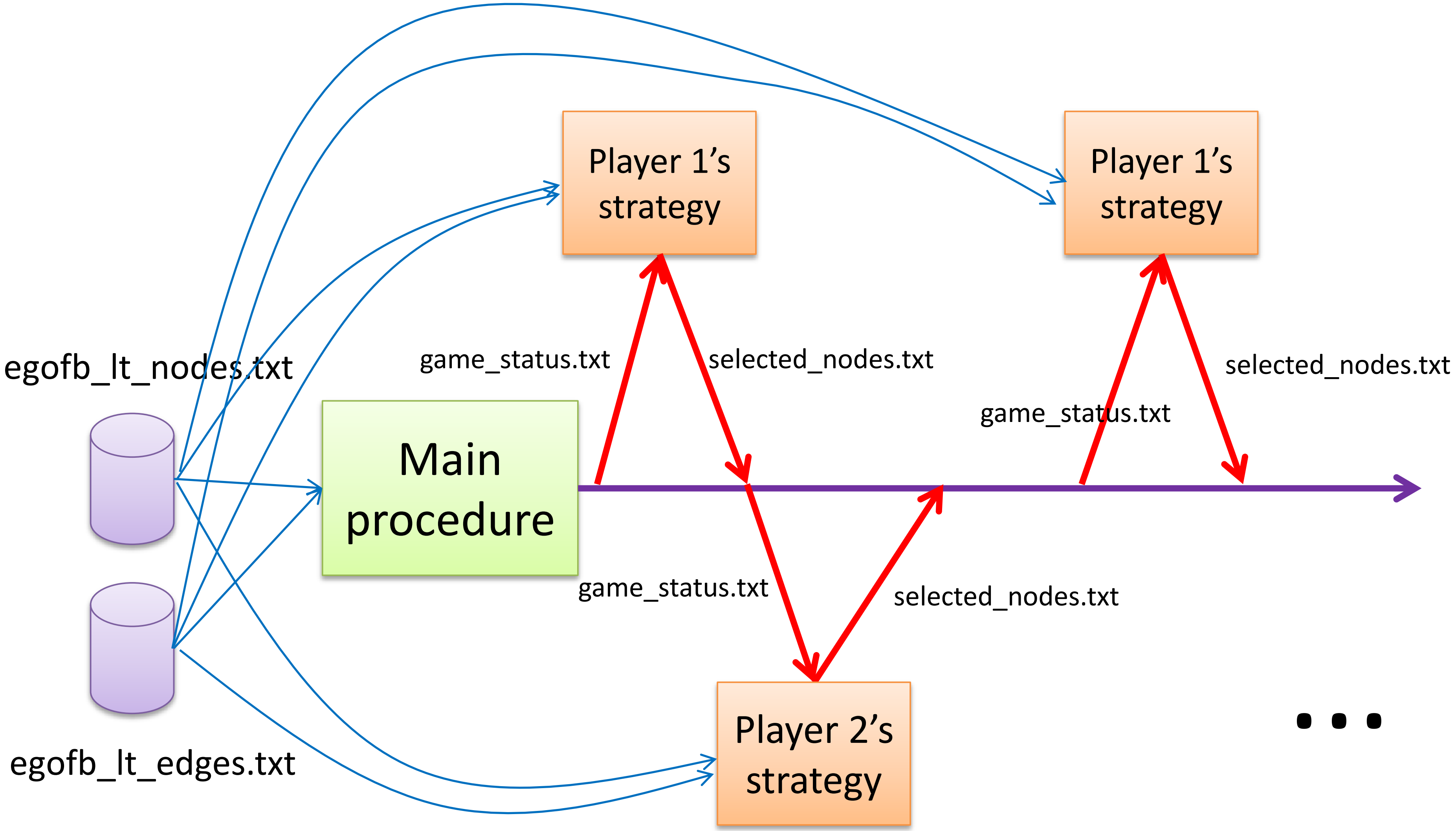
Requirements

- For (S1) and (S2)
  - Player 1: Computer using the two strategies
  - Player 2: Your strategies
  - You only have to design strategies of player 2
- For (S3)
  - Player 1: Strategies from other groups in this class
  - Player 2: Your strategies
  - You can design strategies for player 1 and 2 respectively
  - Only your player 2 results will be counted in this assignment
  - However, since the final score depends on the ‘relative score’ among students rather than ‘absolute score’, your player 1 strategy might indirectly affect the final score

Process (for S1 and S2)



Process (for S3 - pairwise competing)



Input / Output

- Input:
  - Player id (indicates that you are player 1 or player 2)
  - Social network(nodes file, edges file)
  - Game status
  - Number of selected nodes per round
  - Time Limitation per round
- Output
  - A list of nodes selected by your strategy in this round

Input File Format(1)

- Two social network hepth and egofb
- Format of “egofb_lt_nodes.txt”, ”hepth_lt_nodes.txt”: each line consists of one node id and its threshold
  - `# node_id lt_threshold`
  - `node_id1 lt_threshold`
  - `node_id2 lt_threshold`
  - …
  - …

Input File Format(2)

- Format of “egofb_lt_edges.txt”, “hepth_lt_edges.txt”: each line consists of one edge.
  - # Directed
  - # from_node_id to_node_id lt_influence
  - node_id1 node_id2 lt_influence
  - node_id3 node_id4 lt_influence
  - …
  - …

Input File format(3-1)

- Format of the “game_status.txt”: records the log for every turn.

- the nodes player_1 picked in 1st round
- the nodes player_2 picked in 1st round
- the nodes player_1 propagated in 1st round
- the nodes player_2 propagated in 1st round
- the nodes player_1 picked in 2nd round
- …
- …

- Let R denotes the number of round until now (starting from 1).
- If you are player 1, there will be 4(R-1) lines.
- If you are player 2, there will be 4(R-1) + 1 lines.

Input File format(3-2)

- Example for format of the “game_status.txt” when you are player 2

Round 1:

```
1170,873,290
```

Round 2:

```
1170,873,290
234,345,1729
1171,874,293,292
235,346,344
33,45,78
```

Output File format

- Format of the “selected_nodes.txt”:
- **node1 node2 node3 …**

Programming Language

- You can use any programming language.
- We’ll install Networkx, igraph, JUNG in our testing environment(linux). If you use any other language or tool, please put the required files into the zip in submission.

Arena

- TAs have implemented the arena for the influence maximization game.
  - **`main.py`**
  - **`main_two_player.py`**
  - **`DiffusionModel.py`**
  - **`run.sh`**
  - **`run_two_player.sh`**
  - **`Makefile`**
- How to use it?
  - Install python3 & networkx on python3 first
  - Implement your strategy
  - Modify your `Makefile`
  - Execute `run.sh` / `run_two_player.sh`

Delivery

- Three kinds of strategies to compete with S1, S2, S3 respectively.
- Report (pdf)
- You have to write **`Makefile`** for us to execute your strategy(for both as player1 and player2) by the following commands:

```
make strategy1
make strategy2
make strategy3
```

Notes: 意思是，我們會用make strategy1~3去執行你的策略，分別對抗S1、S2、S3，所以務必將Makefile修改好。其中，我們會傳遞參數告訴你是player1 or player2。詳細格式請直接參照Makefile。

Report

- The strategies you design
- The experiments of all the strategies you conduct and explain why you pick it as the best strategy
- Any comment on this homework

- Up to 4 A4-size pages
- pdf format
- File name: report.pdf

Grading

- Performance on training networks (hepth and egofb) 40%
  - The threshold of nodes will be modified
  - Competitor: (S1) 20% (S2) 20% (S3) 60%
- Performance on a testing network 40%
  - Your strategies will be tested in another graphs
  - Competitor: (S1) 20% (S2) 20% (S3) 60%
- For S1 and S2, we will calculate the 'absolute score difference between two players' as your grade. For S3, we will only count the winning percentage of your player-2 strategy
- Report: 20%

Notes

- Homework 1 is a team(one to three persons) task.

- **No plagiarism.**
  - Otherwise, you will receive F in this class
  - Discussion is allowed, but write your own code

Submission

- Please upload hw1_team{team_id}.zip to ceiba before 2014/10/22 22:00 containing the following structure:
  - team{team_id} (folder)
    - Makefile
    - report.pdf
    - All source codes for the three strategies

- Late policy:
  - we will deduct 1/3 per day, that is, 2/3 of the grade if delaying by 1~24hrs, 1/3 of grade if missing by 24~48 hrs, zero after 48 hrs.

Installation – Python3

- Python3
  - download Python-3.4.1.tgz from https://www.python.org/download

```
tar –zxvf Python-3.4.1
cd Python-3.4.1
./configure --prefix=$HOME
make
make test
make install
vim ~/.bashrc
   • export PATH=$HOME/bin:$PATH
Test:
which python3
python3
```

Installation – NetworkX

- setuptools

  -
    ```
    wget --no-check-certificate https://bootstrap.pypa.io/ez_setup.py -O - | python3 - --user
    ```

- Networkx
  - Download networkx-1.9.1.tar.gz from https://pypi.python.org/pypi/networkx/

```
tar --zxvf networkx-1.9.1.tar.gz
cd networkx-1.9.1
python3 setup.py install --user
```

Test:

```
python3
import networkx as nx
nx.__version__
```