THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY
Department of Computer Science and Engineering
COMP4641: Social Information Networks Analysis and Engineering
Spring 2019 Assignment 2
Due time and date: 12:00noon, April 22nd (Mon), 2019.

IMPORTANT NOTES

- **Your grade will be based on the correctness, efficiency and clarity.**
- **Late submission: 25 marks will be deducted for every 24 hours after the deadline.**

Q1. Generate a graph for each of the sub-questions that contains a node satisfying the desired centrality measure. For each question output the adjacency matrix, node index, and centrality (value and rank) of the corresponding node using NetworkX. Note that node index starts from zero, and the higher the rank, the larger is the centrality value.

1. node with high degree centrality but low closeness centrality
2. node with high degree centrality but low betweeness centrality
3. node with high degree centrality but low eigenvector centrality
4. node with high closeness centrality but low degree centrality
5. node with high closeness centrality but low betweeness centrality
6. node with high closeness centrality but low eigenvector centrality
7. node with high betweeness centrality but low closeness centrality
8. node with high eigenvector centrality but low degree centrality
9. node with high eigenvector centrality but low closeness centrality
10. node with high eigenvector centrality but low betweeness centrality

Your program should print following the form below. Please note that this sample answer does not satisfy the centrality ranking requirements. Only the 2 corresponding centrality measures are required to be shown for each subquestion.

```
Q1.1)
adjacency matrix: [[0,0,0,1,1,0,1,0,0,1],
 [0,0,0,0,0,0,1,0,0,0],
 [0,0,0,0,0,1,1,1,0,1],
 [1,0,0,0,0,1,1,0,0,1],
 [1,0,0,0,0,1,0,1,1,1],
```

```
 [0,0,1,1,1,0,0,0,0,1],
 [1,1,1,1,0,0,0,1,0,1],
 [0,0,1,0,1,0,1,0,0,0],
 [0,0,0,0,1,0,0,0,0,1],
 [1,0,1,1,1,1,1,0,1,0]]
node index: 0
closeness centrality: 0.642 rank: 2 / 10
degree centrality: 0.444 rank: 3 / 10
Q1.2)
adjacency matrix: [[...],
  [...],
  .
  .
  .,
  [...]]
node index: node_id
degree centrality: node_degree_centrality, node_dedgree_centrality_rank
betweenness centrality: node_betweenness_centrality, node_betweenness_rank
Q1.3)
.
.
.
```

Q2. Given the power law distribution $p(x) \propto x^{-\alpha}$ (where $\alpha > 3$), derive its variance.

Q3. Consider the network depicted in Figure 1; suppose that each node starts with the behavior B, and each node has a threshold of $q = \frac{1}{2}$ for switching to behavior A.

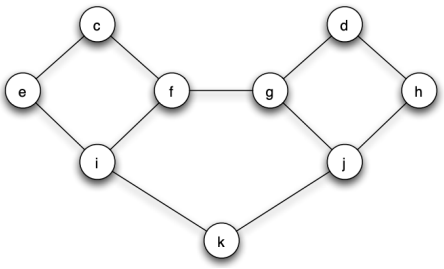

Figure 1: Starting from nodes e and f, the new behavior A fails to spread to the entire graph.

1. Now, let e and f form a two-node set S of initial adopters of behavior A. If other nodes follow the threshold rule for choosing behaviors, which nodes will eventually switch to A?

2. Find a cluster of density greater than $1-q=\frac{1}{2}$ in the part of the graph outside S that blocks behavior A from spreading to all nodes, starting from S, at threshold q.

Submission Guidelines

You should submit two files: one pdf file containing the answers of Q1, Q2 and Q3, and one ipython notebook file(.ipynb) with complete code for Q1 to **hshiac@hotmail.com** before the deadline. All the submitted files should be contained in a single zip package named like **A2_awangab_12345678.zip** (replace awangab with your ust account and 12345678 your student id). Plagiarism will lead to zero mark.