COS 435, Spring 2017 - Problem Set 6

Due 11:59 pm Wednesday April 19, 2017 by DropBox submission

Collaboration and Reference Policy

You may discuss the general methods of solving the problems with other students in the class. However, each student must work out the details and write up his or her own solution to each problem independently. For each problem, list the students with whom you discussed general methods of solving the problem.

Some problems have been used in previous offerings of COS 435. You are NOT allowed to use any solutions posted for previous offerings of COS 435 or any solutions produced by anyone else for the assigned problems. You may use other reference materials; you must give citations to all reference materials that you use.

Lateness Policy

A late penalty will be applied, unless there are extraordinary circumstances and/or prior arrangements:

- Penalized 10% of the earned score if submitted by 10am Thursday (4/20/17).
- Penalized 25% of the earned score if submitted by 4:30 pm Friday (4/21/17).
- Penalized 50% if submitted later than 4:30 pm Friday (4/21/17).

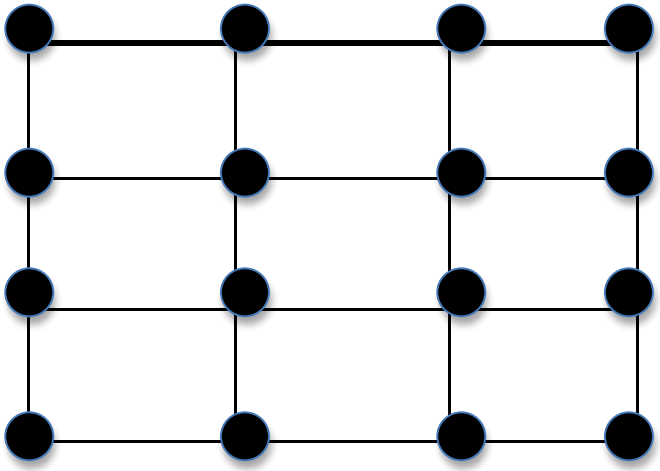
Submission

Submit your solutions as a PDF file using the Computer Science Department DropBox submission system for COS435 at
https://dropbox.cs.princeton.edu/COS435_S2017/HW6 Name your file HW6.pdf. If you have not used this facility before, consult the instructions at
https://csguide.cs.princeton.edu/academic/csdropbox - student
Note that you are automatically enrolled in CS DropBox using the registrar's COS435 enrollment list.

Problem 1: Social network structure

Part a:
The figure below shows a 4-by-4 grid network. Consider the general n-by-n grid network, which has n*n=N nodes.

i. What is the density of an n-by-n grid network as a function of N?
ii. What is the diameter of an n-by-n grid network as a function of N?
iii. What is the average cluster coefficient of an n-by-n grid network as a function of N?
iv. What is the distribution of degrees for n-by-n grid network as a function of N?
v. Which of the properties common to social networks does the grid network satisfy and which does it fail to satisfy? You may ***estimate*** properties that require a large amount of calculation.



Problem 2 Girvan-Newman algorithm to calculate betweenness

In class we calculated steps 1 and 2 of the Girvan-Newman algorithm for one rooting of the graph that is four nodes connected in a square (equivalently, connected in a ring). Below is the diagram of a modified square. Calculate betweenness for all six of the edges of this graph using the Girvan-Newman algorithm. ***Show your calculations for each execution of Step 1 and Step 2,*** one for each node as root of the breadth first search. You may use symmetry arguments when applicable. Be sure to execute the final calculation and ***give the final betweenness value*** for each edge.