FINAL EXAMINATION
Networked Life (NETS 112)
December 15, 2016
Prof. Michael Kearns

This is a closed-book exam. You should have no material on your desk other than the exam itself and a pencil or pen. If you run out of room on a page, you may use the back, but be sure to indicate you have done so. You may also make annotations directly on any diagrams given.

Name:

Problem 1: _____/10

Problem 2: _____/10

Problem 3: _____/15

Problem 4: _____/10

Problem 5: _____/15

Problem 6: _____/10

Problem 7: _____/10

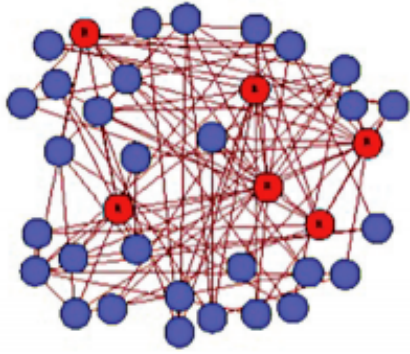**Problem 8:** _____/10

Problem 9: _____/10

TOTAL: _____/100

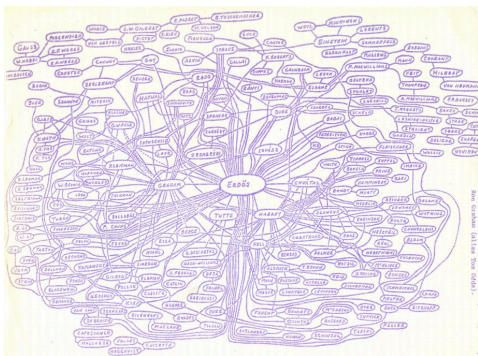**Problem 1 (10 points).** Answer "true" or "false" to each of the following assertions.

(a) Adding new roads can only reduce the average driving time, as long as drivers choose their routes in a self-interested fashion.

(b) The average number of retweets of an initial tweet is approximately 10.

(c) Erdos-Renyi networks will generally have less wealth inequality than preferential attachment networks in the Milk-Wheat trading model.

(d) It is not possible to have arbitrarily large networks in which the diameter is 6 or less unless every vertex has at least N/6 neighbors.

(e) Biased voting subjects generally did better on the minority power graphs than on the others.

(f) The virality of Facebook photo sharing is largely determined by features of the photo itself.

(g) Internet routers are responsible for making sure all packets have arrived at their destination, and in the correct order.

(h) A network without any cycles must always have clustering coefficient 0.

(i) Allowing subjects to create the network themselves made biased voting performance worse.

(j) Our class experiment on the Beauty Contest Game showed slightly worse collective performance than usual.

Problem 2 (10 points). Consider the following sentence from one of the assigned readings: *"We can thus sum up all of the actual payments made across all sessions and experiments, and divide it by the sum of all the maximum social welfare payments to arrive at a measure of the overall efficiency of the subject pools over the years."* What reading is this quote from? Discuss the context of the proposed calculation as precisely as you can, and give the value the author(s) obtained from it. Was this value viewed as being high or low?

Problem 3 (15 points). For each of the networks below, describe the generative or real-world process that created it. A precisely as you can, describe the context in which each network was discussed in class.

(a)

(b)

(c)

(d)

(e)

Problem 4 (10 points). For each of the items below, give its precise definition.

(a) vertex

(b) edge

(c) clustering coefficient of a vertex

(d) perfect matching

(e) network diameter

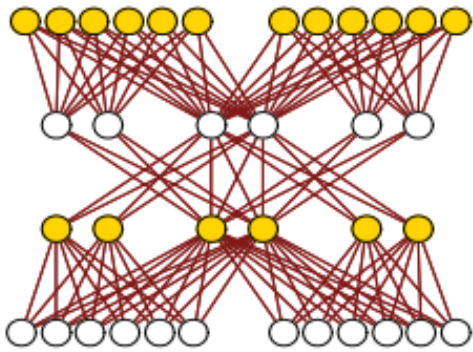(f) connected component

(g) bipartite network

(h) degree distribution

(i) proper coloring

(j) giant component

Problem 5 (15 points). For each of the networks shown below, compute the equilibrium wealths in the Milk-Wheat trading model discussed in class.
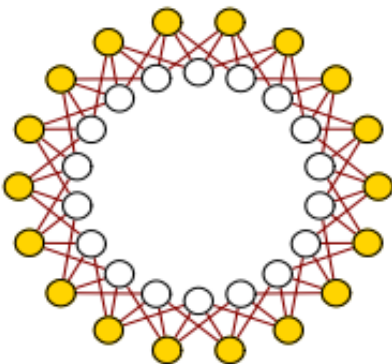
(a)

(b)

(c)

Problem 6 (10 points). Consider the two-player, two action game given by the payoff table below.

2, 2	0, 1
1, 0	1, 1

(a) Describe a simple scenario or story that motivates or justifies the payoffs of this game. Give names to the actions suggested by your motivation.

(b) Does this game have any Nash equilibria? If not, explain why. If so, precisely describe them.

Problem 7 (10 points). List as many differences as you can between the old AT&T telephony network and the modern Internet. Be as precise as possible.

Problem 8 (10 points). As precisely as you can, describe Schelling's housing segregation model and the associated demo we examined in class. What was the main point or lesson of this model and demo?

Problem 9 (10 points). Write a brief essay in which you summarize the topics in the entire course, ideally in the approximate order in which we proceeded.