CSC 425/525 Homework #6 (Chapter 9)
Due Date: Wednesday, March 15

Word process all answers. Figures may be hand drawn. Undergraduates answer any 5 of the 7 questions. Graduate students answer all 7 questions.

1. Consider the following knowledge.
   - Hard working people who have good luck are successful unless they are not good at what they do.
   - People who win things have good luck.
   - People who are good at gambling have good luck unless they cheat.
   - If someone fails often, then that person is not good at what they are doing.
   - Someone who is successful and works a good job will become wealthy unless they have bad investments or divorce a lot.
   a. Barbara works hard, is good at gambling and has a good job. Can we conclude she will become wealthy? Prove your answer with a justification truth maintenance system.
   b. We find out that Barbara has had several failed marriages (divorces). How does this impact your JTMS from part a? (you don't have to draw it, just explain)
   c. Joe works hard, wins things and has a good job however Joe fails often. What can we conclude about his being wealthy? Prove your answer with a JTMS.

2. Given the following table which describes hypotheses and the data they can explain along with a rough estimation of the likelihood of each hypothesis and other information, answer the questions below. Note that "suggests" will bump up or bump down a score by .3.

Hypothesis	Explains	Likelihood	Other
H1	d1, d2, d4	.8	incompatible with H2
H2	d1, d3, d4	.5	incompatible with H1, suggests H6
H3	d2, d4	.6	suggest ~H5
H4	d4, d5, d6, d7	.4	
H5	d5, d6, d7	.8	
H6	d5, d6, d7	.65	

   a. If we want a complete explanation, what should it be?
   b. Assume that d3 is less important to be explained. Can we build a more likely explanation without trying to explain d3? If so, what is your new explanation and if not, explain why your answer to part a would not change.

3. We have the following rules in a Mycin-like system. The values in ( ) are the certainty factors for the rules.
   If A AND B → E (.6)
   If C → F AND G (.8)
   IF D OR (A AND J) → G (.5)
   If E AND NOT F → H (.7)
   If G → I (.4)
   If I AND J → M (.6)
   If B OR NOT H → M (.4)
Assume we know A and C (1.0), B (.5), D (.6) and J (.8). Compute the confidence we would have in a conclusion of M.

4. Your connection to the Internet seems to be down and you want to decide why. You come up with the four possibilities: wireless card is not working, wireless router is not working, out at the company, and there is interference somewhere in your house. You assign the following prior probabilities:

P(wireless card problem) = .03
P(wireless router problem) = .05
P(outage at company) = .01
P(interference) = .10

Further, you come up with the following evidential probabilities (for instance, the probability that a wireless card malfunction will lead to no Internet connection):

P(no Internet | wireless card problem = .94
P(no Internet | wireless router problem) = .75
P(no Internet | outage at company) = .98
P(no Internet | interference) = .28

   a. Use Bayes formula to compute the most likely cause of your Internet outage.
   b. Since you can't use your computer, you decide to watch cable TV (assume you have the same carrier for both) but you are not receiving a cable signal either. How does that impact your solution to the problem if at all? Explain.

5. Provide fuzzy membership functions for the following categories. Some of these may require the use of more than one variable. For instance, "old" might be based solely on the variable age while "intelligent" could be based on IQ, GPA, number of degrees and other factors.
   a. Good physical health
   b. Popularity
   c. Artistic

6. A computer repairman is working on a laptop brought in to him by a customer. The first observation (o1) he notes is that it takes a long time to boot. He believes that this suggests either that the OS has become corrupted (O), that there is not enough virtual memory (M), or that the hard disk is too full (D), all three are supported with a value of .4. Next, he notices (o2) that once booted, several of the application programs will not start. He feels that this supports that the OS has become corrupted (O), that the hard disk is too full (D) or that there is a computer virus (V), supported by a value of .7. Next, while running a particular application (o3), it hangs every time. He feels that this supports not enough virtual memory (M), a virus (V) or a fault with the memory chips (C), supported at .8. Finally, when trying to shut down the OS, he receives the blue screen of death (o4). He feels that this supports OS corruption (O), problem with memory chips (C), or computer virus (V) at .7. Using Demster Schaeffer and showing all your computations, what is the most likely cause of the problems?

7. Draw a Bayesian network to illustrate the factors that can impact a student's job prospects. There should be at least 3 layers in this network and consist of at least 10 nodes. For instance, we might have a collection of nodes representing the following cause-effect situation: student stays out late partying → student doesn't sleep enough → student fails exams → student gets bad grades → student gets low-paying job. Your network should have several such chains that are intertwined. For instance, staying out late partying may not just impact the student's sleep, and bad grades may not be the only thing that can cause a low-paying job.