CSCI 5582 Quiz 3

Name: _____

On my honor, as a University of Colorado at Boulder student, I have neither given nor received unauthorized assistance on this work. _____.

1. **(5 points)** Which of the following people is responsible for the equation
$$P(A \mid B) = \frac{P(B \mid A)P(A)}{P(B)}$$
   a) Rabiner
   b) Viterbi
   c) Sun Tzu
   d) Bayes

2. **(5 points)** Every year an insurance company trade group announces the list of the most-stolen cars in the US. Pretty much every year, the top 3 are the Toyota Camry, Honda Accord, and Ford Taurus. They also claim that "thieves in different parts of the country prefer different kinds of cars". For example, they note that in Detroit the Ford Taurus is number 1, in Los Angeles it's the Camry and it Denver it's the Jeep Grand Cherokee. (If the names of these cars mean absolutely nothing to you, ask me for some assistance).

   Should you take these statistics seriously in deciding what kind of car to buy (or where to live if you own a Camry)? Why or why not?

3. **(10 Points)** Given a set of states and a set of observable symbols, describe the various sets of numbers needed to completely define a Hidden Markov Model.

4. **(5 Points)** Given an observation sequence and an HMM, what exactly does the Forward algorithm compute? (I don't what to know the algorithm; I want to know what it computes).

5. **(5 Points)** Given an observation sequence and an HMM, what does the Viterbi algorithm compute?

6. Consider the following climate related facts. Among its many world-wide effects, the El Nino phenomenon can sometimes lead to a split jet stream over North America. It is also known that split jet streams can lead to wetter winters in the Southwest US. They have also been known to cause drier winters in the Northwest US. Some relevant numbers are: El Ninos tend to happen once every 10 years; the chance of a split jet stream given an El Nino event is .5, while the chance of a split jet stream without an El Nino is .1; the chance that there will be a wet winter in the SW given a split jet stream is .5, while it is .1 when there is not a split jet stream; similarly, the chance of a dry winter in the NW given a split jet stream is .8, and it is .1 when there is no split.

    a) (5 Points) Draw a Bayesian Belief Net that captures these facts complete with all the tables needed to make it work.
    b) (5 Points) You are told that there is an El Nino event underway. Calculate what your belief should be that it will be a wet winter in the SW.
    c) (5 Points) You next learn that it has in fact been wet in the Southwest. What is your belief that it will be dry in the Northwest?
    d) (5 Points) Finally, you learn that there is in fact no split jet stream. Now calculate your belief in a dry winter in the Northwest.