Practice Question for Module-5

Numerical with Solutions:

1. **Exercise 1: https://online.stat.psu.edu/stat414/lesson/6/6.1**
2. **Exercise 2: https://online.stat.psu.edu/stat414/lesson/6/6.2**
3. **Exercise 3: https://online.stat.psu.edu/stat414/lesson/6/6.3**
4. **Exercise 4: https://online.stat.psu.edu/stat414/lesson/6/6.4**
5. **Exercise 5: https://sphweb.bumc.bu.edu/otlt/mph-modules/bs/bs704_probability/bs704_probability6.html**

Q1. Suppose you go for a test to find whether you have COVID-19 disease or not?, to a lab. Let there be 1 out of 100 people in your county is affected with this disease. Assume that there is a 5% chance of you being tested falsely positive (i.e. you do not have the disease but the test comes positive). Also, there is a 10% chance that you have the disease but tested negative (i.e. you have the disease, but the test comes positive). Apply ***Bayes Rule*** to find out the probability of you being tested positive and actually having the disease.

Q2. Consider that 1% of the population in this world is having the COVID-19 disease. Assume that if you really have the disease, then there is a 95 % chance that you tested positive. Also, there is 1% chance that you have tested positive, even if you do not have the disease (because of inaccuracy of the test results). Using ***Bayes Rule*** find out the probability that you have tested positive and actually have the COVID-19 disease. [10 Marks]

Q3. Information from the patients is given in the table below:

Chills(C)	Running nose(R)	Headache(H)	Fever(Fr)	Flu
y	n	mild	y	n
y	y	no	n	y
y	n	strong	y	y
n	y	mild	y	y
n	n	no	n	n
n	y	strong	y	y
n	y	strong	n	n
y	y	mild	n	y

Use Bayes' rule to diagnose a person with the following symptoms [y n mild n] [10 Marks]

Q4. Suppose you live in London, England and you notice that during the winter, it rains 50% of the time and that it is cloudy 80% of the time (sometimes it is cloudy without rain). You know, of course, that 100% of the time, if it is raining, then it is also cloudy. Using Bayes' rule, compute the chances of rain, given that it is just cloudy.

Q5. A theme park hired you after graduation. Assume that you want to predict when the theme park receives lots of visitors. You gathered the following data:

	Feature 1 Sunny?	Feature 2 High Temperature?	Feature 3 Weekend?	Class Lots of Visitors?
Day 1	yes	yes	yes	yes
Day 2	yes	no	yes	yes
Day 3	no	yes	no	yes
Day 4	yes	yes	no	yes
Day 5	yes	yes	no	yes
Day 6	yes	no	no	no
Day 7	no data since you were on business travel			
Day 8	no	no	yes	no

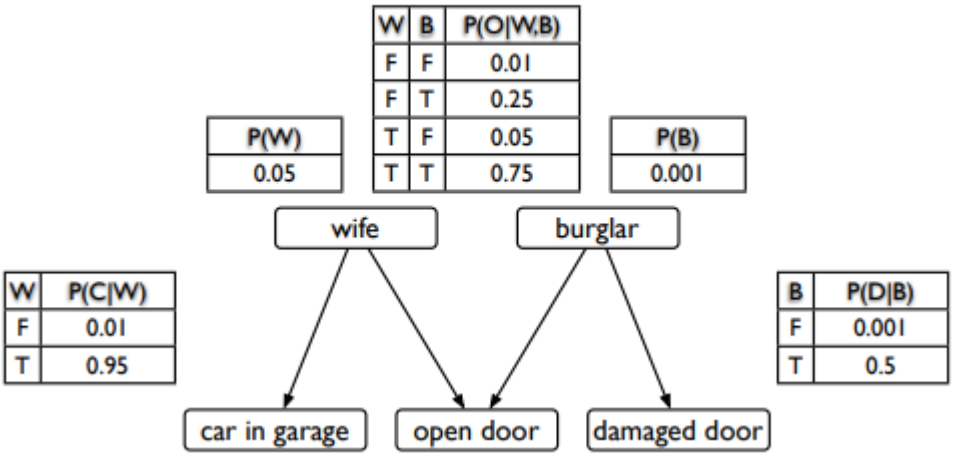
What is the probability that the learned Bayesian network will predict that the theme park receives lots of visitors on a cloudy and hot weekend day?

Q6. In a standard two of St. John school, 30% of the children have grey eyes, 50% of them have blue and the other 20%'s eyes are in other colors. One day they play a game together. In the first run, 65% of the grey eye ones, 82% of the blue eyed ones and 50% of the children with other eye color were selected. Now, if a child is selected randomly from the class, and we know that he/she was not in the first game, what is the probability that the child has blue eyes?

Q7. Construct the decision tree using the training data set given below. The data tuples are described by the attributes age, income, student, and credit rating. The class label attribute, buys computer, has two distinct values (namely, yes, no). Let **C1** correspond to the class buys computer = **yes** and **C2** correspond to buys computer = **no**. The tuple we wish to classify is **X = (age = youth, income = medium, student = yes, credit rating = fair)**

RID	*age*	*income*	*student*	*credit_rating*	*Class: buys_computer*
1	youth	high	no	fair	no
2	youth	high	no	excellent	no
3	middle_aged	high	no	fair	yes
4	senior	medium	no	fair	yes
5	senior	low	yes	fair	yes
6	senior	low	yes	excellent	no
7	middle_aged	low	yes	excellent	yes
8	youth	medium	no	fair	no
9	youth	low	yes	fair	yes
10	senior	medium	yes	fair	yes
11	youth	medium	yes	excellent	yes
12	middle_aged	medium	no	excellent	yes
13	middle_aged	high	yes	fair	yes
14	senior	medium	no	excellent	no

Q8. For the Bayesian network given below:



a. Calculate the probability that the door is open, it is wife and not a burglar, also the car is in the garage, and the door is not damaged.
b. Calculate the probability that it is the burglar, the door is open and also damaged and there is no car in garage.
c. Calculate the probability that the door is closed, it is not wife and not a burglar, also the car is in the garage, and the door is not damaged.