Exam3 practice questions: Spring 2014

Tip: Time yourself when solving each of the problems.

Reasoning about Uncertainty

a. (T/F) If P(a|b,c)= P(b|a,c) then P(a|c)=P(b|c)

b. (T/F) If P(a|b)=P(a) then P(a|b,c)=P(a|c)

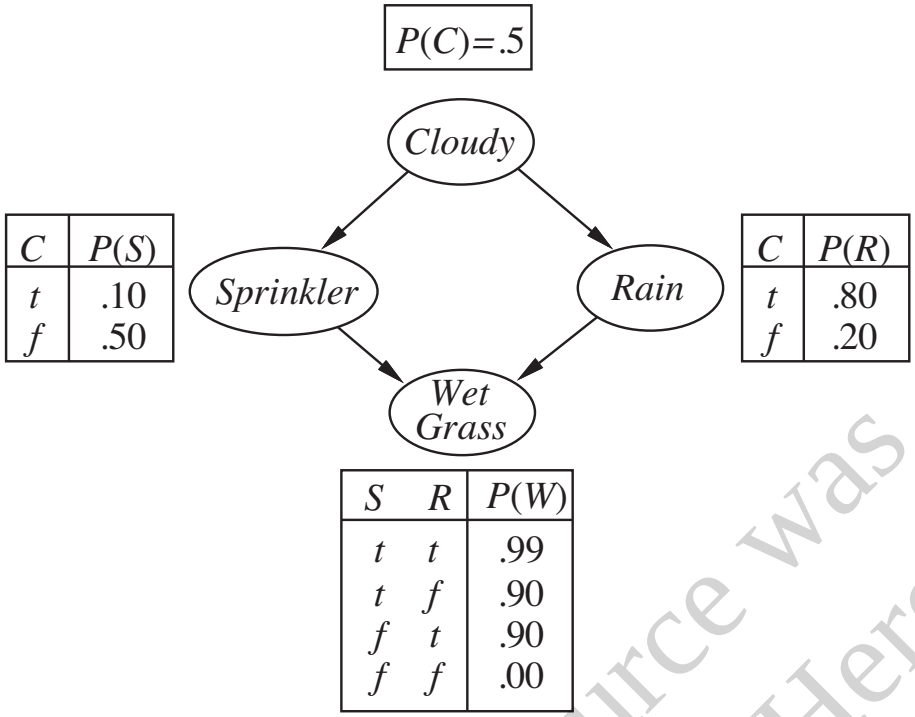
c. Your doctor performs a series of medical tests. You test positive for a serious, but very rare disease. The test is 99% accurate, meaning the probability that it is positive when you do have the disease is 0.99, and the probability that it is negative if you don't is also 0.99. The disease strikes 1 in 10,000.

What is the probability that you have the disease? Give both the formula and the value.

d. Given the full joint probability table for the dentist problem, draw the Bayesian network and its corresponding conditional probability tables. Calculate the **P**(*Cavity* / **toothache**) using the conditional probability tables.

	toothache		¬ *toothache*	
	catch	¬ *catch*	*catch*	¬ *catch*
cavity	.108	.012	.072	.008
¬ *cavity*	.016	.064	.144	.576

f. Given the Belief network for the wet grass problem, answer the questions below



C	P(S)
t	.10
f	.50

C	P(R)
t	.80
f	.20

S	R	P(W)
t	t	.99
t	f	.90
f	t	.90
f	f	.00

f1. Calculate the probability of P(*w, s,* ¬*c*). Give both the formula and calculations with values.

f2. Calculate the probability of P(*w, s, c*). Give both the formula and calculations.

f3. Calculate the probability of P(***S*** |*w*). Give both the formula and calculations with values.

Learning

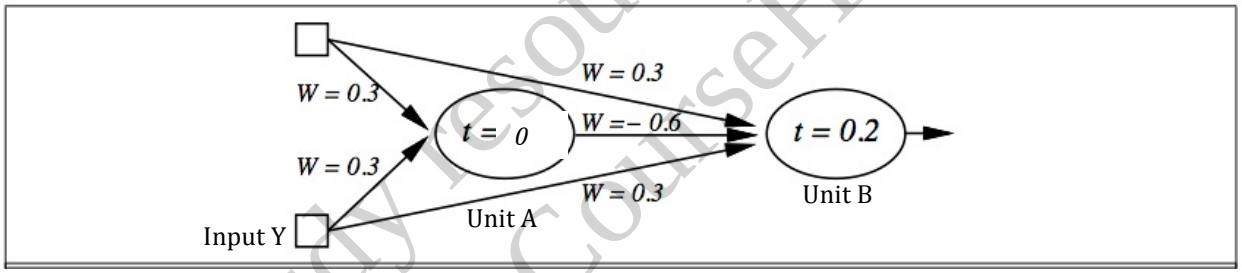
a. Draw the neural network to solve the OR function for two inputs. Specify what type of unit you are using.

b. Why is Machine Learning needed?

c. Circle each learning technique that is a **supervised** learning technique. For what types of problems would you apply each of the following learning techniques?

- Decision Tree
- Neural Net
- Bayesian Learning
- Example-based Learning
- Reinforcement Learning
- Support Vector Machine

d. Given this diagram of a Neural Network with two perceptron units A and B, answer the questions below.



- When input X = 0 and input Y = 0, what does the Unit A output? What does the Unit B output?
- When input X = 0 and input Y = 1, what does the Unit A output? What does the Unit B output?
- When input X = 1 and input Y = 0, what does the Unit A output? What does the Unit B output?
- When input X = 1 and input Y = 1, what does the Unit A output? What does the Unit B output?
- What Boolean function does this Neural Network compute?

g. Given the hypothesis ***Bird*** **= WarmB & LayE & Fly** for the concept **Bird**, answer the questions below:

- [True/False] **f(Robin: WarmB & LayE & Fly)=Bird** is a True Positive
- [True/False] **f(Ostrich: WarmB & LayE & ¬Fly)=Bird** is a False Negative
- [True/False] **f(Pteranodon: ColdB & LayE & Fly)=Reptile** is a True Negative
- [True/False] **f(Platypus: WarmB & LayE & ¬Fly)=Mammal** is a False Positive
- [True/False] **f(Bat: WarmB & ¬LayE & Fly)=Mammal** is a True Positive

Future directions of AI Research

For the questions below choose any 2 topics from Lecture 12:

a. Describe how each topic relates to the material discussed in class
b. Describe the limitations/pitfalls and future directions of each topic
c. Compare and contrast the two research topics