CS-171, Intro to A.I. — Quiz#4 — Fall Quarter, 2014 — 20 minutes

YOUR NAME: _____

YOUR ID: _____ ID TO RIGHT:_____ ROW:_____ SEAT NO.: _____

1. (45 pts total, 15 pts each, -1 each error, but not negative) Bayesian Networks.
1a. (15 pts) Write down the factored conditional probability expression that corresponds to the graphical Bayesian Network shown.
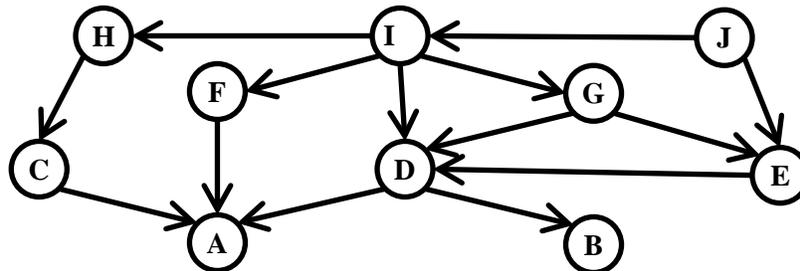

1b. (15 pts) Draw the Bayesian Network that corresponds to this conditional probability:

P(A | D,F,H,I) P(B | D, E,G, J) P(C | H) P(D | G) P(E| J) P(F | H) P(G | I, J) P(H) P(I) P(J)
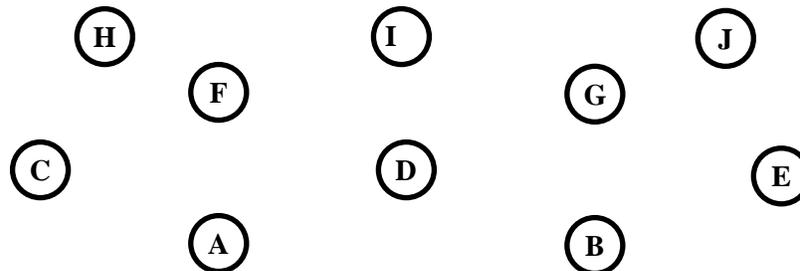
1.c. (15 pts) Below is the Bayesian network for the WetGrass problem [Fig. 14.12(a) in R&N].

P(C)
.5

C	P(S)
t	.1
f	.5

C	P(R)
t	.8
f	.2

S	R	P(W)
t	t	.99
t	f	.90
f	t	.90
f	f	.00
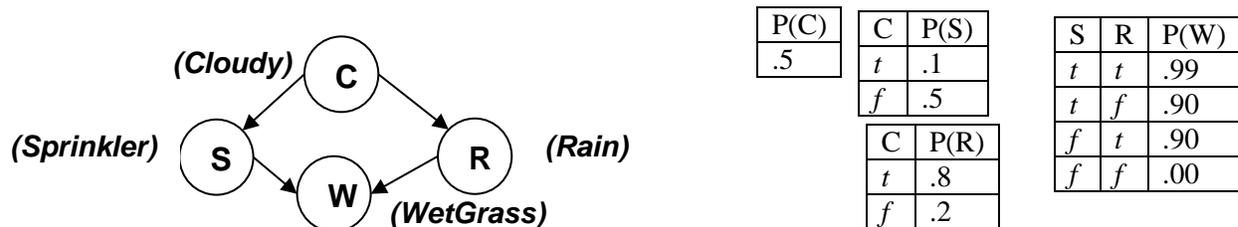
Write down an expression that will evaluate to P(C=t ∧ R=t ∧ S=f ∧ W = t).
The probability tables show the probability that variable is True, e.g., P(M) means P(M=t). Express your answer as a series of numbers (numerical probabilities) separated by multiplication symbols. You do not need to carry out the multiplication to produce a single number (probability). **SHOW YOUR WORK.**

**** TURN PAGE OVER. QUIZ CONTINUES ON THE REVERSE ****

2. (30 pts total) Decision Tree Learning. Consider the following data set consisting of three binary input attributes (*A1, A2,* and *A3*) and one binary output (*y*):

Example	A1	A2	A3	Output y
x1	1	0	0	0
x2	1	0	1	0
x3	0	1	0	0
x4	1	1	1	1
x5	1	1	0	1

2.a. (15 pts) Use the Decision-Tree-Learning algorithm to draw a decision tree for these data.

2.b. (5 pts) How would your tree classify *A1*=0, *A2*=0, *A3*=0? (Write 0 or 1.) _____

2.c. (5 pts) How would your tree classify *A1*=0, *A2*=0, *A3*=1? (Write 0 or 1.) _____

2.d. (5 pts) How would your tree classify *A1*=0, *A2*=1, *A3*=1? (Write 0 or 1.) _____

3. (25 pts total, 5 pts each) Machine Learning. Label the following statements T (true) or F (false).

3a. _____ A decision tree can learn and represent any Boolean function.

3b. _____ The information gain from an attribute A is how much classifier accuracy improves when attribute A is added to the example feature vectors in the training set.

3c. _____ Overfitting is a general phenomenon that occurs with most or all types of learners.

3d. _____ Cross-validation is a way to improve the accuracy of a learned hypothesis by reducing over-fitting using Ockham's razor.

3e. _____ An agent is learning if it improves its performance on future tasks after making observations about the world.