chapter 9: Uncertainty

[1] Why can't we usually handle uncertainty by means of predicate logic?

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[2] Define the following terms, with illustrative **examples** if possible

i. Probability
ii. Prior Probability
iii. Posterior Probability
iv. Conditional Probability
v. Joint Probability
vi. Product rule
vii. Bayes' Rule

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[3] Assume Clue game having two characters, two weapons and two rooms.

Who	What	Where	Probability
plum	rope	hall	1/8
plum	rope	kitchen	1/8
plum	pipe	hall	1/8
plum	pipe	kitchen	1/8
green	rope	hall	1/8
green	rope	kitchen	1/8
green	pipe	hall	1/8
green	pipe	kitchen	1/8

Compute

i. $P(plum, rope, hall)$
ii. $P(plum)$
iii. $P(green, pipe)$
iv. $P(rope, \neg hall)$
v. $P(rope \vee hall)$
vi. $P(green \mid hall)$

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[4] Assume three Boolean RVs: Hayfever HF, Sneeze SN, ItchyEyes IE .

HF	*SN*	*IE*	**Probability**
false	false	false	0.5
false	false	true	0.09
false	true	false	0.1
false	true	true	0.1
true	false	false	0.01
true	false	true	0.06
true	true	false	0.04
true	true	true	0.1

Compute

1. *P(sn)*
2. *P(hf)*
3. *P(sn,ie)*
4. *P(hf,sn)*
5. *P(hf | sn)*
6. *P(hf | ie)*
7. *P(hf | sn) + P(¬ hf | sn)*
8. *P(hf | sn, ie)*

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[5] Consider the following Joint table

	Toothache	¬Toothache
Cavity	0.04	0.06
¬Cavity	0.01	0.89

Calculate

1. P(Toothache)
2. P(Toothache v Cavity)
3. P(Cavity | Toothache)
4. P(Toothache | Cavity)

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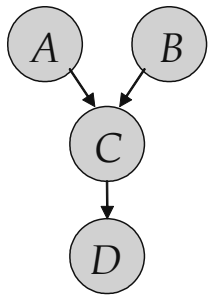
[6] Given the following Bayesian Network



1. Show steps to compute: $P(a,b,c,d) = P(d,c,b,a)$
2. Compute: $P(a,b)$
3. Compute: $P(c)$

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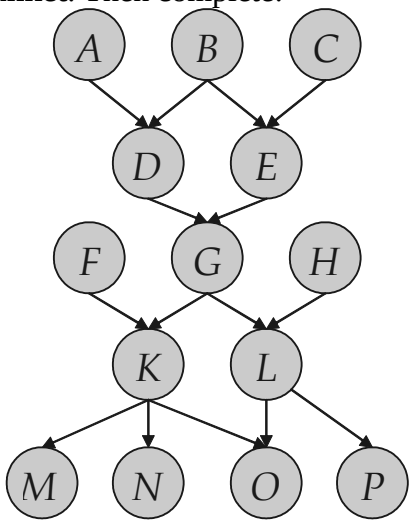
[7] Define **Markov blanket**. Then complete:



Given *D* and *E*, *so G* is CI of .....
Given *F* and *G*, *so K* is CI of .....

What is the Markov blanket for *G*? .....
Given this blanket *G* is CI of .....……

[8] Compare between **Crisp Logic** and **Fuzzy Logic**
According to : definition, Membership function with example, usefulness
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[9] What are the Fuzzy Set Operations, apply them on

A = {1.0, 0.20, 0.75}, B = {0.2, 0.45, 0.50}

[10] define Fuzzy Expert System, showing its stages

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[11] for a Fuzzy Expert System with two Inputs (x, y) and one output (z) and the Membership functions are defined as.

low(t) = 1 - (t / 10)
high(t) = t / 10

a) Draw the Membership functions
b) Create rule base
c) Apply Inference at X = 0.32 , Y = 0.61
d) Apply Composition to determine Z

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[12] we have two relations

R1: show the degree of correspondence between x-qualities (color) and y-qualities (ripeness), and

R2: show degree of correspondence between y-qualities (ripeness) and z-qualities (taste) .

$\mathbf{R}_1(x, y)$	*unripe*	*semiripe*	*ripe*
green	1	0.5	0
yellow	0.3	1	0.4
red	0	0.2	1

The relational matrix $\mathbf{R}_2$ (y–z connection) is given as

$\mathbf{R}_2(y, z)$	*sour*	*sweet-sour*	*sweet*
unripe	1	0.2	0
semiripe	0.7	1	0.3
ripe	0	0.7	1

calculate relation R which is R1○ R2

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Write a report on the following:

1 What is uncertainty? Discussing different methods for handling it.

2 What is Naïve Bayes Classifier, and its effect?

3 Compare between Fuzziness and Probability.

4 handling uncertainty using Hidden Marcov chain, support vector machine,…