Future Academy
Computer Science Department
Expert Systems Exam **Time: 2 hours**
Fourth Year **May 2015**

Question Three:

Suppose an expert, given three conditionally independent evidences E_1, E_2 and E_3, creates three mutually exclusive and exhaustive hypotheses H_1, H_2 and H_3, and provides prior probabilities for these hypotheses – $p(H_1)$, $p(H_2)$ and $p(H_3)$, respectively. The expert also determines the conditional probabilities of observing each evidence for all possible hypotheses. The following Table illustrates the prior and conditional probabilities provided by the expert.

a. compute the following
   1. $P(Hi|E_1)$ where i=1.
   2. $P(Hi|E_1E_2)$, $P(Hi|E_1E_3)$, $P(Hi|E_2E_3)$ where i=2.
   3. $P(Hi|E_1E_2\ E_3)$ where i=3.
b. What does mean that the posterior probabilities for any hypotheses=1.

Probability	Hypothesis		
	i=1	i=2	i=3
$P(H_i)$	0.25	0.40	0.35
$P(E_1\|H_i)$	0.5	0.3	0.8
$P(E_2\|H_i)$	0.7	0.9	0.0
$P(E_3\|H_i)$	0.9	0.6	0.7

Question Four:

a. Compare between Rule and case based systems.
b. Discuss in details the main phases in case base reasoning.

Question Five:

a. What is the difference between a crisp set and a fuzzy set? Determine possible fuzzy sets on the universe of discourse for man weights.
b. Explain the mathematical and graphical representation of hedges.
c. Compute the membership in the set of the following hedges:
   very, extremely, very very, more or less
   for a man has a 0.91 membership in the set of tall men.
d. Suppose we have the following fuzzy sets of tall men and very tall men which define as follow:
   Tall men = {0/180, 0.25/182.5, 0.50/185, 0.75/187.5, 0.5/185, 1/190}
   Very tall men = {0/180, 0.06/182.5, 0.25/185, 0.56/187.5, 0.5/185, 1/190}

   where each element in the set defines as membership *degree / the actual tall*
   Compute the fuzzy set of the following fuzzy sets operations:
   Complement of tall men fuzzy set, intersection of tall men fuzzy set and very tall men fuzzy set, union of tall men fuzzy set and very tall men fuzzy set.

Question Six:

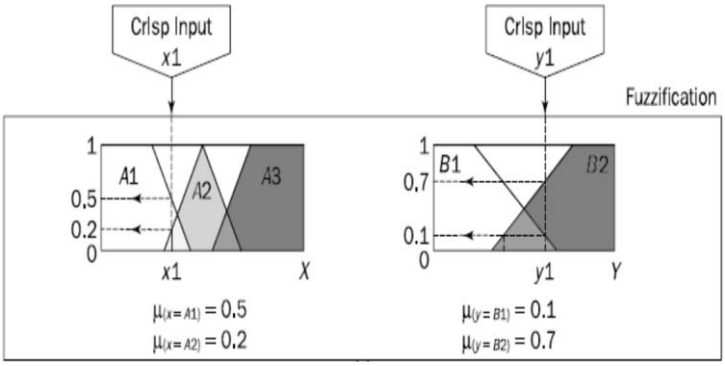
Draw the basic structure (Mamdani-style) that simulate the Fuzzy inference(Fuzzification, Rule evaluation, Aggregation of rule consequents, Defuzzification) for the following rules

1. *IF project_funding is adequate*
   OR project_staffing is small

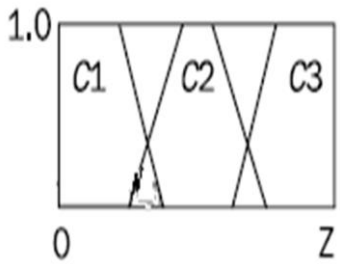
THEN risk is low

2. *IF project_funding is marginal*
   AND project_staffing is large
   THEN risk is normal
3. *IF project_funding is inadequate*
   THEN risk is high

Suppose the ranges of project funding and project staffing between 1 to 100 per cent.
And the crisp input x1=0.35 and y1=0.6
The membership degree for project funding and project staffing and risk as follow:



The membership degree for project funding and project staffing



The membership degree for risk

Good Luck