BITS, Pilani – Dubai
Dubai International Academic City, Dubai

IV Year (CHE/EEE/ME/CS/EIE)
Second Semester, 2008-2009

Comprehensive Examination

Course No: EA C482 | **Course Title: Fuzzy Logic and Applications**
Date: 20th May 2009 | **Weightage: 40%**
Duration: 3 Hours | **Max. Marks. 40**

(Answer Parts A and B on separate answer books.)
(Answer the questions in the sequential order.)
(Answer all the parts of a question together.)

PART – A

1. (a) Prove by Truth Table Method the following:
   (i) $F \vee (G \wedge H) = (F \vee G) \wedge (F \vee H)$
   (ii) $F \longrightarrow (G \longrightarrow H) = G \longrightarrow (F \longrightarrow H)$ **[4 Marks]**
   (b) Show, by method of derivation, that $S \vee R$ is implied by
   $(P \vee Q) \wedge (P \longrightarrow R) \wedge (Q \longrightarrow S)$ **[2 Marks]**

2. (a) Unify and resolve C1 and C2 to obtain C3, where
   $C1 = \{P(x), \neg Q(y), R(x, y), R(f(z), f(z))\}$
   $C2 = \{\neg Q(w), \neg R(f(a)), f(a), \neg R(f(w), f(w)), \neg S(u)\}$
   $C3 = \{P(f(a)), \neg Q(f(a)), \neg Q(a), \neg S(u)\}$ **[2 Marks]**
   (b) Show that $(Ez)\,(Q(z) \wedge R(z))$ is not implied by the formulas $(Ex)(P(x) \wedge Q(x))$ and $(Ey)\,(P(y) \wedge R(y))$, by assuming a universe of discourse which has two elements. **[2 Marks]**

3. (a) Define the following terms in relation to fuzzy sets.
   Height, Normalisation, Core, and Support. **[1 Mark]**
   (b) (i) Prove that $supp(A \cup B) = supp(A) \cup supp(B)$
   (ii) Show, by a counter example, that $supp(A') = [supp(A)]'$ is not true in general. **[3 Marks]**

   (c) A is a fuzzy set on the universe N, the set of natural numbers, defined by
   $A = 0.3/1 + 0.5/2 + 0.1/3 + 0.7/4 + 0.9/5$
   Find FC(A), the fuzzy cardinality of A. **[2 marks]**

4. Consider the ternary fuzzy relation T on U x V x W given by
   $T = 0.2/(a,x,\&) + 0.7/(b,x,\&) + 0.3/(a,y,\&) + 1/(a,y,*) + 0.1/(b,y,*)$
   where, $U = \{a, b\}$, $V = \{x, y, z\}$, and $W = \{\&, *\}$
   Find the cylindric closure of T_{12}^{3}, T_{13}^{2}, and T_{23}^{1}. **[4 Marks]**

[P.T.O.]

PART – B

5. Write down the truth tables for $\vee$, $\wedge$, $\neg$ in L_4 **[0.5+0.5=0.5=1.5 Marks]**

6. Show that $F \longrightarrow [\neg(\neg F)]$ is tautology in L_2 but $F \longrightarrow [\neg(F \longrightarrow (\neg F))]$ is not in L_3. Use the truth table. **[1.5 Mark]**

7. Show the graphical representation of Triangular and Trapezoidal membership functions and write down the mathematical definitions of these functions clearly mentioning the number of parameters needed to describe them completely. **[2Marks]**

8. Mention clearly two different types of deffuzification **[2Marks]**

9. In a risk assessment we deal with characterizing uncertainty in assessing the hazard to human health posed by various toxic chemicals. Because the pharmacokinetics of the human body are very difficult to explain for long term chemical hazards, such as chronic exposure to lead or to cigarette smoke, hazards can sometimes be uncertain because of scarce data on uncertainty in the exposure patterns. Let us characterize hazard linguistically with two terms: "low" hazard and "high" hazard

   "Low " hazard = {0/1 , 0.3/2 , 0.8/3 , 0.1/4 , 0/5}
   "High " hazard = { 0/1 , 0.1/2 , 0.2/3, 0.8/4 , 1/5}

   Find the membership functions for the following linguistic expressions

   i) Very high hazard and not low hazard
   ii) Slightly low hazard or high hazard
   iii) Intensely low hazard
   iv) Fairly high hazard

   [5Marks]

10. You are asked to develop a controller to regulate the temperature of a room. Knowledge of the system allows you to construct a simple rule of thumb: when the temperature is hot then cool room down by turning the fan at the fast speed, or expressed in rule form,

    IF temperature is HOT, ***THEN*** fan should turn FAST.

    Fuzzy sets for hot temperature and fast fan speed can be developed: for example,

    H = "hot" = {0/60 , 0.1/70 , 0.7/80 , 0.9/90 , 1/100} represents universe **X** in °F

    And **F ="fast"= {0/0 , 0.2 /1 , 0.5/2 , 0.9/3 , 1/4}** represents universe **Y** in 1000rpm

    a) From these two fuzzy sets construct a relation for the rule using classical implication $[\mu_R = \max[\min(\mu_H, \mu_F), (1-\mu_H)]$

    b) Suppose a new rule uses a slightly different temperature, say "moderately hot" and is expressed by the fuzzy membership function :

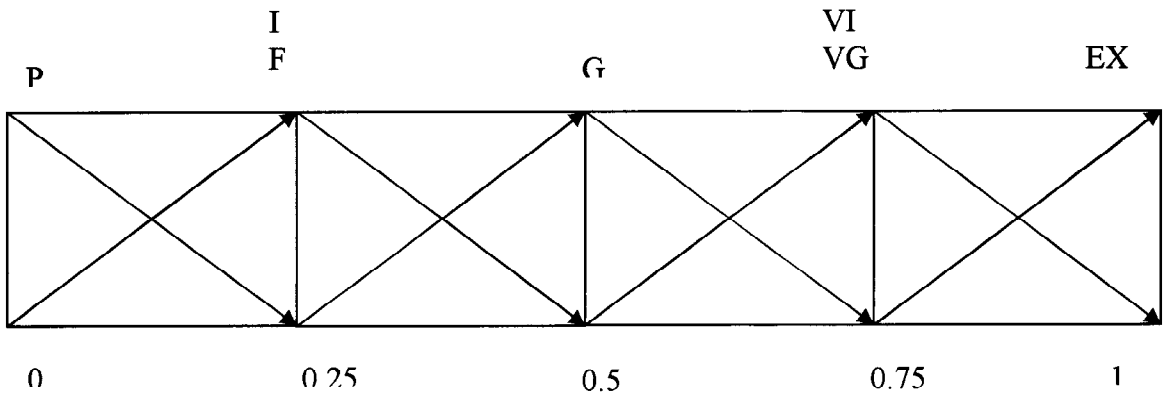
    H'= **{0/60 , 0.2/70 , 1/80 , 1/90 , 1/100}**

    Find the resulting fuzzy fan speed using max – product composition **[2+2 = 4 Marks]**

11. Three candidates a_1,a_2 and a_3 are contesting an election. They have been Assessed by an opinion poll with respect to the following characteristics (criteria): c_1: being honest c_2: being educated and c_3 having helping tendency. The result of the poll is as given in the following table:

	a_1	a_2	a_3	F
c_1	VG	P	G	VI
c_2	F	VG	G	I
c_3	EX	G	P	VI

The candidates were also rated by a separate agency independently and their rating are Good, Average and Fair for them in that order. Use the right decision model to help these agencies to arrive at the best candidates based on these data.



(Here, Ex = Excellent, VG = Very Good , G = Good , F = Fair , P = Poor, VI = Very Important and I = Important). Membership function height = 1.

[4 Marks]

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BITS, Pilani – Dubai
Dubai International Academic City, Dubai

IV Year (ChE/EEE/ME/CS/EIE)
Second Semester, 2008-2009

Test 2 (Open Book)

Course No: EA C482 | **Course Title: Fuzzy Logic and Applications**
Date: 15th April 2009 | **Weightage: 20%**
Duration: 50 minutes | **Max. Marks. 20**

(Answer the questions in the sequential order.)
(Answer all the parts of a question together.)

1. Given the following propositional variables and well formed formulas:

P.Variables

p: Ram is senior
q: Mohan owns a Premier
r: Mohan is a Junior
s: Ravi drives Maruti

WFFS:

a- It is not the case that both Ram is not senior and Mohan does not own Premier
b- Ram is a senior implies that Mohan owns Premier
c- Either Mohan is a junior or he does not own a Premier
d- Ravi does not drive Maruti implies that Mohan is not a Junior.

i) Write the equivalent WFFS in terms of the given propositional variables.
ii) Find the conclusion that match Ram, Mohan and Ravi with the cars Ambassador, Premier and Maruti. **[1.5+1.5=3 Marks]**

2. (a) Verify whether the following formula is tautology or contradiction using Truth table: $((\neg P \rightarrow Q) \rightarrow (Q \rightarrow P))$. **[1Mark]**

(b) The two WFFs P(b, y, a) and P(b, d, c) are not unfiable where a, b, c and d stand for distinct constants. State the reason for this. **[1Mark]**

3. Find the clausal form of

$$(Ex)[(Ey)\{P(x,y) \vee R(x)\} \rightarrow (Ez)Q(z,x)]$$ **[2Marks]**

4. Consider the WFF F: $P(x, c) \leftrightarrow (Q(y) \wedge O(x))$, where c is a constant. Let D = {a, b} and I be an interpretation over D such that I(c) = a and I(P), I(Q) and I(O) are given by the following table:

	x	y	I(P)	I(Q)	I(O)
σ_1	a	a	1	1	0
σ_2	a	b	1	0	1
σ_3	b	a	0	1	0

Compute the values of $v(F)(\sigma_1)$, $v(F)(\sigma_2)$, $v(F)(\sigma_3)$. **[1+1+1=3 Marks]**

[PTO]

5. U, V, and W are universal sets. R_1 and R_2 are relations on UxV and S is a relation on VxW. Either show that $So(R_1 \cup R_2) = (SoR_1) \cup (SoR_2)$ or give a counter example to disprove it. **[3 marks]**

6(a) Show that the projection on U of R ∪ S, is equal to the union of the projections on U of R and S, taken separately. **[2 marks]**

(b) Show that the complement of the projection on U is not (in general) same as the projection on U of the complement of R. **[1 mark]**

7(a) Let R be a binary fuzzy relation on U. Show that R is (max-min composition) transitive if and only if RoR is contained in R, where (as usual) o stands for the max-min composition. **[2 marks]**

(b) If R is a binary fuzzy relation on A then its inverse R^{-1} is defined as the binary fuzzy relation on A given by $R^{-1}(a, b) = R(b, a)$ for all a, b in A. Show that

(i) R^{-1} is reflexive if R is reflexive.

(ii) R^{-1} is symmetric if R is symmetric.

(iii) R^{-1} is transitive if R is transitive. **[2 marks]**

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BITS, Pilani – Dubai
Dubai International Academic City, Dubai

IV Year (CHE/EEE/ME/CS/EIE)
Second Semester, 2008-2009

Test 1 (Closed Book)

Course No: EA C482 | **Course Title: Fuzzy Logic and Applications**
Date: 22nd Feb 2009 | **Weightage: 20%**
Duration: 50 minutes | **Max. Marks. 20**

(Answer the questions in the sequential order.)
(Answer all the parts of a question together.)

1. For any two fuzzy sets A and B, show that $(A \cup B)' = A' \cap B'$. **[3 marks]**

2. Show by a counter example that the law of excluded middle (LEM) and the law of contradiction (LoC) are not true for fuzzy sets. **[2 marks]**

3. A = (0.0, 0.3, 0.2, 0.8, 0.1) is a fuzzy set on the universe U = {a, b, c, d, e}. Find the following.
(a) A', the complement of A.
(b) $A_{0.3}$, the α-cut of A.
(c) ht(A), the height of A.
(d) A_N, the normalisation of A.
(e) core(A), the core of A.
(f) supp(A), the support of A.
(g) L(A), the level set of A.
(h) 0.5A, the restricted scalar multiple of A. **[4 marks]**

4. Define the term fuzzy power set. State the relationship between power sets and fuzzy power sets. **[1 mark]**

5. A and B are fuzzy sets on U = {a, b, c, d} given by
A = (0.2, 0.5, 0, 0.8), B = (0.6, 0, 0.8, 0.3)
(i) Find FC(A), FC(B), FC($A \cap B$).
(ii) Do you observe any relation between these fuzzy sets? **[3*1+1 = 4 marks]**

[P.T.O.]

6. Consider the three domains U,V and W where U=V=W=N, the set of natural numbers. Let f: U x V → W be given by f(m, n) = m + n. i.e. f is the sum operation on natural numbers.
Let A and B be fuzzy sets on U and V respectively, given by
A = 0.2/2+0.8/3 +0.7/4 and B = 0.7/3 + 0.6/4 + 0.5/5
(a) find supp(A) and supp(B)
(b) find f(m , n) table
(c) find a fuzzy set C = f(A,B) for all w elements belong to W.
[0.5+0.5+2=3 marks]

7. Give the mathematical definition of the "Drastic Intersection" operation. Define the T-Norm which is referred as strict Archimedean T- Norm. **[0.5+0.5 =1 mark]**

8. If α –cuts of a fuzzy set A are as follows, then obtain fuzzy set A
$A_{0.2}$ = 1/X1 + 1/X2 +1/X3 +1/X4 +1/X5
$A_{0.4}$ = 0/X1 + 1/X2 +1/X3 +1/X4 +1/X5
$A_{0.6}$ = 0/X1 + 0/X2 +1/X3 +1/X4 +1/X5
$A_{0.8}$ = 0/X1 + 0/X2 +0/X3 +1/X4 +1/X5
A_{1} = 0/X1 + 0/X2 +0/X3 +0/X4 +1/X5 **[2 marks]**

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BITS, Pilani – Dubai
Dubai International Academic City, Dubai

IV Year (CHE/Mech/CS)
Second Semester, 2008-2009

Quiz 3 Version A

Course No: EA C482 | **Course Title: Fuzzy Logic and Applications**
Date: 6th May 2009 | **Weightage: 5%**
Duration: 20 minutes | **Max. Marks. 5**

ID No. **Name:**

1. Which of the following is the correct definition of $\leftrightarrow$ in many-valued logic?
   a. $T(p \leftrightarrow q) = \max\{(T(p), T(q)\}$
   b. $T(p \leftrightarrow q) = \min\{1, 1-T(p)+T(q)\}$
   c. $T(p \leftrightarrow q) = \max\{1, 1-T(q)+T(p)\}$
   d. $T(p \leftrightarrow q) = 1 - |T(p) - T(q)|$

2. Which of the following is NOT true?
   a. $(Ex)\ [P(x) \wedge Q(x)] = [(Ex)\ P(x)] \wedge [(Ex)\ Q(x)]$
   b. $(Ex)\ [P(x) \vee Q(x)] = [(Ex)\ P(x)] \vee [(Ex)\ Q(x)]$
   c. $(Ax)\ [P(x) \vee Q(x)] = [(Ax)\ P(x)] \vee [(Ax)\ Q(x)]$
   d. $(Ax)\ [P(x) \wedge Q(x)] = [(Ax)\ P(x)] \wedge [(Ax)\ Q(x)]$

3. What is the name given to the following rule of inference?

   If p then q
   p'
   ---
   q'
   ---

   where p, q, p', and q' are fuzzy propositions.
   a. Fuzzy Modus Tollens (FMT)
   b. Generalised Modus Ponens (GMP)
   c. Fuzzy Syllogism (FS)
   d. Fuzzy Inference Mechanism (FSM)

4. What is a necessary and sufficient condition for L_m to be contained in L_n?
   a. $m \leq n$
   b. m divides n
   c. (n-1) divides (m-1)
   d. (m-1) divides (n-1)

5. Which of the following is NOT a tautology in L_3?
   a. $[(\neg F) \rightarrow F] \rightarrow F$
   b. $F \rightarrow F$
   c. $(F \wedge G) \rightarrow (G \wedge F)$
   d. $F \rightarrow [\neg(\neg F)]$

6. Which of the following rules of inference of predicate logic should be applied only when certain conditions are satisfied?
   a. EG
   b. UI
   c. UG
   d. None of these

7. Which of the following law of classical logic is NOT satisfied in multi-valued logic?
   a. DeMorgan's law (DM)
   b. Distributive laws (D)
   c. Law of exclude the Middle (LEM)
   d. Associative laws (A-1 and A-2)

8. Which of the following is the definition of Mamdani implication?
   a. $T[P(x) \rightarrow Q(y)] = \max [P(x), Q(y)]$
   b. $T[P(x) \rightarrow Q(y)] = \min [P(x), Q(y)]$
   c. $T[P(x) \rightarrow Q(y)] = \max \{1, 1 - P(x) + Q(y)\}$
   d. $T[P(x) \rightarrow Q(y)] = \min \{1, 1 - P(x) + Q(y)\}$

9. What operation is used in the Fuzzy Inference Mechanism (FIM) to combine the effect of all the rules in the rule base?
   a. aggregation
   b. disjunction
   c. conjunction
   d. None of these

10. A ------ is a substitution that makes two or more WFFs equal.
   a. conjugate
   b. substitute
   c. unification
   d. unifier

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BITS, Pilani – Dubai
Dubai International Academic City, Dubai

IV Year (CHE/Mech/CS)
Second Semester, 2008-2009

Quiz 2 Version A

Course No: EA C482 | **Course Title: Fuzzy Logic and Applications**
Date: 31st Mar 2009 | **Weightage: 5%**
Duration: 20 minutes | **Max. Marks. 5**

ID No. **Name:**

1. Which of the following is not a basic connective used in defining WFFs?
   a. V
   b. ^
   c. ¬
   d. =>

2. F → G is false only when
   a. F and G are False
   b. F is False and G is true
   c. F is true and G is False
   d. F and G are True

3. Which of the following is not true?
   a. pVq → p
   b. ¬C is a tautology
   c. T ≡ ¬C
   d. Every propositional symbol is valid in an interpretation

4. Which of the following is not correct?
   a. F → G = (¬F) v G
   b. F ^ (¬F) = T
   c. F ↔ G = (F → G) ^ (G → F)
   d. ¬ (F v G) = (¬F) ^ (¬G)

5. Which of the following is not correct?
   a. Every contradiction is equivalent to C
   b. All tautologies are equivalent to one another
   c. A contradiction is invalid
   d. All of these are correct

6. A BFR R on U x V where U = {a, b, c} and V = {x, y} is defined by
   R = 0.6/(a,x) + 1.0/(a,y) + 0.3/(b,x) + 0.5/(b,y) + 0.4/(c,x) + 0.2/(c,y)
   What is R_2?
   a. (1, 0.5, 0.4)
   b. (0.6, 0.3, 0.2)
   c. (0.3, 0.2)
   d. (0.6, 1.0)

7. A BFR R on U x V where U = {a, b, c} and V = {x, y} is defined by
   R = 0.6/(a,x) + 1.0/(a,y) + 0.3/(b,x) + 0.5/(b,y) + 0.4/(c,x) + 0.2/(c,y)
   R_1 = (1.0, 0.5, 0.4). What is R_1^2?
   a. 1.0/(a,x) + 1.0/(a,y) + 0.5/(b,x) + 0.5/(b,y) + 0.4/(c,x) + 0.4/(c,y)
   b. 0.6/(a,x) + 0.3/(b,x) + 0.2/(c,x) + 1.0/(a,y) + 0.5/(b,y) + 0.4/(c,y)
   c. 1.0/(a,y) + 0.5/(b,y) + 0.4/(c,y)
   d. 1.0/(a,x) + 0.5/(b,x) + 0.4/(c,x)

8. R is a fuzzy relation on U x V and S is a fuzzy relation on V x W where U = {a, b}, V = {x, y}, and W = {&, *}, given by
   R = 1.0/(a,x) + 0.4/(a,y) + 0.3/(b,x) + 0.0/(b,y)
   S = 0.7/(x,&) + 0.1/(x,*) + 0.2/(y,&) + 0.9/(y,*)
   What is S o R?
   a. 0.2/(a,&) + 0.1/(a,*) + 0.0/(b,&) + 0.1/(b,*)
   b. 0.2/(a,&) + 0.7/(a,*) + 0.3/(b,&) + 0.1/(b,*)
   c. 0.7/(a,&) + 0.4/(a,*) + 0.3/(b,&) + 0.1/(b,*)
   d. 0.9/(a,&) + 0.2/(a,*) + 0.3/(b,&) + 0.0/(b,*)

9. A BFR R is defined by

$$R = \begin{matrix} 0.0 & 0.2 & 0.1 \\ 0.2 & 1.0 & 0.5 \\ 0.1 & 0.5 & 0.3 \end{matrix}$$

   Then R is
   a. Reflexive but not symmetric
   b. Symmetric but not reflexive
   c. Both reflexive and symmetric
   d. Neither reflexive nor symmetric

10. S is a ternary fuzzy relation with six cylindric extensions S_1^{23}, S_2^{13}, S_3^{12}, S_{13}^{2}, S_{12}^{3}, S_{23}^{1}. How many cylindric closures can be constructed from these?
    a. 6
    b. 15
    c. 30
    d. 57

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BITS, Pilani – Dubai
Dubai International Academic City, Dubai

IV Year (CHE/Mech/CS)
Second Semester, 2008-2009

Quiz 1 Version A

Course No: EA C482 | **Course Title: Fuzzy Logic and Applications**
Date: 4th Mar 2009 | **Weightage: 5%**
Duration: 20 minutes | **Max. Marks. 5**

ID No. **Name:**

1. How many fuzzy sets can be defined on a universal set containing n elements?
   a. n!
   b. n^2
   c. 2^n
   d. infinite

2. Which of the following statements is NOT true for fuzzy sets?
   a. $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
   b. $A \cap A = A \cup A$
   c. $A \cup (A \cap B) = B$
   d. $(A \cup B)' = A' \cap B'$

3. Which of the following is true for scalar cardinality of a fuzzy set?
   a. It is always a nonnegative integer.
   b. It can be any real number.
   c. It is defined only for fuzzy sets over finite universe.
   d. It is defined only for fuzzy sets with finite support.

4. If ht(A) = 0, then A is
   a. Φ
   b. U
   c. a normal set.
   d. a crisp set.

5. Which of the following fuzzy sets can not be normalised?
   a. The empty fuzzy set Φ.
   b. A fuzzy set whose support is an infinite set.
   c. A crisp set in the form of a fuzzy set.
   d. A fuzzy set over an infinite universe.

6. Which of the following statements is NOT true?
   a. supp(A) is a crisp set for all fuzzy sets A.
   b. supp(A) $\subseteq$ core(A) for all fuzzy sets A.
   c. supp(A) = core(A) only for crisp sets A.
   d. supp(A) = Φ if and only if A = Φ

7. Which of the following statements is NOT true?
   a. α-cut of a fuzzy set is a crisp set.
   b. Restricted Scalar Multiplication is defined only for α such that $0<\alpha\leq 1$.
   c. If $0<\alpha \leq \beta\leq 1$, then $A_\alpha \subseteq A_\beta$ for any fuzzy set A.
   d. If $\alpha = 1$, $\alpha A = A$

8. If A, B are fuzzy sets on U and α, β are such that $0<\alpha, \beta\leq 1$, then which of the following is NOT true?
   a. $\alpha(A \cup B) = (\alpha A) \cup (\alpha B)$
   b. $(\alpha A)' = \alpha(A')$
   c. $(\alpha\beta)A = \alpha(\beta A)$
   d. $\alpha A \subseteq A$

9. Which of the following is the universe of the fuzzy cardinality FC(A) of a fuzzy set A on the universe U?
   a. U.
   b. R, the set of real numbers.
   c. N, the set of natural numbers.
   d. [0, 1]

10. Concentration of A, con(A), is the α-th power of A where α is
   a. ½
   b. 2
   c. ¼
   d. 0

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Dr. Sherif Kamel

BITS,PILANI-DUBAI CAMPUS
Academic City, Dubai
Year IV– semester 2 2008-2009
Quiz 3

Course No. EA C482 Course Title : fuzzy logic
Date : April 2009 Time 20 minutes Max Mrks=5

NAME:---------- ID:.....

In applying the fuzzy logic to an Automotive driving situation , we are considering the speed and distance between cars. Assume the following rules for this logic:

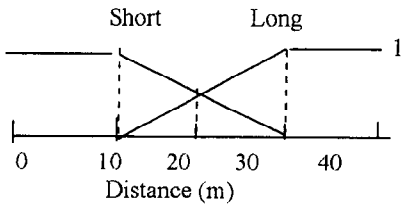
Rule 1: IF distance between cars is short
AND speed is low,
THEN hold the gas pedal steady (maintain the speed).

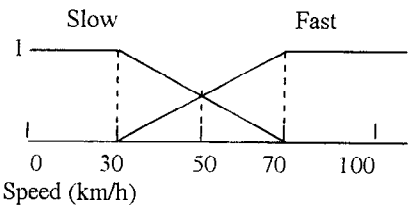
Rule2 : IF distance between cars is short
AND speed is fast,
THEN step on the brake (reduce the speed).

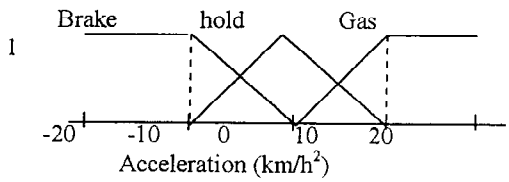
Rule3: IF distance between cars is long
AND speed is slow,
THEN step on the gas pedal (increase the speed).

Rule4 : IF distance between cars is long
AND speed is fast,
THEN hold the gas pedal steady (maintain the speed).

The membership functions for driving are given below:







a- Determine the linguistic variables and their domains.
b- Determine the linguistic value for each variable.
c- Construct the Rule table for driving.
d- Based on Mamdani's Direct Method ,sketch roughly the Reasoning process for the following input [distance between cars 15m and the speed 60km/h].Guess linguistically the conclusion .

Dr. Sheikh Kamal

BITS,PILANI-DUBAI CAMPUS
Academic City, Dubai
Year IV– semester I 2008-2009
Quiz 2

Course No. EA C482 Course Title : fuzzy logic
Date : March 11,2009 Time 15 minutes Max Mrks=5

NAME:---------- ID:.....

Q 1: [1 Mark]

a- Using truth table method prove the following. **[1 Mark]**

$F \leftrightarrow G = (F \wedge G) \vee (\neg F \wedge \neg G)$

b-Use the resolution method to prove that $\{F, \neg F\} \Rightarrow C$ **[1Mark]**

c-Prove the following using the rules of inference: **[1Mark]**

$\neg [(Ax)\ P(x)] = (Ex)\ [\neg P(x)]$

Q2 [1+ 1=2 Marks]

A binary relation between $X = \{ x_1, x_2, x_3 \}$ and $Y = \{ y_1, y_2, y_3, y_4 \}$ is defind with the help of the following Relation Matrix :

	y_1	Y_2	Y_3	Y_4
x_1	0.1	0.2	0.3	0.2
x_2	0.2	0.1	0.5	0.7
x_3	0.5	1.0	0.8	0.6

Obtain :

1- Projection $[R \downarrow X]$ AND $[R \downarrow Y]$

2- Cylindrical Extention $[R \uparrow X]$ And $[R \uparrow Y]$

BITS,PILANI-DUBAI CAMPUS
Academic City, Dubai
Year IV – semester 2 2008-2009
Quiz 1

Course No. EA C482 Course Title : fuzzy logic
Date : Feb 16,2009 Time 15 minutes Max Mrks=5

NAME:---------- ID:.....

Q 1: [1.5 Mark]

Define Concentration(Con), Dilation (DIL),and Contrast Intensification(INT) Operations.If A=0.2/1 + 0.5/2 + 0.8/4 +0.9/5 Then Obtain CON(A),DIL(A),and INT(A)

Q2: [1.5 Marks]

A and B are fuzzy sets on U={a,b,c,d} given by A=(0.2,0.5,0,0.8) and B=(0.6,0,0.8,0.3)

-a- Find FC(A), FC(B)

-b- FC(AUB)

Q3: [2 Marks]

Let x be linguistic variable that measures a university's academic excellence , which take the values from the universe of discourse {1,2,3,4,5,6,7,8,9}.Suppose the linguistic values for that variable includes Excellent, Good, Fair , and Bad

The membership functions of these linguistic labels are listed below:

Excellent(x) ={(8,0.2),(9,0.6),(10,1)}
Good(x) ={(6,0.1),(7,0.5),(8,0.9),(9,1),(10,1)}
Fair(x) ={(2,0.3),(3,0.6),(4,0.9),(5,1),(6,0.9), (7,0.5),(8,0.1)}
Bad(x) ={(1,1),(2,0.7),(3,0.4),(4,0.1)}

Construct the membership function of the following compound sets

a- Not Bad but Not Very Good

b- Good but Not Excellent