



**ABES Engineering College, Ghaziabad**  
**B. Tech Odd Semester Sessional Test-2**

**Printed Pages: 5**  
**Session: 2022-23**

**Course Code: KCS056**  
**Course Name: Application of Soft Computing**  
**Maximum Marks: 75**

**Roll No.:**  
**Date of Exam:**  
**Time:**

**Instructions:**

1. Attempt All sections.
2. If require any missing data, then choose suitably.

<b>Q. No.</b>	<b>Question</b>	<b>Mark s</b>	<b>CO</b>	<b>KL</b>	<b>PI</b>
<b>Section-A</b>		<b>Total Marks: 5*2 = 10</b>			
<b>1</b>	<b>Attempt ALL Parts</b>				
a)	Mention two conditions for representing partition w.r.t fuzzy logic	2	CO3	K2	1.1.2
b)	A membership function of a fuzzy set is given as $\mu_A(x) = 1/(1+x)^2$ . Represent it graphically.	2	CO4	K2	1.1.1
c)	For $A = [(1,.3) (2,.5) (3,1)]$ , Find strong alpha cut set for $\alpha=.5$	2	CO4	K3	2.3.1
d)	If chromosome is encoded as binary string of length of 200 and mutation probability is 2%. Explain the statement.	2	CO5	K2	2.4.4
e)	How can we calculate the fitness function value of a string, if it is a minimization problem and $f(x)=0$	2	CO5	K2	2.3.1
<b>Section-B</b>		<b>Total Marks: 3*5 = 15</b>			
<b>2</b>	<b>Attempt ANY ONE part from the following</b>				
a)	Consider 3 fuzzy sets given by: $A = \{(low,1), (medium,0.2), (high,0.5)\}$ $B = \{(positive,0.9), (zero,0.4), (negative,0.9)\}$ $C = \{(low,0.1), (medium,0.2), (high,0.7)\}$ 1) Find fuzzy relation for the Cartesian product of A and B. 2) Find CoR using max-min composition.	2+3	CO3	K3	2.4.1
b)	For a speed control of DC motor, the membership function of series resistance, armature current and speed are given as follows: $R_{se} = \{0.4/30, 0.6/60, 1.0/100, .1/120\}$ $I_a = \{0.2/20, 0.3/40, 0.6/60, 0.8/80, 1.0/100, 0.2/120\}$ $N = \{0.35/500, 0.67/1000, 0.97/1500, 0.25/1800\}$ Compute the relation T for relating series resistance to motor speed.	5	CO3	K3	2.3.1

<b>3</b>	<b>Attempt ANY ONE part from the following</b>																			
a)	Let sets of values of variable X and Y be $X=\{a, b, c\}$ and $Y=\{1, 2\}$ respectively. Assume that the 3 proposition "If X is A then Y is B is given" where $A=.4/a+.2/b+.6/c$ and $B=1/1+.4/2$ . Then given a fact expressed by proposition "X is A'" where $A'=0.6/a+0.9/b+0.7/c$ . Derive "Y is B" using generalized modus ponens	5	CO4	K2 2.4.1																
b)	Why fuzzy representation is always better than crisp representation for representing real world problems. Using your own intuition plot fuzzy membership function for weight of people.	2+3	CO4	K2 2.2.5																
<b>4</b>	<b>Attempt ANY ONE part from the following</b>																			
a)	In the three variable problem the following variable bound are specified $-6 < x < 12$ $.002 \leq y \leq 0.004$ $104 \leq z \leq 105$ What should be the minimum string length of any point $(x, y, z)$ coded in binary string to achieve the following accuracy in solution up to two significant digits.	5	CO5	K2 2.4.1																
b)	Consider the following Population of binary string for maximization problem. <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>String</th> <th>Fitness</th> </tr> </thead> <tbody> <tr> <td>001100</td> <td>8</td> </tr> <tr> <td>010101</td> <td>12</td> </tr> <tr> <td>101011</td> <td>6</td> </tr> <tr> <td>110001</td> <td>2</td> </tr> <tr> <td>000100</td> <td>18</td> </tr> <tr> <td>100000</td> <td>9</td> </tr> <tr> <td>010100</td> <td>10</td> </tr> </tbody> </table> What will be the expected no of copies of the best string in above population of mating pool under Tournament Selection.	String	Fitness	001100	8	010101	12	101011	6	110001	2	000100	18	100000	9	010100	10	5	CO5	K2 2.2.3
String	Fitness																			
001100	8																			
010101	12																			
101011	6																			
110001	2																			
000100	18																			
100000	9																			
010100	10																			
<b>Section-C</b>		<b>Total Marks: <math>5*10 = 50</math></b>																		
<b>5</b>	<b>Attempt ANY ONE part from the following</b>																			
a)	Let two fuzzy sets $P = \{P_1, P_2, P_3, P_4\}$ and $D = \{D_1, D_2, D_3, D_4\}$ represent a set of variety of paddy plants and a set of plant diseases. In addition to these, also consider another set $S = \{S_1, S_2, S_3, S_4\}$ be the common symptoms of the diseases. Let, R be a fuzzy relation on $P \times D$ , representing which plant is susceptible to which diseases, then R can be stated as,	10	CO3	K3 2.1.3																

$$\bar{R} = \begin{bmatrix} P_1 & D_1 & D_2 & D_3 & D_4 \\ P_2 & 0.6 & 0.6 & 0.9 & 0.8 \\ P_3 & 0.1 & 0.2 & 0.9 & 0.8 \\ P_4 & 0.9 & 0.3 & 0.4 & 0.8 \\ P_5 & 0.9 & 0.8 & 0.4 & 0.8 \end{bmatrix}$$

Also, consider T be another relation on D x S, which is given by

$$\bar{T} = \begin{bmatrix} D_1 & S_1 & S_2 & S_3 & S_4 \\ D_2 & 0.1 & 0.2 & 0.7 & 0.9 \\ D_3 & 1.0 & 1.0 & 0.4 & 0.6 \\ D_4 & 0.0 & 0.0 & 0.5 & 0.9 \\ D_5 & 0.9 & 1.0 & 0.8 & 0.2 \end{bmatrix}$$

Find the association of plants with the different symptoms of the disease.

- b) Determine if the requirements of the fuzzy relation being Equivalence is fulfilled or not.

$$R = \begin{bmatrix} 1 & 0.6 & 0 & 0.2 & 0.3 \\ 0.6 & 1 & 0.4 & 0 & 0.8 \\ 0 & 0.4 & 1 & 0 & 0 \\ 0.2 & 0 & 0 & 1 & 0.5 \\ 0.3 & 0.8 & 0 & 0.5 & 1 \end{bmatrix}$$

### 6 Attempt ANY ONE part from the following

- a) Let X= {a, b, c, d} Y= {1,2,3,4} and  
 A= {(a,0), (b,0.6), (c,0.8), (d,1)}  
 B= {(1,0.2), (2,1), (3,0.8)}  
 C= {(1,0), (2,0.4), (3,1), (4,0.8)}  
 Determine the implication relation

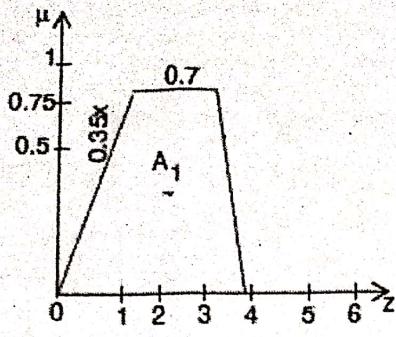
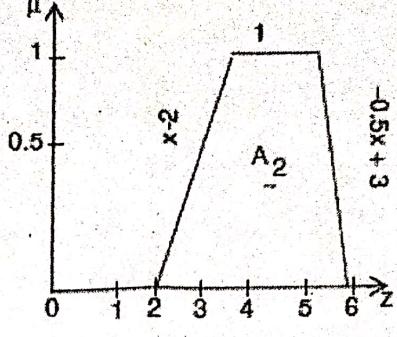
1. If X is A THEN Y is B else Y is C
2. If X is A THEN Y is B

10 CO3 K3 2.2.3

5+5 CO4 K3 2.2.3

- b) Apply Fuzzy Modus Ponens rule to deduce Rotation is quite slow.  
 Let  
 Temperature= {30,40,50,60,70,80,90,100}  
 Rotation= {10,20,30,40,50,60}  
 Given  
 High= {((70,1), (80,1), (90,0.3))},  
 Very High= {((80,0.6), (90,0.9), (100,1))}  
 Slow = {((30,0.8), (40,1), (50,0.6))}  
  1. If temperature is high rotation is slow.
  2. The temperature is very high

10 CO4 K3 2.2.3

7	<b>Attempt ANY ONE part from the following</b>				
a)	For the given membership function as shown in Figure determine the defuzzified output values using	2+2+2 +2+2	CO4	K3	
	  <p>1 Max Membership      2. weighted average      3. Mean Max Membership      4. Center of Sums      5. First of maxima and Last of Maxima.</p>			2.4.1	
b)	Using the inference approach, find the membership values for the triangular shapes (Isosceles, Right Angle, Isosceles right angle, Equilateral, Others) for a triangle with angles as $45^\circ, 75^\circ, 60^\circ$ .	2+2+2 +2+2	CO4	K3	2.4.1
8	<b>Attempt ANY ONE part from the following</b>				
a)	Use GA to solve the following non-linear programming problem: Minimize $(x_1-2.5)^2 + (x_2-5)^2$ subject to $5.5x_1 + 2x_2^2 - 18 \leq 0$ , $0 \leq x_1, x_2 \leq 5$ . Give 3 and 2 decimal places of accuracy to variable $x_1$ and $x_2$ respectively 1. How many bits are required for coding variable? 2. Write down the fitness function which you would be using in reproduction	5+5	CO5	K2	2.2.2
b)	How can fitness function be found for any optimization problem? Maximize the function $f(x)=x^2$ , with $x$ in integer interval $[0, 31]$ with the help of genetic algorithm	3+7	CO5	K2	2.1.1
9	<b>Attempt ANY ONE part from the following</b>				
a)	Find the starting fitness value of the function using Genetic Algorithm. Take precision of variables up to 4 decimal places $f(x_1, x_2) = 21.5 + x_1 \sin(4\pi x_1) + x_2 \sin(20\pi x_2)$ where $-3.0 \leq x_1 \leq 12.1$ $4.1 \leq x_2 \leq 5.8$	10	CO5	K3	2.4.4