Introduction to Soft Computing
Assignment 1
TYPE OF QUESTION: MCQ

Number of questions: **15** **Total mark: 15 × 1 = 15**

QUESTION 1:
Which of the following is not an example of hard computing?

a. Searching and shorting techniques
b. Finding roots of a polynomial
c. Hand written character recognition
d. Finding closest pair of points given a set of points

Correct Answer: c
Explanation: Hand written character recognition is performed by soft computing, as the inputs can be noisy and ambiguous and the output is probabilistic in nature. For other tasks, there exist mathematical models that generates a precise output.

QUESTION 2:
The term Hard Computing was introduced by?

a. Charles Darwin
b. Lofti A Zadeh
c. Rechenberg
d. Ebrahim H. Mamdani

Correct Answer: b
Explanation: In 1996, Lofti A Zadeh introduced the term Hard computing

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QUESTION 3:
Which of the following is a characteristic of any soft computing methodology?

a. It is based on binary logic, numerical analysis.
b. It produces precise solutions.
c. It is deterministic.
d. It exploits the tolerance for imprecision and uncertainty to achieve tractability, robustness and low solution cost.

Correct Answer: d
Explanation: Soft computing is a collection of methodologies that aim to exploit the tolerance for imprecision and uncertainty to achieve tractability, robustness, and low solution cost. It is based on fuzzy logic, neural nets and probabilistic reasoning. It provides an approximate solution.

QUESTION 4:

Let X is a universe of discourse and $\mu_A(x)$ is the membership function for the fuzzy set A. The set of all points $x \in X$ in the fuzzy set A is defined as a "core", if

a. $\mu_A(X) = 0$
b. $\mu_A(x) > 1$
c. $\mu_A(x) < 1$
d. $\mu_A(x) = 1$

Correct Answer: d
Explanation: The core of a fuzzy set A is the set of all points $x \in X$ such that $\mu_A(x) = 1$

QUESTION 5:

A fuzzy set is defined as a

a. A collection of elements
b. A collection of membership functions
c. A collection of ordered pairs of elements and corresponding membership function
d. None of the above

Correct Answer: c
Explanation: A fuzzy set is defined as a set of ordered pairs of elements and corresponding membership functions.

QUESTION 6:

The value of membership function at a crossover point is given by

a. 0.25
b. 0.5
c. 1
d. 0

Correct Answer: b
Explanation: At crossover point, the value of membership function is 0.5.

QUESTION 7:

Which membership function is known as Cauchy MF?

a. Gaussian
b. Sigmoidal
c. Generalized Bell
d. Triangular

Correct Answer: c
Explanation: The detailed description can be found Week 1 Lecture material 3– Page no 7.

QUESTION 8:

A Gaussian membership function of x, with two parameters c and σ is given by

a. $e^{\frac{1}{2}\left(\frac{x-c}{\sigma}\right)^2}$
b. $e^{-\frac{1}{2}\left(\frac{x-c}{\sigma}\right)^2}$
c. $e^{-\frac{1}{2}\left(\frac{x+c}{\sigma}\right)^3}$
d. $e^{-\frac{1}{2}\left(\frac{c}{x-\sigma}\right)^2}$

Correct Answer: b
Explanation: The Gaussian membership function is given by

Gaussian (x; c, σ) = $e^{-\frac{1}{2}\left(\frac{x-c}{\sigma}\right)^2}$

QUESTION 9:

Two fuzzy set A and B is given by

$$A = \{(x_1, 0.5), (x_2, 0.8), (x_3, 0.2)\}$$
$$B = \{(y_1, 0.2), (y_2, 0.1), (y_3, 0.9)\}$$

The Cartesian product A × B is given by-

a.
$$\begin{matrix} 0.5 & 0.5 & 0.5 \\ 0.8 & 0.8 & 0.8 \\ 0.2 & 0.2 & 0.2 \end{matrix}$$

b.
$$\begin{matrix} 0.2 & 0.2 & 0.2 \\ 0.1 & 0.1 & 0.1 \\ 0.9 & 0.9 & 0.9 \end{matrix}$$

c.
$$\begin{matrix} 0.2 & 0.1 & 0.5 \\ 0.2 & 0.1 & 0.8 \\ 0.2 & 0.1 & 0.2 \end{matrix}$$

d.
$$\begin{matrix} 0.5 & 0.5 & 0.9 \\ 0.8 & 0.8 & 0.9 \\ 0.2 & 0.2 & 0.9 \end{matrix}$$

Correct Answer: c

Explanation: The Cartesian product is given as $\mu_{A \times B} = min(\mu_A(x), \mu_B(y))$

QUESTION 10:

Which of the following is the equation for disjunctive sum?

a. $\mu_A(x) + \mu_B(x) - \mu_A(x).\ \mu_B(x)$
b. min $(1, \mu_A(x))$
c. $(A^c \cap B) \cup (A \cap B^c)$.
d. max$(0, \mu_A(x) + \mu_B(x) - 1)$

Correct Answer: c

Explanation: The detailed description can be found in Week 1 Lecture material 4 – Page no. 6.

QUESTION 11:

A fuzzy set A is said to be closed if -

a. If $\lim_{x\to-\infty} \mu_A(x) = 1$ and $\lim_{x\to+\infty} \mu_A(x) = 0$

b. If $\lim_{x\to-\infty} \mu_A(x) = \lim_{x\to+\infty} \mu_A(x) = 0$

c. If $\lim_{x\to-\infty} \mu_A(x) = 0$ and $\lim_{x\to+\infty} \mu_A(x) = 1$

d. If $\lim_{x\to-\infty} \mu_A(x) = \lim_{x\to+\infty} \mu_A(x) = 1$

Correct Answer: b

Explanation: Condition stated in option a is Open-left fuzzy set, Condition stated in option b is closed fuzzy set, and Condition stated in option c is Open-right fuzzy set.

QUESTION 12:

Two fuzzy set A and B are given by

$A = \{(x_1, 0.4), (x_2, 0.3), (x_3, 0.1)\}$, and

$B = \{(x_1, 0.5), (x_2, 0.7), (x_3, 0.3)\}$

Intersection of these two sets i.e. $A \cap B$ is given by

a. $\{(x_1, 0.4), (x_2, 0.7), (x_3, 0.3)\}$

b. $\{(x_1, 0.5), (x_2, 0.3), (x_3, 0.1)\}$

c. $\{(x_1, 0.5), (x_2, 0.7), (x_3, 0.1)\}$

d. $\{(x_1, 0.4), (x_2, 0.3), (x_3, 0.1)\}$

Correct Answer: d

Explanation: $A \cap B = min(\mu_A(x), \mu_B(x))$. The detailed description can be found week 1 lecture material 4- Page 3.

QUESTION 13:

Given Two set $A = (1,2,3,4)$ and $B = (3,5,7)$

A relation R is defined as, $R = \{(a,b)|b = a-1, (a,b) \epsilon A \times B\}$

Which of the following is the matrix representation of R?

a. $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$

b. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

c. $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

d. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$

Correct Answer: a

Explanation: Given Two set $A = (1,2,3,4)$ and $B = (3,5,7)$

$A \times B = \{(1,3),(1,5),(1,7),(2,3),(2,5),(2,7),(3,3),(3,5),(3,7),(4,3),(4,5),(4,7)\}$

Given $R = \{(a,b)|b = a-1, (a,b) \epsilon A \times B\}$

So, $R = \{(4,3)\}$

So, the matrix representation of R is $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$

QUESTION 14:

Suppose a relation R is given by: $\begin{bmatrix} 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$

Then, $\bar{R}$

a. $\begin{bmatrix} 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 \end{bmatrix}$

b. $\begin{bmatrix} 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 \end{bmatrix}$

c. $\begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

d. $\begin{bmatrix} 0 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \end{bmatrix}$

Correct Answer: d

Explanation: The detailed description can be found in Week 1 Lecture material 5 – Page no. 6.

QUESTION 15:

Let $P = \begin{bmatrix} 0.7 & 0.6 \\ 0.8 & 0.3 \end{bmatrix}$ and $Q = \begin{bmatrix} 0.8 & 0.5 & 0.4 \\ 0.1 & 0.6 & 0.7 \end{bmatrix}$.

Find R where $R = P \circ Q$ using max-min composition

a. $\begin{bmatrix} 0.7 & 0.6 & 0.6 \\ 0.8 & 0.5 & 0.4 \end{bmatrix}$

b. $\begin{bmatrix} 0.7 & 0.6 & 0.3 \\ 0.3 & 0.5 & 0.7 \end{bmatrix}$

c. $\begin{bmatrix} 0.1 & 0.3 & 0.3 \\ 0.3 & 0.2 & 0 \end{bmatrix}$

d. $\begin{bmatrix} 0.7 & 0.7 & 0.7 \\ 0.3 & 0.2 & 0.7 \end{bmatrix}$

Correct Answer: a

Explanation:

max {min(0.7, 0.8), min(0.6,0.1)} = 0.7

max {min(0.7, 0.5), min(0.6,0.6)} = 0.6, and so on.

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