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**MIT WORLD PEACE
UNIVERSITY | PUNE**

TECHNOLOGY, RESEARCH, SOCIAL INNOVATION & PARTNERSHIPS

॥ विश्वानामिति पूर्ण ॥

**ASSIGNMENT /
TEST BOOKLET**

Student's Name : Nishu Mohan Singh

Class : First Year B.Teh Division : Puml.A Roll No.: PA10 Academic Year : 2020 -2021

Subject : Soft Computing Assignment / Test No. : 1 Date : 18-12-2020

PLEDGE

I solemnly affirm that I have written this Assignment/Test based on my own preparation. I have neither copied it from others nor given it to others for coping. I know that this is to be submitted as a part of my submission at the end of the term.

Signature of the student

Q. No.	1	2	3	4	5	6	7	8	9	10	Total	
Marks/Grade												Name & sign of the faculty Member

(Please start writing assignment/ test from here)

Question 1

Hard Computing

1) Computing is based on binary logic

Soft Computing

Computing based on fuzzy logic

2) Focuses on giving a precise answer

Gives an approximate answer

3) Only sequential computing is allowed

It allows parallel computing

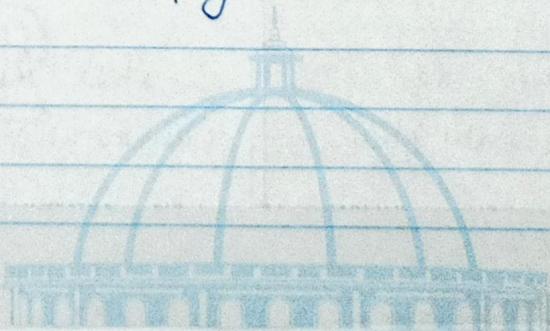
4) Also known as conventional intelligence

Also known as computational intelligence

Question 2

Components

- 1) Neural Networks : These are perception networks that can process information
- 2) Fuzzy Logic : It is a generalized version of binary logic where the output can be between 0 and 1
- 3) Support Vector Machine : It is used as a model for classification and regression
- 4) Evolutionary Computation : This allows the system to learn and improve its performance over time.
- 5) Machine Learning : It is an umbrella term for algorithm that can improve performance on a specific task.



(b) Probabilistic Logic: The aim is to combine the capacity of probability theory to handle uncertainty with the capacity of deductive logic to exploit structure of formal argument.

Question 3

Fuzzy sets: These are sets where elements have degrees of membership. Every element has a membership value between 0 and 1.

Example : $A = \{ (1, 0.7), (2, 0.1), (3, 0.2) \}$

↑ ↑
 Element Membership
 ↓ Value

Membership function : A membership function of a fuzzy set A on the universe of discourse X is defined as:

$$m_A : X \rightarrow [0, 1]$$

When each value x is mapped to a value between 0 and 1. This value is the membership value of x .

Question 4

=> Income : { High, medium, ~~and~~ Low }

=> Speed : { fast, slow }

=> TV show : { not interested, moderately interested, very interested }

=> A meal : { unpalatable, ok, good, delicious }

=> Traffic light : { Red, Green, Yellow }

In this case, a fuzzy set is not necessary since a traffic light can only take one value ie : output or membership of one ^{variable} member is 1 and the rest are 0. Therefore, a crisp set will be more appropriate.

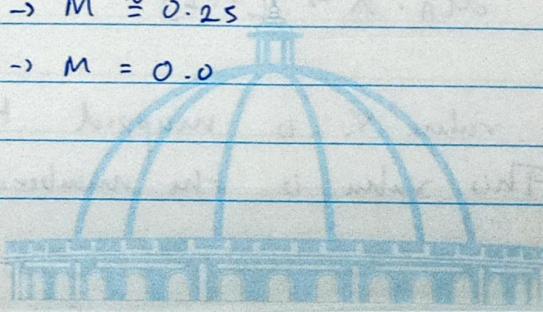
Question 5

i) According to the graph :

$$\Rightarrow \text{Up} \rightarrow M \approx 0.5$$

$$\Rightarrow \text{middle} \rightarrow M \approx 0.25$$

$$\Rightarrow \text{down} \rightarrow M = 0.0$$



ii) The arrow is not moving up i.e. moving up with confidence $M = 0$
 And moving down with the confidence $M \approx 0.75$

iii) Calculating confidence for the conditions:

Arrow is down : $M = 0$

Middle & moving down : $M = \min(0.25, 0.75) = 0.25$

Middle & moving up : $M = \min(0.25, 0) = 0.0$

Arrow is up : $M = 0.5$

Calculating confidence for the Actions:

Cloudy :

$$M_1 = 0 \times 0.8 = 0 \quad \left. \begin{array}{l} M = M_1 + M_2 - M_1 \times M_2 \\ \end{array} \right\}$$

$$M_2 = 0.25 \times 0.6 = 0.15 \quad \Rightarrow M = 0.15$$

Sunny :

$$M_1 = 0.0 \times 0.6 = 0 \quad \left. \begin{array}{l} M = M_1 + M_2 - M_1 \times M_2 \\ \end{array} \right\}$$

$$M_2 = 0.5 \times 0.8 = 0.4 \quad \Rightarrow M = 0.4$$

\therefore Cloudy : $M = 0.15$

Sunny : $M = 0.4$



Question 6

Defuzzification: It is the process of producing a quantifiable results in crisp logic, given fuzzy sets and corresponding membership degrees. It is the process that maps a fuzzy set to a crisp sets.

Method : Center of Gravity

This method provides a crisp values based on the COG of the fuzzy sets. The total area of the membership function distribution and to represent the combined control action is divided into a number of sub-area.

Using COG:

$$x^* = \frac{\sum_{i=1}^n x_i u(x_i)}{\sum_{i=1}^n u(x_i)}, \text{ for discrete function}$$

$$x^* = \frac{\int x u_A(x) dx}{\int u_A(x) dx}, \text{ for continuous function.}$$