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MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent institution of MAHE, Manipal)

VI SEMESTER B.TECH. (MECHATRONICS ENGINEERING) END SEMESTER EXAMINATIONS, APRIL 2018

SUBJECT: ARTIFICIAL INTELLIGENCE [MTE 4027]

(24/04/2018)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- Data not provided may be suitably assumed with justification
- 1A With a neat block diagram describe supervised and unsupervised learning in artificial neural 02 networks.
- **1B** Implement the following logical expression using McCulloch-Pitts neuron model. **03** $y = ab + \overline{b}$
- 1C Illustrate, how ANN can be used to control the inverted pendulum shown in the figure 1C. 05



- 2A Describe the Hebbian learning algorithm with a suitable example.
- 2B What is genetic algorithm? List down the different steps involved in Genetic Algorithm. 03

03

2C Suggest and implement a suitable artificial neural network to store the state transitions as **04** shown in figure 2C.



3A Consider the fuzzy set M and N defined in the interval U = [0,5] by the following **03** membership functions.

$$\mu_M(x) = \frac{x}{x+3} \text{ and } \mu_N(x) = 2^{-x}$$

Find: i) $A = \overline{M U \overline{N}}$ ii) Height of the fuzzy set A iii) Is fuzzy set A convex?

- **3B** Differentiate between Classification and Clustering. Illustrate using a suitable example. **03**
- **3C** Elucidate Self Organizing Feature Map Algorithm (SOFM) using a suitable example. **04**
- 4A "Artificial Neural Network and Fuzzy system are integrated to build more robust intelligent 02 systems". Justify the statement.
- **4B** "A well designed fuzzy system can be helpful in medical disease diagnosis". Comment on **04** this statement and support your answer with a suitable example.
- 4C Consider a 2 input one output fuzzy system that is constructed from the following rules. 04

Rule 1: IF x_1 is High and x_2 is Low THEN y is Low

Rule 2: IF x_1 is Low and x_2 is High THEN y is High where High and Low are fuzzy sets in R as given below:

High:
$$\frac{0.3}{1} + \frac{0.6}{2} + \frac{0.9}{3}$$
 Low: $\frac{0.8}{-1} + \frac{0.5}{0} + \frac{0.2}{1}$

Suppose that the input to the fuzzy system is $(x_1^*, x_2^*) = (0.6, 0.2)$. Determine the output fuzzy set using "Product Inference Engine" and y* using "center average defuzzification".

- **5A** Design a fuzzy rule base (FRB) and define relevant input and output fuzzy sets to generate **05** y = cos(x) where x = [-90, 270] and output is defined in the universe y = [-1,1].
- **5B** Derive the equation for weight updation in Error Back Propagation learning algorithm for **05** single hidden layer neural network.