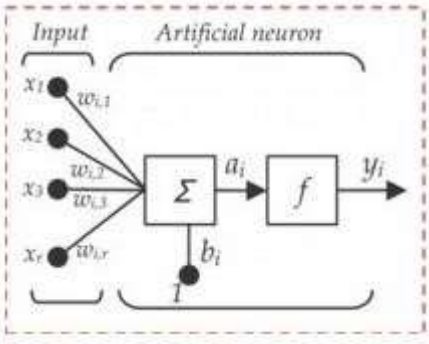
Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

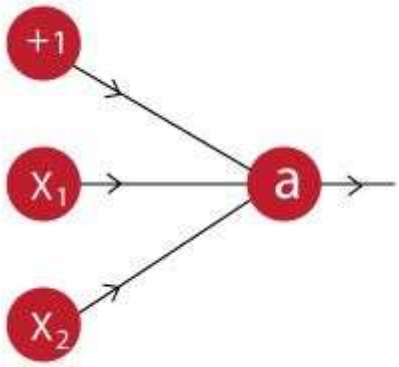
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Artificial Neural Networks & its applications — **Semester: II**
Program: M. Tech. (CSE) — **Time: 03 hours**
Course Code: CSAI 7005P — **Max. Marks: 100**

SECTION A

1. Each Question carries 4 Marks

Q1	Justify the need for *activation function*. Compare the different types of activation functions in ANN.	**CO1**
Q2	Distinguish between *Overfitting* and *Overtraining*.	**CO2**
Q3	Below is a mathematical representation of a neuron.  The different components of the neuron are denoted as: x1, x2,…, xN: These are inputs to the neuron. These can either be the actual observations from the input layer or an intermediate value from one of the hidden layers. w1, w2,…,wN: The Weight of each input. bi: Is termed as Bias units. These are constant values added to the input of the activation function corresponding to each weight. It works similar to an intercept term. a: is termed as the activation of the neuron, which can be represented as and y: is the output of the neuron $$a = f(\sum_{i=0}^{N} w_i x_i)$$ Considering the above notations, will a line (y = mx + c) fall into the category of a neuron? Justify	**CO3**

<table>
<tr><td>Q4</td><td>Discuss McCulloch-Pitts function.</td><td>CO1</td></tr>
<tr><td>Q5</td><td>Let us assume we implement an AND function to a single neuron. Below is a tabular representation of an AND function:
<table>
<tr><th>X1</th><th>X2</th><th>X1 AND X2</th></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td></tr>
</table>
The activation function of our neuron is denoted as:
$$f(x) = \begin{cases} 0, & for\ x < 0 \\ 1, & for\ x \geq 0 \end{cases}$$


What would be the weights and bias?</td><td>CO3</td></tr>
<tr><td colspan="3">SECTION B
1. Each question carries 10 marks</td></tr>
<tr><td>Q6</td><td>Discuss the main objectives of self-adaptive neural networks. Consider the below relation of height and weight. Classify them into two clusters using K means clustering algorithm.
<table>
<tr><th>SL No</th><th>Height in cm</th><th>Weight in kg</th></tr>
<tr><td>1</td><td>185</td><td>72</td></tr>
<tr><td>2</td><td>170</td><td>56</td></tr>
<tr><td>3</td><td>168</td><td>60</td></tr>
<tr><td>4</td><td>179</td><td>68</td></tr>
<tr><td>5</td><td>182</td><td>72</td></tr>
<tr><td>6</td><td>188</td><td>77</td></tr>
<tr><td>7</td><td>180</td><td>71</td></tr>
<tr><td>8</td><td>180</td><td>70</td></tr>
<tr><td>9</td><td>183</td><td>84</td></tr>
<tr><td>10</td><td>180</td><td>88</td></tr>
<tr><td>11</td><td>180</td><td>67</td></tr>
<tr><td>12</td><td>177</td><td>76</td></tr>
</table></td><td>CO3</td></tr>
<tr><td>Q7</td><td>Distinguish between forward propagation and backpropagation in ANN with suitable examples.</td><td>CO3</td></tr>
</table>

<table>
<tr><td>Q8</td><td>Discuss various data compression and reduction techniques using ANN.</td><td>CO4</td></tr>
<tr><td>Q9</td><td>Distinguish between competitive learning and boltzmann learning in ANN with suitable examples.</td><td>CO2</td></tr>
<tr><td colspan="3">Section C
1. Each question carries 20 Marks.</td></tr>
<tr><td>Q10</td><td>(a) State Kohonen's self-organizing feature map algorithm. Construct Kohonen's self organizing feature map to cluster four given vectors [0 0 1 1], [1 0 0 0], [0 1 1 0] and [0 0 0 1]. The number of clusters to be formed is two. Assume an initial learning rate of 0.5

OR

(b) State the learning vector quantization (LVQ) method. Construct an LVQ net with five vectors assigned to two clusters. Assume an initial learning rate of 0.1 Given vectors along with clusters as shown below
<table>
<tr><th>Vector</th><th>Cluster</th></tr>
<tr><td>[0 0 1 1]</td><td>1</td></tr>
<tr><td>[1 0 0 0]</td><td>2</td></tr>
<tr><td>[0 0 0 1]</td><td>2</td></tr>
<tr><td>[1 1 0 0]</td><td>1</td></tr>
<tr><td>[0 1 1 0]</td><td>1</td></tr>
</table></td><td>CO4</td></tr>
<tr><td>Q11</td><td>(a) Suppose you have been given a data set of training examples

{(X1, Y1), (X2, Y2) ……(Xn, Yn)}

Find the equation of the line that best fits the data, which minimizes the squared error.</td><td>CO1</td></tr>
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