Department of Computer Science & Engineering

University of Asia Pacific (UAP)

Program: B.Sc. in Computer Science and Engineering

Final Examination	**Fall 2020**	**4th Year 1st Semester**
Course Code: CSE 403/407	**Course Title: Artificial Intelligence and Expert Systems**	**Credits: 3**
Full Marks: 120* (Written)		**Duration: 2 Hours**

* Total Marks of Final Examination: 150 (Written: 120 + Viva: 30)

Instructions:

1. There are **Four (4)** Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Programmable calculators are not allowed.

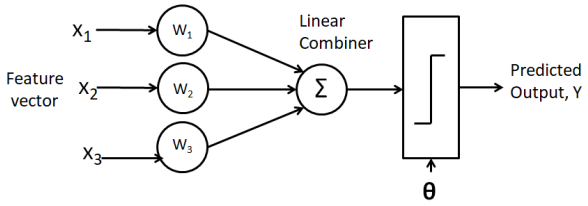
1. a) What do you mean by back propagation neural network (BPNN)? 5

b) For the following perceptron, the feature vector is X=[1 0 1] and the desired output Y=1. Consider step activation function with threshold θ = 0.2, learning rate α = 0.1. 25

i) **Measure** the predicted output and

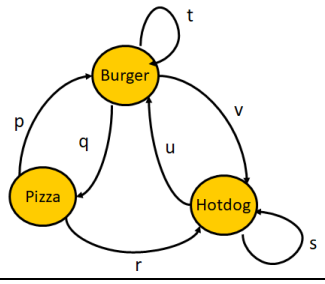
ii) Updated weights (W_1, W_2 and W_3) after one iteration.

W_1 =(Last 2 digits of ID) **mod** 2–0.2	W_2 =(Last 2 digits of ID) **mod** 3–0.5	W_3 =0.1



2. a) **Explain** query variable, evidence variable and hidden variable with example. 6

b) Suppose, the UAP Food Court serves pizza, burger and hotdog. The Probability Transition Matrix (A) is as follows. There are 3 states (pizza is state 0, burger is state 1 and hotdog is state 2). Let, burger is being served **today** {X_1= [0 1 0]}. What is the **predicted** probability that they will serve pizza on **3rd day**? If **someone's ID is 25** then the Transition Matrix (A) is as follows: 24



Probability Distribution

t = 1 – q = 1 - 0.025 = 0.975

$q = (Last\ 2\ digits\ of\ ID) \div 1000 = 25 \div 1000 = 0.025$

$p = \left(\sqrt{Last\ 2\ digits\ of\ ID}\right) \div 100 = (\sqrt{25}) \div 100 = 0.05$

r = 1 – p = 1 – 0.05 = 0.95

$$A = \begin{bmatrix} t & q & 0 \\ p & 0 & r \\ u & 0 & s \end{bmatrix}$$

$u = (Last\ 2\ digits\ of\ ID) \div 10000 = 25 \div 10000 = 0.0025$

s = 1 – u = 1 - 0.0025 = 0.9975

3. **a)** What are hedges in fuzzy logic? **Illustrate** how do hedges **modify** existing fuzzy sets? 4+6

b) A group of 5 students of CSE department have been found to be **very good** programmer with membership values: [A, B, C, D and E] respectively. **Estimate** what would be membership values in order to represent them to be: i) **extremely good** programmer and ii) **more or less good** programmer. Also **show** their graphical representation. 20

A = (Last 3 digits of id) **division** 1000	B = (Last 3 digits of id) **division** 2000
C = (Last 3 digits of id) **division** 4000	D = 1 - A
E = 1 - B	

4. Your plan is to execute the Genetic Algorithm (GA) for one run to solve a given problem **f(x) = 2x-1**. Consider 2 pairs of individuals (4 population like A, B, C and D), where the genotype representation (bit string) of the population are as follows: 30

Population A = 1st digit of your age	Population B = 2nd digit of you age
Population C = (A + B) + 1	Population D = C + Min(A, B) + 1

For example, if someone's **age** is **24**, then the value of the 4 populations will be as follows. In this case, the range of X is **X: 2 ~ 10**, so he/she may use **4-bit** representation.

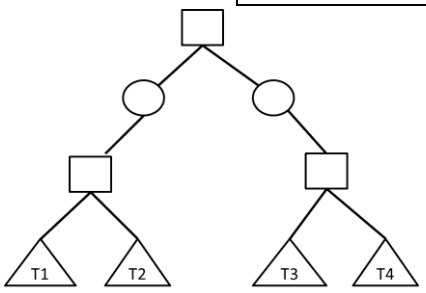
Population A = 2	Population B = 4
Population C = (2+4)+1 = 7	Population D = 7 + Min(2, 4) + 1 = 10

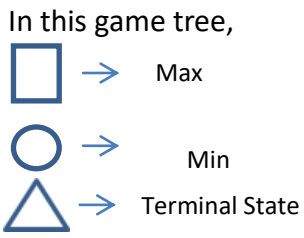
Execute the algorithm for one run explaining the 3 operators (selection, crossover and mutation) and **measure** the improve fitness value for each iteration. For selection, you may use Roulette-Wheel Technique.

OR

Your target is to prune the following game tree in order to improve the searching time efficiency. Which algorithm do you think is the best for this problem and what is the required condition for pruning? Consider the values of the terminal states as follows. **Illustrate** the step by step **pruning process** with **graphical representations**. 30

T1 = (Last 2 digits of ID) **mod** 3 + 2	T2 = - 7
T3 = - 2	T4 = T1 + 3





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