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The Open University of Sri Lanka
Faculty of Engineering Technology

Study Programme	:	Bachelor of Technology Honours in Engineering
Name of the Examination	:	Final Examination
Course Code and Title	:	**DMX5315 – Artificial Intelligence**
Academic Year	:	2021/2022
Date	:	14th February 2023
Time	:	09.30 -12.00 hrs
Duration	:	03 hours

WRITE YOUR REGISTRATION NUMBER CLEARLY WITHIN THE SPACE PROVIDED →

General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of Seven (7) questions in Six (3) pages.
3. Answer any **Five (5)** questions only. All questions carry equal marks.
4. Answer for each question should commence from a new page.
5. This is a Closed Book Test (CBT).
6. Answers should be in clear handwriting.
7. Do not use Red colour pen.
8. Please remember to write your registration number in the space provided.
9. It is **EXTREMELY IMPORTANT** that you do not remove the question paper attached to this sheet or any part of the paper from the examination hall
10. In case of a doubt consult the supervisor or an invigilator conducting the examination

Question 01

a) List down 5 types of Intelligence with the description of each. [5 marks]

b) Reasoning is a key component of intelligence. Compare and contrast the two types of reasoning. [4 marks]

c) To what extent are the following computer systems instances of artificial intelligence?

i. Supermarket bar code scanners. [3 marks]

ii. Voice-activated telephone menus. [3 marks]

d) *"Animals, humans, and computers cannot be intelligent—they can do only what their constituent atoms are told to do by the laws of physics."* Is the statement true or false? Comment on your answer. [5 marks]

Question 02

a) What is the definition of an AI agent? [02 marks]

b) How does the reasoning component of an AI agent use the information gathered by the perception component to make decisions? [03 marks]

c) Briefly explain how the interaction between the perception, reasoning, and action components enable the AI agent to learn and adapt over time? [05 marks]

d) Explain the difference between **breadth-first** search and **depth-first** search algorithms, and provide an example of when each would be used in AI problem-solving? [10 marks]

Question 03

a) Briefly explain the term "Defuzzification" [03 marks]

b) What are the methods of Defuzzifying the aggregate fuzzy sets? [03marks]

c) Explain with example equations, how does a fuzzy set union and intersection be used to aggregate multiple fuzzy sets into a single fuzzy set? [08 marks]

d) If A and B are two Fuzzy sets with membership functions, what is the value of $\mu A \cap B$

$\mu A(x) = \{0.2, 0.5, 0.6, 0.1, 0.9\}$ and $\mu B(x) = \{0.1, 0.5, 0.2, 0.7, 0.8\}$ [06 marks]

Question 04

a) Describe an example that can be solved using the Mamdani fuzzy inference method, and how would you perform the calculations for the aggregation of multiple fuzzy rules into a single output membership degree? **Note** – List down the inputs, outputs, fuzzy rules related to the selected example. [20 marks]

Question 05

a) List down and briefly explain the five categories of knowledge. [05 marks]

b) What are the main advantages of applying fuzzy logic in knowledge-based systems? [05 marks]

c) Describe the backward chaining inference process with an example application. [10 marks]

Question 06

a) What are the steps involved in constructing a semantic network from the knowledge base of a **car assembly robot** expert system, and how does this network represent the relationships between concepts related to car assembly? [15 marks]

b) Illustrate the semantic network explained in above **a).** [05 marks]

Question 07

a) What are the differences between supervised and unsupervised learning in neural networks, and how do they each impact the learning algorithm? [06 marks]

b) List down three types of errors used in Neural networks, and write down the formulae of each. [06 marks]

c) The input layer is Y(x)=x, Signal passing the input layers the same as,

$$In(n)^n = \begin{matrix}0.6\\0.5\\0\end{matrix} \quad w_n(n) = \begin{matrix}0.4 & 0.3\\0.3 & 0.6\\-0.7 & 0.9\end{matrix} \quad O(n) = \begin{matrix}0.5\\0.7\end{matrix}$$

The total input available to hidden neurons are, $I_n(n)^T w_n(n)$ in matrix form. Output of the hidden neurons can be calculated by,

$Output = \frac{1}{1+e^{-activation}}$, Where, the activation is the product of inputs and no of outputs for a hidden layer node.

Calculate the final output layer values as shown in FigureQ7(a). [08 marks]

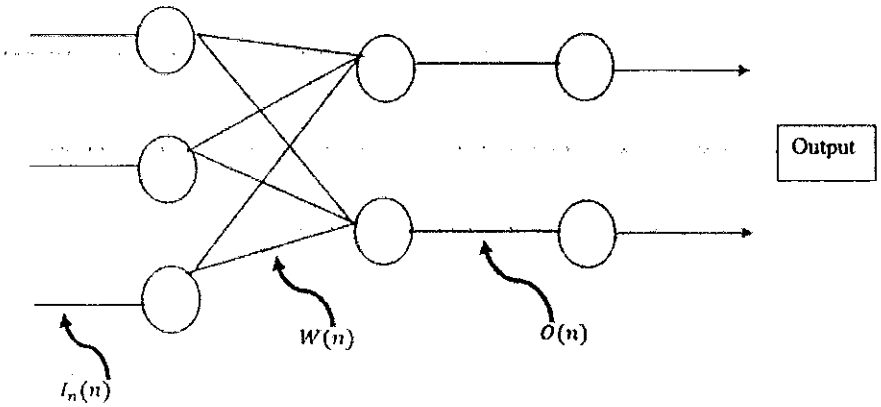

Figure Q7(a)

End