| Reg. No. | | | | | | | | | | | | | | | |
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# B.Tech. DEGREE EXAMINATION, NOVEMBER 2023

Sixth Semester

## 18MHE461T – ARTIFICIAL INTELLIGENCE FOR ROBOTICS AND VISION

*(For the candidates admitted from the academic year 2020-2021 & 2021-2022)*

**Note:**

(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) **Part - B & Part - C** should be answered in answer booklet.

Time: 3 hours | Max. Marks: 100

**PART – A (20 × 1 = 20 Marks)**

Answer **ALL** Questions

| | Marks | BL | CO | PO |
|---|---|---|---|---|
| 1. _____ gives the prediction probability of a datapoint for a classification algorithm.<br>(A) Accuracy (B) F1 score<br>(C) Log loss (D) Mean absolute error | 1 | 2 | 1 | 1 |
| 2. _____ type of AI system, might lead to singularity.<br>(A) Reactive machines (B) Limited memory AI<br>(C) Narrow AI (D) Strong AI | 1 | 2 | 1 | 1 |
| 3. F1 score is a _____ of precision and recall.<br>(A) Harmonic mean (B) Arithmetic mean<br>(C) Geometric mean (D) Root mean square | 1 | 1 | 1 | 1 |
| 4. An agent runs in the cycle of _____.<br>(A) Perceiving, thinking and acting (B) Perceiving, thinking and waiting<br>(C) Waiting, thinking and acting (D) Perceiving, waiting and acting | 1 | 1 | 1 | 1 |
| 5. Fuzzy logic is a _____.<br>(A) Two-valued logic (B) Many valued logic<br>(C) Crisp set logic (D) Binary set logic | 1 | 1 | 2 | 1 |
| 6. The membership value for a triangular membership function is obtained by _____.<br>(A) $\max\left(\min\left(\frac{x-a}{b-a}, \frac{c-x}{c-b}\right), 0\right)$ (B) $\min\left(\max\left(\frac{x-a}{b-a}, \frac{c-x}{c-b}\right), 0\right)$<br>(C) $\min\left(\max\left(\frac{x-b}{a-b}, \frac{x-c}{b-c}\right), 0\right)$ (D) $\max\left(\min\left(\frac{x-b}{a-b}, \frac{x-c}{b-c}\right), 0\right)$ | 1 | 4 | 2 | 1 |
| 7. Which of the following represents idempotency property of fuzzy sets?<br>(A) $\underset{\sim}{A} \cap \underset{\sim}{X} = \underset{\sim}{A}$ (B) $\underset{\sim}{A} \cap \underset{\sim}{A} = \underset{\sim}{A}$<br>(C) $\underset{\sim}{A} \cap X = X$ (D) $\underset{\sim}{A} \cap \phi = \phi$ | 1 | 2 | 2 | 1 |
| 8. _____ is represented as set membership in fuzzy logic.<br>(A) Degree of truth (B) Degree of false<br>(C) Complement (D) Probability | 1 | 1 | 2 | 1 |

9. Artificial neural network follows _____ modelling route. 1 1 3 1

(A) Black box (B) White box
(C) Grey box (D) Green box

10. _____ logical operation is an example of linearly non-seperable dataset. 1 2 3 1

(A) AND (B) OR
(C) NOR (D) EXNOR

11. Which of the following does not form a part of hybrid neuro fuzzy system? 1 2 3 1

(A) Real inputs and fuzzy weights (B) Fuzzy inputs and real weights
(C) Real inputs and real weight (D) Fuzzy inputs and fuzzy weights

12. Which of the following is not true for a neural network? 1 2 3 2

(A) Node can be in non-excited state (B) Connection computers its weighted input
(C) Network has set of nodes and connections (D) Node can be in excited state

13. The derivative of the sigmoid function $\sigma'(z)$ is given as _____. 1 1 4 1

(A) $\sigma(z)(1+\sigma(z))$ (B) $\sigma(z)(1-\sigma(z))$
(C) $\frac{\sigma(z)+(1-\sigma(z))}{\sigma(z)\times(1-\sigma(z))}$ (D) $\frac{1}{\sigma(z)+1}$

14. The fixed logic specialized hardware used in deep learning is _____. 1 1 4 1

(A) GPU (B) CPU
(C) ASIC (D) FPGA

15. What is the size of the output image obtained as a result of convolution of an input image of size 512×512 with a kernel of size 7×7 with padding = 1 and stride = 3? 1 2 4 2

(A) 72×72 (B) 128×128
(C) 170×170 (D) 256×256

16. _____ is a parallel computing platform and programming model developed by NUDIA for general computing on GPUs. 1 1 4 1

(A) CPU (B) TPU
(C) CUDA (D) Keras

17. _____ has a memory. 1 1 5 1

(A) Perceptron (B) LSTM
(C) Logistic regression algorithm (D) CNN

18. _____ is incorporated in popular commercial applications for voice search such as Siri 1 2 5 1

(A) Autoencoders (B) Reinforcement learning
(C) CNN (D) Recurrent neural networks

19. Positive reinforcement may lead to _____ of states that can _____ the consequences. 1 1 5 2

(A) Underload, reduce (B) Overload, reduce
(C) Underload, increase (D) Overload, increase

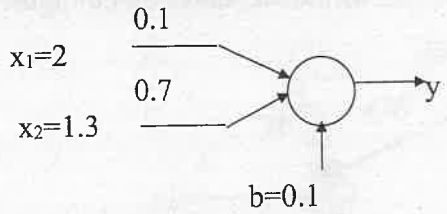
20. RNN achieves best results in _____. 1 2 5 1

(A) Financial predictions (B) Speech recognition
(C) Image recognition (D) Image classification

## PART – B (5 × 4 = 20 Marks)

Answer **ANY FIVE** Questions

| | Marks | BL | CO | PO |
|---|---|---|---|---|
| 21. Write a brief note on logistic regression and the features of its cost function. | 4 | 2 | 1 | 1 |
| 22. Differentiate between classical set and fuzzy set. | 4 | 2 | 2 | 1 |
| 23. Determine the max-min and max-product composition of the two given fuzzy relations: $\tilde{R} = \begin{bmatrix} 0.1 & 0.5 & 0.7 \\ 0.2 & 0.6 & 0.3 \\ 0.4 & 0.9 & 0.6 \end{bmatrix}$ and $\tilde{S} = \begin{bmatrix} 0.4 & 0.8 \\ 0.1 & 0.4 \\ 0.7 & 0.6 \end{bmatrix}$ | 4 | 3 | 2 | 2 |
| 24. Compare the performance of batch gradient descent and stochastic gradient descent algorithms. | 4 | 2 | 3 | 1 |
| 25. Explain the need for transfer learning. | 4 | 2 | 4 | 1 |
| 26. Define perceptron learning rule. What is the output of the neuron given below with the sigmoid activation function? | 4 | 3 | 4 | 2 |




| | | | | |
|---|---|---|---|---|
| 27. State the advantages and disadvantages of deep reinforcement learning. | 4 | 2 | 5 | 1 |

## PART – C (5 × 12 = 60 Marks)

Answer **ALL** Questions

| | Marks | BL | CO | PO |
|---|---|---|---|---|
| 28. a. Differentiate between the following:<br>(i) Model parameters and hyper parameters<br>(ii) Type 1 and Type 2 error<br>(iii) Generalization and regularization | 12 | 4 | 1 | 1 |

**(OR)**

b. Differentiate between the following:
(i) Lasso and Ridge regression
(ii) Hold out and 5×5 fold cross validation
(iii) Supervised and unsupervised learning

| | | | | |
|---|---|---|---|---|
| 29. a. Describe in detail about various fuzzification methods with example. | 12 | 4 | 2 | 1 |

**(OR)**

| | | | | |
|---|---|---|---|---|
| b. Design a fuzzy lighting controller system, in which the control system dim the bulb light automatically according to the environmental light. Assume that the inputs to the system are the environmental light x1 and the changing rate of the environmental light $x_2$, while the output variable which represents the control value to the dimmer is DM. consider the following assumption:<br>$x_1$ can be dark (D), medium (M) and light (L) and its range is between 120 and 220 with three membership functions L(130, 150), π(130, 150, 190, 210) and | 12 | 3 | 2 | 2 |

Γ(190, 210) for D, M and L respectively. $X_2$ ranges between −10 and +10 and is divided into negative small (NS), zero (ZE) and positive small (PS) with three membership functions $\wedge(-20,-10,0)$, $\wedge(-10,0,10)$ and $\wedge(0,-10,20)$ for NS, ZE and PS respectively.

The following is the fuzzy rule base

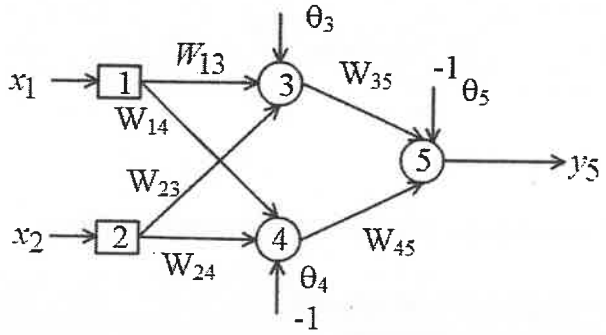
| $x_2$ \ $x_1$ | D | M | L |
|---|---|---|---|
| PS | B | S | VS |
| ZE | B | B | S |
| NS | VB | B | B |

The output DM ranges between 0 and 10 and is divided into very small (VS), small (S), big (B) and verify (VB) with four membership functions $L(2,4)$, $\wedge(2,4,6)$, $\wedge(4,6,8)$ Γ(6, 8) for VS, S, B and VB respectively. Evaluate the output for $x_1$=128 and $x_2$ = −8 using Mamdani-style fuzzy inference.

30. a. Illustrate the architecture of a neuro fuzzy system with necessary diagrams. 12 4 3 1

**(OR)**

b. The following table gives the training dataset and the corresponding ground truths. Derive the first epoch training update data for a back propagation network with 2 neurons in the hidden layer and one O/P neuron as shown in the figure 12 3 3 2




Assume learning rate, $\propto = 0.1$. choose the initial network parameters as follows:

$w_{13} = 0.3$ $w_{23} = -0.9$ $w_{35} = 0.9$ $\theta_3 = 0.1$

$w_{14} = 0.1$ $w_{24} = 1.2$ $w_{45} = -0.6$ $\theta_4 = 0.3$

$\theta_5 = -0.5$

31. a. Illustrate the working and features of Resnet module and inception module used in convolutional neural network architectures. 12 4 4 1

**(OR)**

b. Explain the challenges involved in datasets used in deep learning and how data augmentation helps in overcoming them. What are the different types of data augmentation techniques? List out this features. 12 4 4 1

32. a. Differentiate autoencoders form principal component analysis algorithm. Illustrate the working of autoencoders with neat sketch. 12 4 5 1

**(OR)**

b. What are the differences that a LSTM network has from a typical RNN? Illustrate the working of LSTM with neat sketch.

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