Instructions

    i.   This EXAMINATION has TWO sections.

    ii.   SECTION A is compulsory. Answer ALL questions in this section.

    iii. Answer ANY TWO questions in SECTION B.

SECTION A

QUESTION ONE (30 MARKS)

a) McCulloch-Pitts is one of the earliest artificial neural networks.

    i.   Enumerate any four requirements of McCulloh-Pitts neuron.   (4 marks)

    ii.   Illustrate how a McCUlloh-Pitts neural network would perform the logical XOR function.   (4 marks)

b) Demonstrate your understanding of neural network applications in the fields of medicine, automotive and banking.   **(3 marks)**

c) Distinguish between each of the following terms as used in Neural Networks

    i.   Supervised and unsupervised learning   (2 marks)

    ii.   Pattern classification and pattern association   (2 marks)

    iii. Feed forward network and recurrent network   (2 marks)

    iv. Artificial neural networks and Biological neural networks   (2 marks)

d) The basis operation of an artificial neuron involves summing its weighted input signal and applying an activation function to determine whether it will 'fire' or not

    a. Explain what you understand by the term 'activation function'   (1 marks)

    b. Using appropriate illustrations, explain each of the following activation functions

   i. Binary Step Function   (2 marks)

   ii. Bipolar Sigmoid Function   (2 marks)

e) Artificial neural networks (ANNs) are modelled from biological neurons. Outline the biological properties that are borrowed into ANNs   (6 marks)

QUESTION TWO (20 MARKS)

 a) Using a well-structured graph Interpret the following code using a graph as used in sigmoid function   (2 marks)

$$\phi(z) = \frac{1}{1 + e^{-z}}$$

 b) Distance metrics play a significant role in neural network problems in determining the similarity and diversity of sample sets. Using appropriate examples, explain each of the following distance methods

   i. Euclidean distance   (2 marks)

   ii. Jaccard index   (2 marks)

   iii. Hamming distance   (2 marks)

 c) Self-organizing maps are widely used in clustering problems of neural networks. Explain how the Kohonen self-organizing map works   (4 marks)

 d) You have been hired in a Big Data company involved in prediction of traffic patterns. Explain the techniques that you would apply for this task and justify why   (5 marks)

 e) Compare and contrast an artificial neural network and the biological neuron   (3 marks)

QUESTION THREE (20 MARKS)

 a) Using your own example implement the following perceptron, showing how it can be implemented on the case of education sector in grading student for graduation

                      (3 marks)

$$output \begin{cases} 1 & if\ W \bullet x + b > 0 \\ 0 & otherwise \end{cases}$$

 b) Explain how the Hamming Net algorithms works in Neural networks.   **(5 marks)**

 c) Within a given hidden layer of an artificial neural network, we can choose any activation function. Describe why you will recommend particular activation function over the other.

(3 marks)

d) Compare and contrast forward and backpropagation concepts using suitable example

(4 marks)

e) Discuss the steps of building a bird classifier using Transfer Learning approach. **(5 Marks)**

QUESTION FOUR (20 MARKS)

a) Artificial neural networks differs with biological neural networks because of the few characteristics. Explain **three** characteristic that defines neural networks (3 marks)

b) Interpret the result of the following model as it was developed using weka machine language software (6 marks)

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=== Classifier model (full training set) ===

Id3


Degree = First: Y
Degree = Second
|   Expr = Yes: Y
|   Expr = No
|   |   Univ = UON: N
|   |   Univ = MOI: Y
|   |   Univ = KU: N
Degree = Pass: N

Time taken to build model: 0 seconds

=== Evaluation on training set ===
=== Summary ===

Correctly Classified Instances        12          100     %
Incorrectly Classified Instances       0            0     %
Kappa statistic                        1
```

c)

d) With a clear structure interpret the following function as used in artificial neural networks

$Yin = x1.w1 + x2.w2 + x3.w3 \ldots xn.wn$ (2 marks)

e) Biological neural networks is a series of interconnected neurons whose activation defines a recognizable linear pathway. Explain the function of the following components

    a. Dendrites (2 marks)

    b. Axon (2 marks)

    c. Soma (2 marks)

f) Artificial intelligence is the ability of a computer or a robot controlled by a computer to do tasks that are usually done by humans because they require human intelligence and discernment. Explain three branches of artificial Intelligence (3 marks)

QUESTION FIVE (20 MARKS)

a) Using a case of a hospital describe multi-layer feed forward network showing clearly the importance of hidden and output layers in it? (7 marks)

b) A recurrent neural network (RNN) is a type of artificial neural network which uses sequential data or time series data. With an aid of a diagram explain fully recurrent network and Jordan network (6 marks)

c) Suppose that a credit card company decided to deploy a new system for assessing credit worthiness of its customers. The new system is using a feed-forward neural network with a supervised learning algorithm. Suggest what the bank should have before the system can be used? Discuss problems associated with this requirement (5 marks)

d) Explain the following terms (2 marks)

    a. Neurons

    b. Perception