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**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

TEST 1

Winter Semester: 2021 - 22

Course Code: ECE 295

Course Name: Artificial Neural network

Programme & Sem: B.Tech (ECE) & VI Sem

Date: 27th April 2022

Time: 10:00 AM to 11:00 AM

Max Marks: 30

Weightage: 15%

Instructions:

- (i) ***Read Questions carefully and answer accordingly***
- (ii) ***All Questions are compulsory***

Part A [Memory Recall Questions]

Answer all questions. Each question carries TWO marks.

(7Qx2M=14M)

1. Artificial neural networks are inspired in working from biological neuron. It has the capability to organize its structural constituents, known as neurons. Why do we need artificial neural networks? (CO-1)[Knowledge]

- a. to solve tasks like machine vision & natural language processing
- b. to apply heuristic search methods to find solutions of problem
- c. to make smart systems which are human interactive & user friendly
- d. all of the mentioned

2. A brain already has considerable structure and the ability to build up its own rules of behavior through experience. What are the issues on which biological networks proves to be superior to AI networks? (CO-1)[Knowledge]

- a. robustness & fault tolerance
- b. flexibility
- c. collective computation
- d. all of the mentioned

3. Dendrites are the branches of neurons that receive signals from other neurons. The signals go into the cell body (or soma). A cell may have hundreds of dendrites, but may have only one axon. What are dendrites? (CO-1)[Knowledge]

- a. fibers of nerves
- b. nuclear projections
- c. other name for nucleus
- d. none of the mentioned

4. The cell body contains the nucleus and cytoplasm. The axon extends from the cell body and often gives rise to many smaller branches before ending at nerve terminals. The cell body of neuron can be analogous to what mathematical operation?

(CO-1)[Knowledge]

- a. summing
- b. differentiator
- c. integrator
- d. none of the mentioned

5. Activation function of neural networks are used to map inputs to outputs. Identify the following activation function

$$\phi(v) = \frac{1}{1+e^{-av}} \text{ where } a \text{ is the slope parameter.}$$

- a. Step function
- b. Ramp function
- c. Sigmoid function
- d. Gaussian function

6. A single perceptron can only be used to implement **linearly separable** functions. It takes both real and Boolean inputs and associates a set of **weights** to them, along with a **bias**. What is the objective of perceptron learning?

(CO-1)[Knowledge]

- a. class identification
- b. weight adjustment
- c. adjust weight along with class identification
- d. none of the above mentioned

7. If $e(n)$ denotes error for correction of weight, then what is formula for error in perceptron learning model with $w(n+1) = w(n) + \eta(d(n) - y(n))x(n)$, where $d(n)$ is desired output, $y(n)$ is actual output, $x(n)$ is input vector and 'w' denotes weight

(CO-1)[Knowledge]

- a. $e(n) = \eta(d(n) - y(n))x(n)$
- b. $e(n) = \eta(d(n) - y(n))$
- c. $e(n) = d(n) - y(n)$
- d. none of the above

Part B [Thought Provoking Questions]

Answer both the questions. Each question carries FOUR marks. (2Qx4M=8M)

8. Designing a classifier model requires the right choice of input features, architecture and selection of an ideal learning process. You want to design a system to automatically classify fruits from a collection of three different fruits. Comment on your selection of features, architecture and learning process of the neural network?

(CO-2)[Comprehension]

9. A real time working model is expected to work for different variations of the test input. The process of building the robustness in the system to handle such different variation of the same input is known as Invariant Capability. Ram wants to build a speech recognition system for his final year project using ANN? While training the model, he

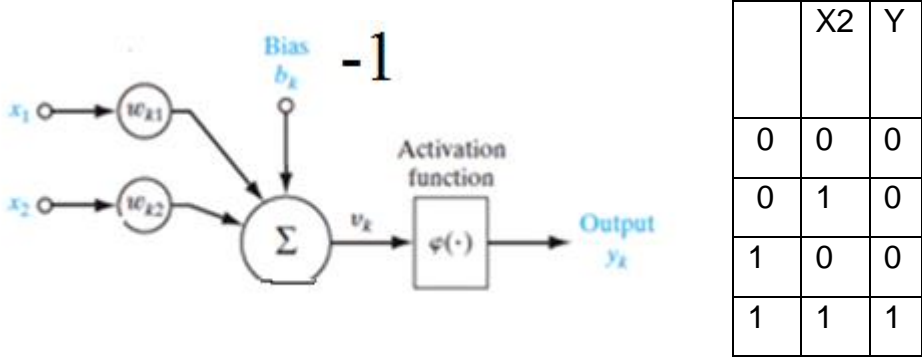
uses only male voice? Comment on the invariant capability of his machine. What ways he may improve the invariant capability of his machines.

(CO-2)[Comprehension]

Part C [Problem Solving Questions]

Answer both the questions. Each question carries FOUR marks. (2Qx4M=8M)

10.

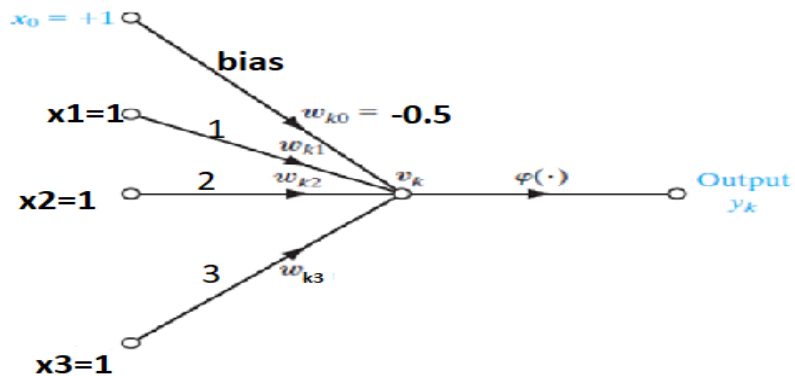


In a perceptron model, different Boolean operations may be implemented by changing the weight and bias parameter. Let us assume we implement an AND function to a single neuron. Above is a tabular representation of an AND function: The activation function of our neuron is denoted as: $f(y) = \{ y_k = 0 \text{ for } v_k < 0; y_k = 1, \text{ for } v_k \geq 0 \}$ What would be the weights of input and bias?

(CO-4)[Application]

11. Compute the weighted sum “ v_k ” which is the input to the activation function, with three inputs x_1, x_2, x_3 and weight values respectively 1, 2 and 3 respectively. There is also a bias weight of -0.5 . The input is (1,1,1)

(CO-4)[Application]





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TEST 2

Winter Semester: 2021 - 22

Course Code: ECE 295

Course Name: Artificial Neural network

Programme & Sem: B.Tech (ECE) & VI Semester

Date: 2nd June 2022

Time: 10:00 AM to 11:00 AM

Max Marks: 30

Weightage: 15%

Instructions:

- (i) *Read Questions carefully and answer accordingly*
 - (ii) *All Questions are compulsory*
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Part A [Memory Recall Questions]

**Answer all Questions. Each question carries TWO marks.
(7Qx2M=14M)**

1. There are two phases of operation in back propagation algorithm. Mention the two phases and their importance in brief. **(CO-1)[Knowledge]**
2. Hidden neurons plays a key role in Back propagation Algorithm. Mention two jobs of Hidden neurons. **(CO-1)[Knowledge]**
3. In batch Learning adjustments to the synaptic weights of the MLP are performed after the presentation of all the N examples in the training sample t that constitute one epoch of training. So batch learning tries to minimize which error? **(CO-1)[Knowledge]**
4. XOR gate is an example for MLP and it is not a linearly separable example. Why is the XOR problem exceptionally interesting to neural network researchers? **(CO-1)[Knowledge]**
5. Machine learning algorithms can be classified into batch or online methods by whether or not the algorithms can learn incrementally as new data arrive. What is the difference between batch learning and online learning? **(CO-1)[Knowledge]**
6. Hebbian learning is learning through self-experience. Write the two postulates of Hebbian Learning? **(CO-1)[Knowledge]**
7. Perceptron convergence theorem is used to find the range of values of weights. Mention the alpha equation and state its significance? **(CO-1)[Knowledge]**

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries FOUR marks (2Qx4M=8M)

8. LMS algorithm is an example of adaptive filters where the coefficients of the filters are automatically updated based on the error signal. One of the applications of LMS algorithms is active noise cancellation. Explain the two steps of LMS filter and apply the same for active noise cancellation. **(CO-2)[Comprehension]**

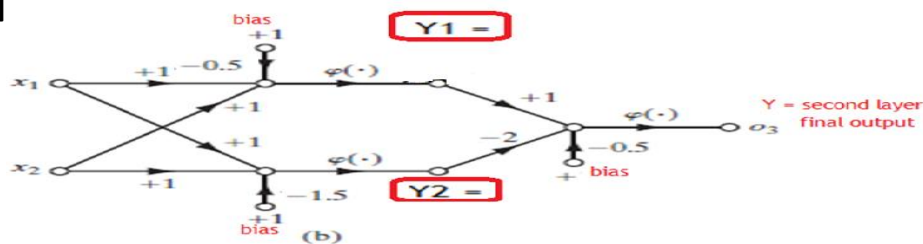
9. Hebbian learning is learning from self-experience as there is no desired signal from supervisor. The weights of the neurons improve with experience. Take an example of OR gate and justify the statement. **(CO-2)[Comprehension]**

Part C [Problem Solving Questions]

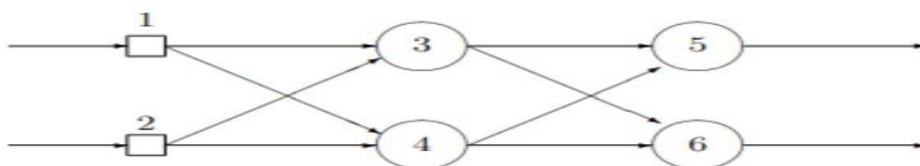
Answer both the Questions. Each question carries FOUR marks. (2Qx4M=8M)

10. XOR gates can't be implemented using SLP and requires the combination of multiple gates. Obtain the gates implemented at Y1, Y2 and Y using all four combinations of x1 and x2. Clearly show the steps for calculation of the output at the three positions. **(C.O.3)**

[Application]



11. The following diagram represents a feed-forward neural network with one hidden layer.



A weight on connection between nodes i and j is denoted by w_{ij} , such as w_{13} is the weight on the connection between nodes 1 and 3. The following table lists all the weights in the network:

$w_{13} = -2$	$w_{35} = 1$
$w_{23} = 3$	$w_{45} = -1$
$w_{14} = 4$	$w_{36} = -1$
$w_{24} = -1$	$w_{46} = 1$

Each of the nodes 3, 4, 5 and 6 uses the following activation function $\Phi(v)=1$, for $v \geq 0$, else $\Phi(v)=0$. Calculate the output of the network (y_5 and y_6) for each of the input patterns: 10, 01. **(C.O.3)**

[Application]

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**PRESIDENCY UNIVERSITY
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SCHOOL OF ENGINEERING

END TERM EXAMINATION

Winter Semester: 2021-22

Course Code: ECE 295

Course Name: Artificial Neural network

Programme & Sem: B.Tech (ECE) & VI Sem

Date: 1st July 2022

Time: 9:30 AM to 12:30 PM

Max Marks: 100

Weightage: 50%

Instructions:

- (iii) Read Questions carefully and answer accordingly
 - (iv) All Questions are compulsory
 - (v) Any missing data can be suitably assumed
-

Part A [Memory Recall Questions]

Answer 20 Questions. Each question carries 2 marks. Q1-Q10 is MCQ and Q11-Q20 is short answer type.

(20Qx2M=40M)

1. BPA is one method of training MLP's. It uses the transmission of error back through the network to allow weights to be adjusted so that the network can learn. What is true regarding back propagation rule?

(CO-1)[Knowledge]

- a. It is a multilayer feed forward Network
- b. final output does not depend on some of the hidden neurons
- c. hidden layers output is not all important, they are only meant for supporting input and output layers
- d. none of the mentioned

2. A linear separable function can be implemented using SLP. It takes both real and Boolean inputs and associates a set of **weights** to them, along with a **bias**. What is the objective of perceptron learning? (CO-

1)[Knowledge]

- a. adjust weight along with class identification
- b. weight adjustment
- c. error correction
- d. none of the above mentioned

3. Change in weight is done every time an error is got at the output neuron .The expression for weight correction for a synaptic weight connecting neuron i to neuron j which is defined by the delta rule is given by

(CO-1)[Knowledge]

- a. Weight correction = (learning rate parameter) * (local gradient)* (input signal of neuron j)
- b. Weight correction = (learning rate parameter) * (input weight)* (input signal of neuron j)
- c. Weight correction = (error energy) * (local gradient)* (input signal of neuron j)

d. Weight correction = (output signal of a neuron) * (local gradient)* (input signal of neuron j)

(C.O 1)[Knowledge]

4. Training an Artificial neural network for complex problems uses MLP in which BPA is an algorithm where there can be 2 types of training which are online learning and batch learning. Which of the below statement is true with respect to online learning.

(CO-1)[Knowledge]

a. learning is done with more examples.

b. adjustments to the synaptic weights of the MLP are performed after the presentation of all the N examples in the training sample t that constitute one epoch of training

c. the synaptic weights of the MLP are performed on an example-by-example basis.

d. none of the above

5. **Flip-flops** and latches are fundamental building blocks of digital electronics systems.

In SR flip-flop S and R stands for

(CO-

1)[Knowledge]

a. S= stable, R= Reset

b. S= set, R= reset

c. S= store, R= Restore

d. None of the above.

6. A **Perceptron** is a neural net used for supervised learning of binary classifiers. Rosenblatt's perceptron is built around a nonlinear neuron, namely

(CO-1)[Knowledge]

a. hyperbolic tangent model of a neuron

b. The threshold model of a neuron

c. the McCulloch–Pitts model of a neuron

d. none of the above.

7. Least mean squares (**LMS**) algorithms are a class of **adaptive filter** used to mimic a desired **filter** by finding the **filter** coefficients. Here LMS stands for

(CO-

1)[Knowledge]

a. Least median square

b. local mean square

c. Least mean square

d. Least maximum square

8. Activation functions are mathematical equations that determine the **output** of a neural network. Activation function is also called as (CO-1)[Knowledge]

a. Stable function

b. Squashing Function

c. Random Function

d. None of the above

9. An artificial **neural network's learning** rule or **learning** process is a method, mathematical logic or algorithm which improves the **network's** performance and/or

training time. Hebbian learning is where there is

(CO-1)[Knowledge]

- a. Self - learning without a teacher
- b. learning with the help of a teacher
- c. Learning from the error at the output
- d. None of the above

10. There are two phases of operation in back propagation algorithm. The phase in which error signal is propagated to correct the weights is called

(CO-1)[Knowledge]

- a. Forward phase
- b. Backward phase
- c. feed forward phase
- d. none of the above

11. Full adders are used to add 3 bit binary numbers. Write the truth table of a full adder and the sum and carry equation? (CO-

1)[Knowledge]

12. Latches are memory elements in a digital circuit. Draw the perceptron model of a latch and write the required weights and bias. (CO-

1)[Knowledge]

13. It is sometime desirable to select one input out of the many incoming input signal using multiplexer. Draw the truth table of 4:1 Mux. Also explain the role of select lines.

(CO-1)[Knowledge]

14. Perceptron convergence theorem is used to find the range of values of weights. Mention the beta equation and state its significance?

(CO-1)[Knowledge]

15. There are two types of signal in back propagation algorithm. Mention the two types of signals and their importance in brief. (CO-

1)[Knowledge]

16. In online Learning adjustments to the synaptic weights of the MLP are performed on example by example basis. So online learning tries to minimize which error?

(CO-1)[Knowledge]

17. Back Propagation Algorithm has different stopping criteria to terminate the training steps. Mention any two criteria in brief. (CO-

1)[Knowledge]

18. BPA can be made better using different heuristics. Discuss any two such techniques.

(CO-1)[Knowledge]

19. Hebbian learning is learning through self-experience. Mention the equation for finding the weight update and new weights in Hebbian learning.

(CO-1)[Knowledge]

20. Artificial neural network is inspired by human brain. Mention any two analogy between them. (CO-

1)[Knowledge]

Part B [Thought Provoking Questions]

**Answer 3 Questions. Each question carries 10 marks.
(10Qx3M=30M)**

21. Adders and subtractors are building blocks of many circuits are used in many microcontrollers and microprocessors. Explain the truth table of half subtractor and its implementation using perceptron model. Comment on the number of hidden layer required. Verify the structure using truth table by taking all the following combinations of inputs - 10, 11.

(CO-2)[Comprehension]

22. Neural networks are used to solve day to day life problems of the society. Mention any two problems of city/village and propose the solution using neural network. Explain the learning paradigm, network architecture and activation function used in all two scenarios.

(CO-2)[Comprehension]

23. The weights of neural network determine the performance a neural network. Convergence theorem is used to find the range of weight update W_{n+1} . Derive the expression to find the lower and upper value of W_{n+1} i.e. alpha and beta equation.

(CO-2)[Comprehension]

Part C [Problem Solving Questions]

**Answer all the Questions. Each question carries 10 marks.
(3QX10M=30M)**

24. MUX is used to select any one incoming input to the output using select lines. Write the truth table of MUX and state the combination circuit to implement the same. Also draw the perceptron implementation of 4:1 MUX given the bias as -3 for all the perceptron.

(C.O.3) [Application]

25. Apply SLPA to 3 inputs OR GATE. Assume all initial weights are zero, Bias = -2, LR = 1. Draw the truth table for 3 inputs OR gate and find the input synaptic weights for the given bias weight using error correction learning algorithm. The activation function is threshold function

(C.O.3) [Application]

26. Full adders are used to add three bit binary numbers. The sum equation of full adders requires XOR gates and carry equation requires AND gates. Write the truth table of carry and sum for full adder. Connect two perceptron model of XOR gate to create a full adder.

(C.O.3) [Application]

