WORLD UNIVERSITY
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WUB

Final Exam

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Course Name: Artificial Intelligence and Neural Networks (CSE1110)

Ans to the Q. NO: 01

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a) Ans: Reinforcement Learning is a machine learning paradigm where an agent learns to make decisions by interacting with an environment to maximize cumulative rewards. Reinforcement learning revolves around the idea that an agent & interacts with an environment to achieve goal. The agent performs actions and receives feedback to optimize its decision-making over time.

- Agent: The decision-maker that performs actions.
- Environment: The world or system in which the agent operates.
- State: The situations or condition the agent is currently in
- Action: The possible moves or decisions the agent can make.
- Reward: The feedback or result from the

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environment based on the agent's action.

Reinforcement learning Methods:

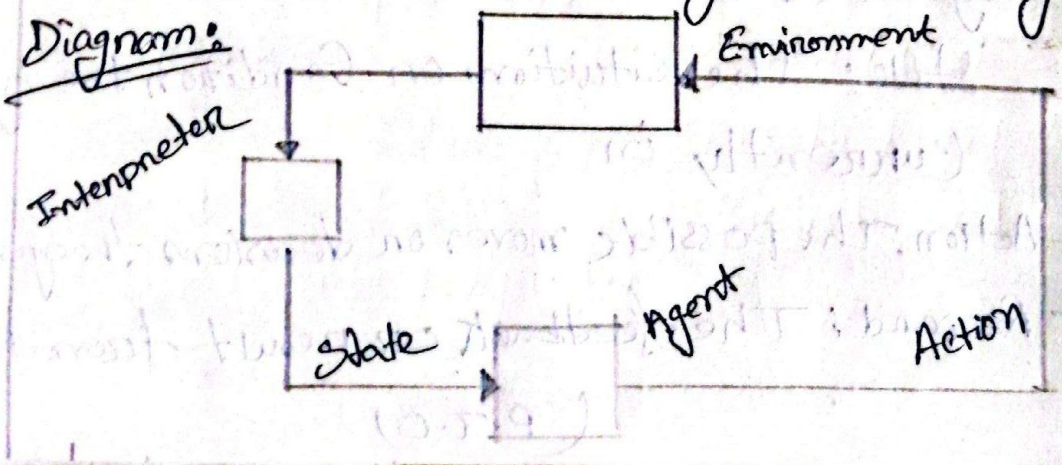
① Policy: A strategy that the agent uses to determine the next action based on the current state

② Reward function: A function that provides feedback on the actions taken. guiding the agent towards its goal.

③ Value function: Estimates the future cumulative rewards the agent will receive from a given state.

④ Model of the Environment: A representation of the environment that predicts future states and reward, aiding in planning.

Diagram:



(b) Ans: Below write the diffinences between Stack and Queue data Structure:

Stack	Queue.
A Stack is a collection of elements that follows the LIFO principle.	A queue is a collection of elements that follows the FIFO principle.
A Stack uses push and pop operations for insertion and deletion respectively	A Queue uses enqueue and dequeue operations for insertion and deletion respectively
In a Stack, both insertion and deletion happen at the same end, known as the top.	In a Queue, Insertion and deletion happens at the rear end and deletion happens at the front end.
Expression evaluation and Syntax parsing is use case.	CPU task scheduling (round robin scheduling) in use case.
only the top element is accessible directly	only the front and rear elements are accessible directly

Ans to the Q. NO:02

a) Ans: Below write a distinguish between Uninformed and Informed Search.

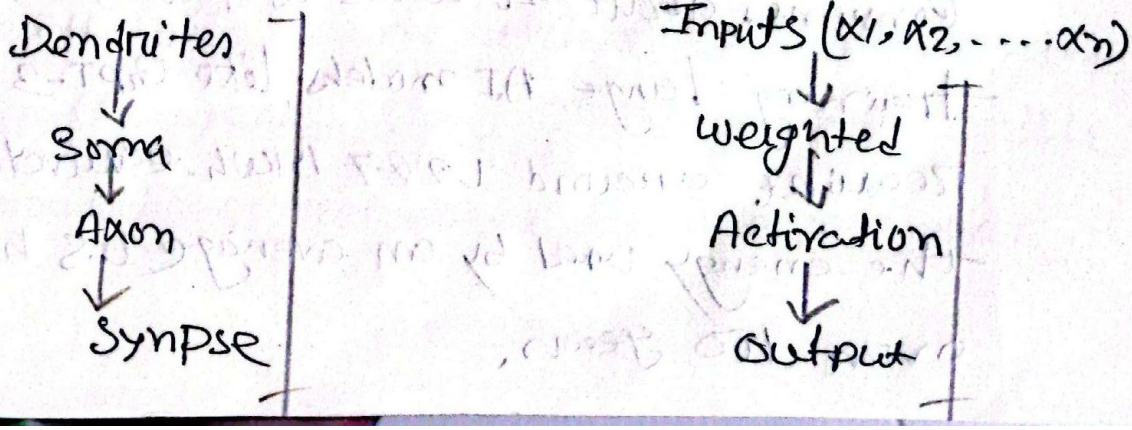
Informed Search	Uninformed search
It is also known as Heuristic search	It is also known a Blind search
Search methods that have no additional information about the goal's location other than no problem defination	Search methods that use extra knowledge to find the goal faster.
It finds a solution more quickly	It finds solution slow as compared to an informed search
It may or may not be complete and cost is low.	It is always complete and cost is high.
Examples :- Greedy search. - A* search - AO* search - Hill climbing Algorithm	Examples: - Depth first search - Breath first search - Branch and Bound

Ans to the Q. NO: 05

a) Ans: Comparison of Biological Neurons and Artificial Neurons:

Biological Neurons	Artificial Neurons.
Neuron 86 billion in human Brain	Perceptron/Node varies by model
Complex Structure (soma, axon, dendrites)	Simple mathematical model
Electrochemical Signals (Spikes, neurotransmitters)	Numeric values (weighted Sums and activations
Synaptic plasticity (Strength Changes based on experience	Adjusting weights using algorithms
Very energy efficient (brain consums ~20w)	High energy Consumption (Needs powerful Hardware)

Graphical Representation:



Key distinctions:

Fixed v Dynamics Adjustments: In artificial networks, weights and biases are adjusted during the training phase and remain fixed during operation. Biological neurons continuously adjust synaptic strengths in real time.

Complexity of Signals: Biological neurons process a multitude of chemical and electrical signals, whereas artificial neurons operate with numerical values within predefined mathematical frameworks.

Energy Consumption: The human brain consumes about 20 watts of power, while training large AI models like GPT-3 can require around 1,287 MWh, equivalent to the energy used by an average U.S household over 100 years.

(b) Ans: three main layers in a multilayer Artificial Neural Networks.

(1) Input Layer: Input Layer is the first layer in an ANN and responsible for receiving the raw input data. This layer's neurons correspond to the features in the input data. For example, in image processing, each neuron might represent a pixel value. The input layer doesn't perform any computations but passes the data to the next layer.

Key points:

- Role: Receive raw data.
- Function: passes data to the hidden layers.

(2) Hidden Layers: Hidden layers are the intermediate layers between the input and output layers. They perform most of the computations required by the network

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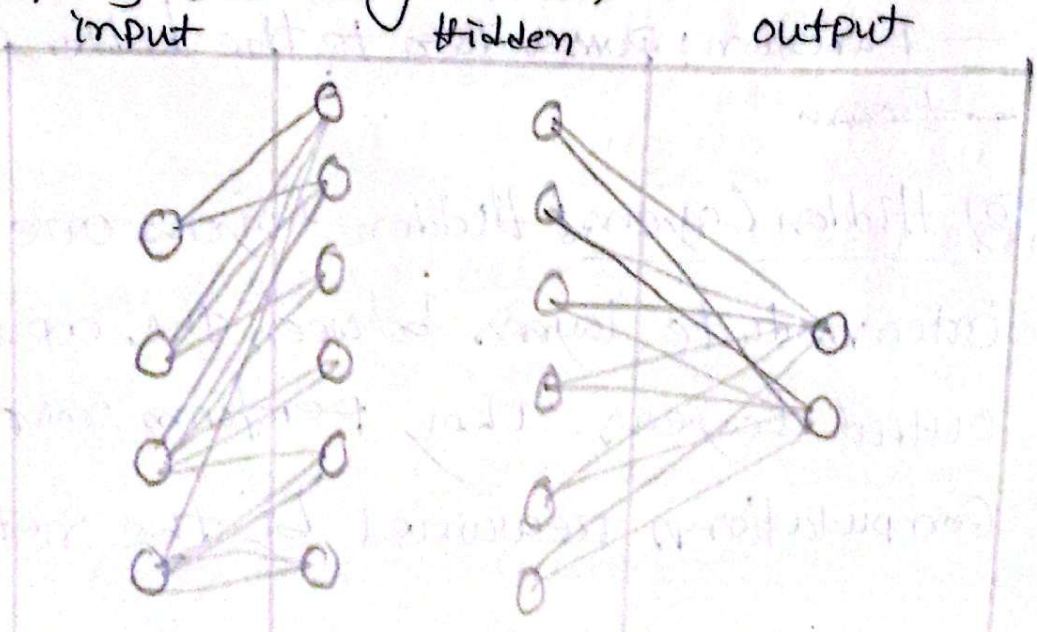
Hidden layers can vary in number and size depending on the complexity of the task. Each hidden layer applies a set of weights and biases to the input data, followed by an activation function to introduce non-linearity.

③ Output Layer: output layer is the final layer in an ANN. It produces the output predictions. The number of neurons in this layer corresponds to the number of classes in a classification problem or the number of outputs in a regression problem.



Ans to the Q. NO: 06.

a) Ans: Below write the all following functions equations:

① Sigmoid Activation function:

Defination: The sigmoid function maps input values into a range between 0 and 1. It is often used when we need output on ~~probabilit~~ probabilities.

Equation: $\sigma(x) = \frac{1}{1+e^{-x}}$

② ReLU (Rectified Linear unit) Activation function:

Defination: ReLU outputs the input directly if it is positive. otherwise, it outputs zero, It is currently the most popular activation function for hidden layers.

Equation: $ReLU(x) = \max(0, x)$

③ Tanh (Hyperbolic Tangent) Activation function:

Defination: Tanh is similar to the

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Sigmoid function but maps inputs to a range between −1 and 1.

Equation: $\tanh(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}$

④ Softmax Activation function:

Definition: Softmax turns a vector of numbers into a vector of probabilities that sum to 1. Used mainly in multi-class classification problems.

Equation: $\text{Softmax}(x_i) = \frac{e^{x_i}}{\sum_{j=1}^{n} e^{x_j}}$

⑤ Linear Activation function:

Definition: A linear activation function is simply the identity function, where output is directly proportional to input.

Equation: $f(x) = x$

(b) Ans: CNN are a specialized class of neural networks designed to process grid-like data such as images. They are particularly well-suited for images image recognition and processing tasks. They are inspired by the visual processing mechanisms in the human brain CNN excel at capturing hierarchical patterns and spatial dependencies within images.

How CNN work;

(1) Input : The CNN receives an input image. which is typically preprocessed to ensure uniformity in size and format.

(2) Convolutional Layers: Filters are applied to the input image, ~~which is typically preprocessed to ensure uniformity in size and format.~~ to extract features like edges, textures, and shapes.

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③ Pooling Layers: The feature maps generated by the Convolutional layers are downsampled to reduce dimensionality.

④ Fully Connected Layers: The downsampled features maps are passed through fully connected layers to produce the final output, such as a classification label.

⑤ Output: The CNN outputs a ~~predict~~ prediction, such as the class of the image.