2

What are Fuzzy Sets?
Fuzzy sets are sets where each element has a degree of membership between 0 and 1.

Union → maximum membership value of each element from both sets.
Intersection → minimum membership value for each element.
Difference → It shows elements that belong to A but not to B.

What is Cartesian product used for?
In fuzzy set theory, the Cartesian product is used to create a fuzzy relation between two fuzzy sets.
It combines every element of one fuzzy set with every element of another, and assigns a membership value to each pair using the min of their individual membership values.

What is max-min composition?
Max-min composition is a method used to combine two fuzzy relations to find an overall relation between the first and third sets in a chain of relations.
It finds the maximum of the minimums between pairs of membership values.

What is a membership function?
A membership function shows how much an element belongs to a fuzzy set. It gives a value between 0 and 1 — where 0 means it does not belong at all, and 1 means it fully belongs.

3

What is load balancing algorithm?
A load balancing algorithm is the logic or rule that decides which server should handle each incoming request.

Types of load balancing

1. Round Robin: Requests are given to servers one by one in order.
2. Least Connections: It looks at all servers and picks the one with the fewest current connections.
3. Random: Requests are sent to any server randomly.
4. Weighted Round Robin: Like Round Robin, but Servers with higher capacity get more requests than weaker servers.
5. Weighted Least Connections: Servers with more resources get more requests, but it's also based on the current load.

What happens if one server fails in a load balancing system?

If a server fails, the load balancing system needs to detect the failure and reroute traffic to the remaining healthy servers. This can be done by constantly checking the health of each server.

Why do we need load balancing in a system?
It prevents any one server from getting overloaded, improving performance and reliability.
It ensures the system can handle more requests and stay available even if one server goes down.

Real-world applications of load balancing

1. Amazon or Netflix use load balancing to handle millions of users simultaneously.
2. Online multiplayer games like Fortnite or PUBG use load balancing to provide low latency and high availability for millions of users.

4

What are genetic algorithms?
Genetic Algorithms are a type of evolutionary algorithm that mimics the process of natural selection.
The best solutions are selected and modified through mutation and crossover, generating new solutions that hopefully perform better.

Chromosome: Chromosome is a set of values that represent a possible solution.
Selection: Choosing the best chromosomes (solutions) based on fitness to reproduce.
Crossover: Combining two parent chromosomes (solutions) to make a new one.
Mutation: Making small random changes in a solution to introduce variety and avoid getting stuck.
Population: A population is a collection of individuals (solutions).

What is fitness function?
The fitness function tells us how good a solution (chromosome) is.

5

What is Clonal Selection?
This model copies (clones) the best solutions. It improves them over time, helping find better answers, just like our immune system strengthens over time after fighting an infection.

What is affinity?
How well an antibody (solution) solves the problem.

6

What is Neural Style Transfer?
Neural Style Transfer is a fascinating application of deep learning that involves the artistic transformation of images by combining the content of one image with the style of another.

What are content and style images?
Content image is the photo whose structure or layout we want to keep.
Style image is the art or painting whose texture and colors we want to apply.

What technique is used here?
The technique uses Convolutional Neural Networks (CNNs) to separate and recombine content and style features from two input images.

Can you apply this on any image?
Yes, but results vary depending on how different the content and style images are.

What are some real-life uses of neural style transfer?
Photo filters, art generation, visual effects in games or movies, and stylized avatars.

7

What is Artificial Immune System (AIS)?
AIS is a machine learning model inspired by the human immune system.
Just like how our body protects itself from harmful pathogens, AIS aim to protect computational systems, especially in cybersecurity, anomaly detection and pattern recognition.

What is the role of Euclidean distance in this code?
It measures the similarity (affinity) between the input data and detector. If the distance is small, the input is considered damaged.

8

What is DEAP (Distributed Evolutionary Algorithms)?
DEAP is a Python library that helps create and run algorithms inspired by natural evolution, like genetic algorithms. It's used to solve problems by evolving solutions over time through processes like selection, mutation, and crossover.

What types of problems can DEAP solve?
DEAP can solve optimization problems such as function maximization/minimization, multi-objective problems, and machine learning tasks, including classification and regression.

What are the main steps of an evolutionary algorithm?
The main steps are:

1. Initialization: Create an initial population of solutions.
2. Selection: Choose individuals based on their fitness to reproduce.
3. Crossover: Combine two parents to create offspring.
4. Mutation: Apply random changes to offspring.
5. Replacement: Update the population with new solutions.

9

What is Ant Colony Optimization?
Ant Colony Optimization (ACO) is a bio-inspired optimization algorithm based on the behavior of real ants, where they find the shortest path between their colony and a food source using pheromone trails.

What is the Traveling Salesman Problem (TSP)?
TSP is a classic optimization problem where a salesman must visit a set of cities, each exactly once, and return to the starting city while minimizing the total travel distance.

ACO parameters

1. Number of ants
2. Number of iterations
3. ALPHA: It controls how much influence the pheromone trail has on the ants' decision to follow a particular path.
4. BETA: It controls how much ants prioritize shorter distances.
5. Pheromone evaporation rate: Represents the rate at which pheromone evaporates over time.