Algorithms in Nature :-

Algorithms in Nature refer (describe) to the patterns and processes observed in the natural world that exhibit (show) algorithmic behaviour.

An algorithms is a set of step-by step instructions for solving a problem or achieving a specific outcome.

In nature, various phenomena follow rules or patterns that can be likened (to compare) to algorithms. For example:-

1) Swarm intelligence (SI):- Swarm intelligence algorithms are inspired by the behaviour of social insects and other animal societies and have been successfully applied to various optimization problems.

SI based on (Important points)

1) Decentralization :- SI algorithms are based on the principle of decentralization, where there is no central control or decision-making authority

ii) self-organization :- SI systems are able to organize themselves and adapt the changing conditions without external guidence.

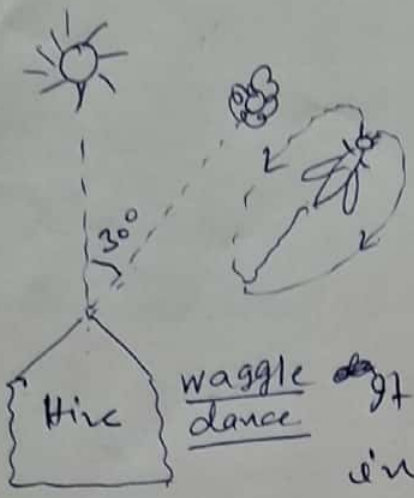
3) Interaction and Co-operation :- Agents (Ex- birds) within SI system interact and cooperate with each other.

EX: Common SI Algorithms :(Ex. of swarm Intelligence)

1) Ant colony optimization (ACO) :- ACO is a SI algorithm inspired by the foraging behaviour of ants.
Ants use pheromone trails to communicate and find the shortest path for food source.
It has been successfully applied to the problems such as routing and sheduling.

2) Particle swarm optimization (PSO) :- PSO is a SI algorithm inspired by the behaviour of flocks of birds and schools of fish.
Birds fly together in flocks, following simple rules to stay coordinated and avoid collisions. It is like dancing together without bumping (टकराना) into each other.
It has been used to solve optimization problems in fields such as engineering & finance.

3) Artificial Bee colony (ABC) :- ABC is a SI algorithm inspired by the foraging behaviour of honey bees.



- Angle of dance in relation to the sun shows direction
- Duration of dance indicates distance to food

It has been used for optimization in fields such as image processing and engineering design.

SI algorithms have been successfully applied to various optimization problems, including:

i) Train scheduling → optimize train schedules
ii) Wind Turbine Design → optimize the design of wind turbine blades
iii) Traffic Light Control → optimize traffic light control
(iv) Supply Chain Management - optimize supply chain management.

Thus swarm intelligence algorithms are a powerful tool for optimization, providing a biology-inspired approach to solve complex problems.

Other examples of Algorithms in Nature are Tree Branching, Weather Predication, Genetic Algorithms etc.