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CSD

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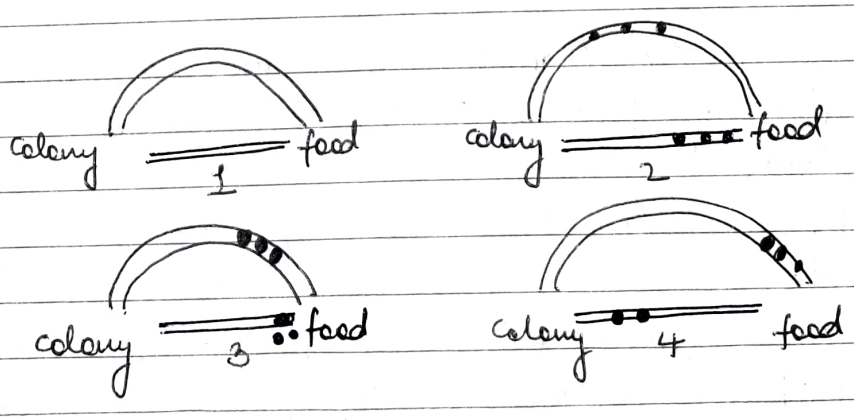
# Assignment : 3
## Soft Computing

**Ques 1:**
Ant Colony Optimization (ACO) is an optimization algorithm which employs the probabilistic technique and is used for solving probabilistic technique and is used for solving computational problems & finding the optimal path with the help of graphs.

→ ACO technique is purely inspired from the foraging behaviour of ant colonies. Ant communicate with each other using pheromone.

→ The underlying principal of ACO is to observe the movement of ants from their nest in order to search for food in the shortest path possible.




Stages:
① All ants are in their nest. There is no pheromone content in the environment.
② Ants begin their search with equal probability along each side.

③ The ants through the shorter path reaches food source earlier. The probability of selection of shorter path is higher.
④ More ants return via the shorter path and subsequently the pheromone concentration also increases & the whole colony gradually uses the shorter path is higher probability, so path optimization is attained.

Algo for ACO:
① Set parameters values for ACO.
② initialize pheromone concentration for each region.
③ create region to explore memory.
④ determine obj. for.
⑤ check region explored is better or not, for update of region memory.
⑥ Pheromone evaporation.
⑦ local optimum achieved.

Ques2: • Genetic Algorithms are search algorithms inspired by Darwin's Theory of evolution in nature.
→ By simulating the process of natural selection, reproduction & mutation, the genetic algorithms can produce high quality solutions for various problems including search & optimization.
→ By the effective use of theory of evolution genetic algorithm are able to surmount problems faced by traditional algorithms.

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Qus 3:

Advantages:

① It inherent parallelism.
② Positive feedback accounts for rapid discovery of good solutions.
③ Efficient for traveling salesman problem.
④ Can be used in dynamic application.

Disadvantages:

① Theoritical analysis is difficult.
② sequences of random decisions
③ probability distribution change by iteration
④ ~~research~~ research is experimental rather than theoretical.

Qus 4: Application areas of ACO:

→ Job shop schedule
→ Network model
→ Vehicle routing
→ Graph coloring
→ Digital image process.

| Qus 6: | GA | PSO |
|---|---|---|
| ① General feature | Random search population based | Random search population based |
| ② Individual memory | none | Yes; through pBest |
| ③ Individual operator | mutation | pBest updating |
| ④ Social operator | Selection crossover | gBest |
| ⑤ Balance exploration | Tunable | Higher w: Exploration<br>lower w: exploitation |

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Ques 7

Advantages:
→ Insensitive to scaling of design variables.
→ Simple Implementation.
→ Easily parallelized for concurrent processing.
→ derivation free.

Disadvantages:
→ Tendency to a fast & premature convergence in mid optimum point.
→ Slow convergence in refined search stage.

Ques 8: Single objective optimization
When an optimization problem involves only one objective function, the task of finding the optimal solution is called single objective optimization.

eg: find out a CAR for me with minimum cost.

Multi-objective optimization
When an optimization problem involves more than one objective function, the task of finding one or more optimal solution is known as multi-objective optimization.

eg: find out a CAR for me with minimum cost & maximum comfort.