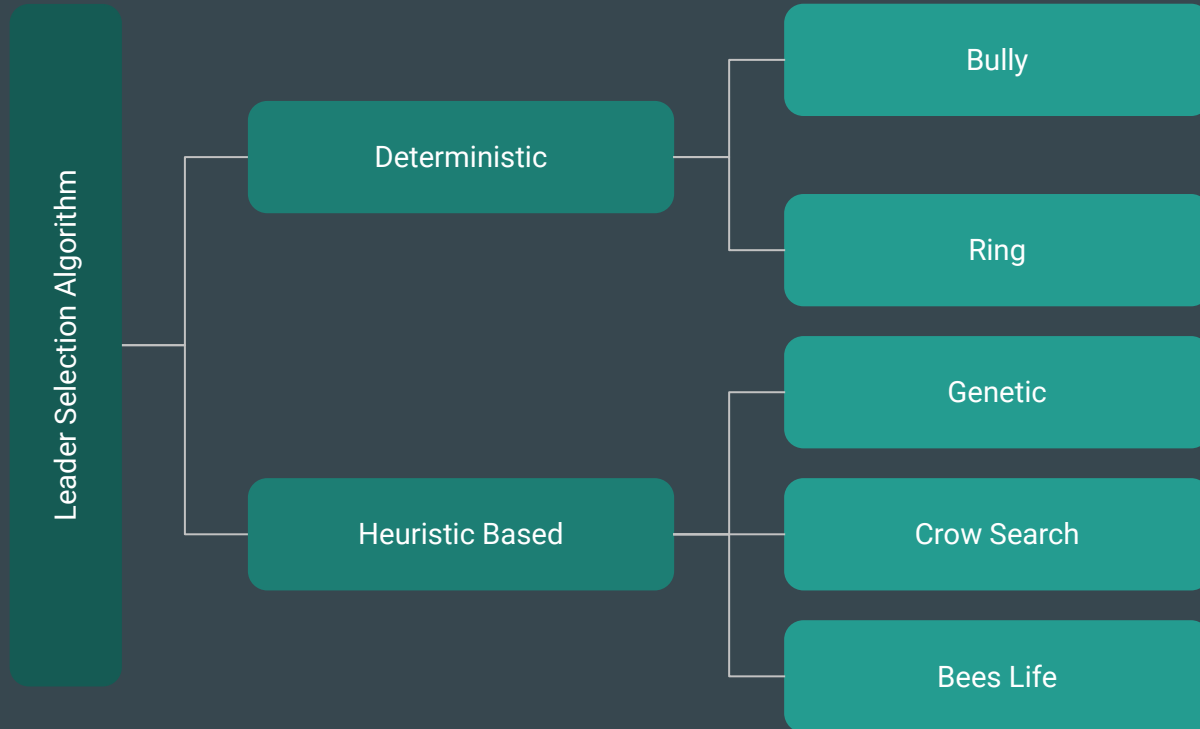


# Distributed System Leader Selection Algorithm

...

Genetic Algorithm & Crow Search Algorithm

# Taxonomy of Leader Selection Algorithms



# Why heuristic based leader election?

- We need to find the problem of Deterministic Algorithms



Powerful server  
ID: 1



Powerful server  
ID: 2



Weak server  
ID: 3



# Solution

## Heuristic Based Leader Election..

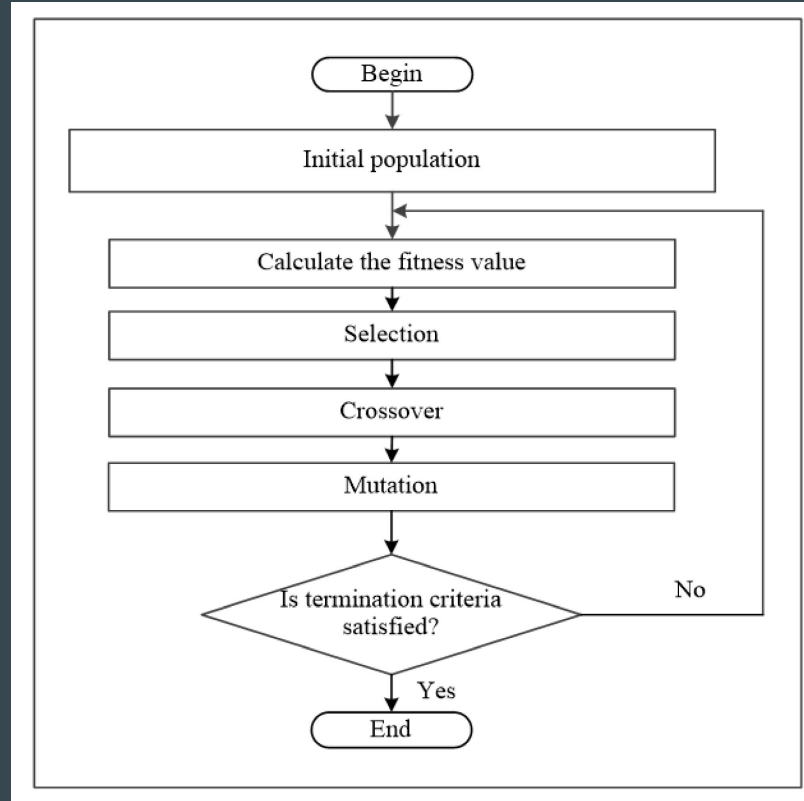
Existing:

- Bee Life Algorithm (BLA)
- Genetic Algorithm based Leader Election(GLEA)

Our Proposal:

- Crow Search Algorithm(CSA)

# Genetic Algorithm (Generic)



# Genetic Algorithm (Leader Selection) - Terminology

**Gene:** Single assignment of task to a server. For example,  $t_0S_1$  is a gene which means task-0 is assigned to server-1.

**Chromosome:** A set of genes where every task is assigned to any server.  $Q$

**Population:** Collection of chromosomes.

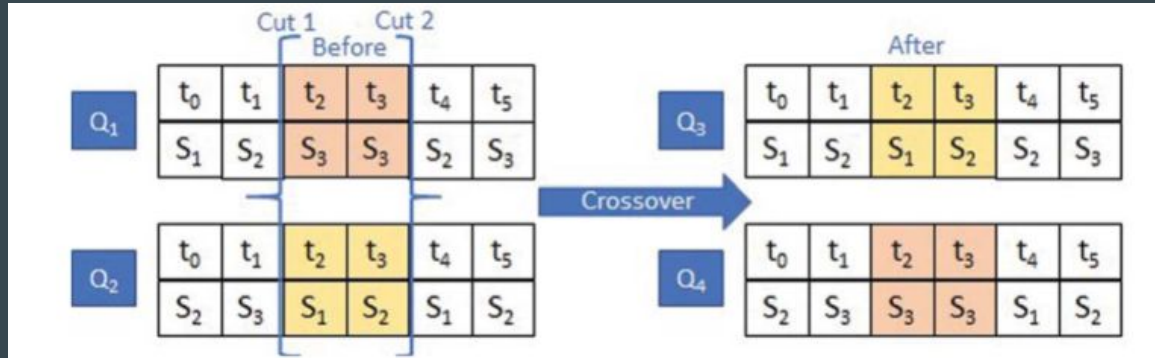
**Fitness Function:** Weighted sum of available resources

$$f(Q) = w_1 \text{CPU}_A + w_2 \text{RAM}_A + w_3 \text{Bandwidth}_A + w_4 \text{Throughput}_A$$

**Selection:** Probability  $P(Q) = f(Q) / \sum f(Q)$

# Genetic Algorithm for Leader Selection - Continued

Crossover:



Mutation:



# How to use Genetic Algorithm to Select Leader?

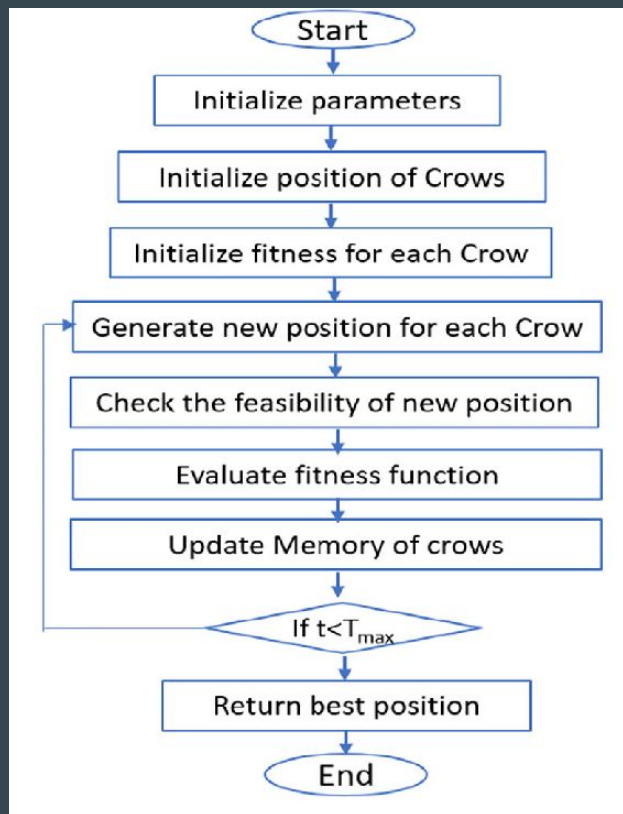
**Initially**, the node with the best resources is selected as leader. Then, genetic algorithm is run to find optimized task assignment.

**After optimizing task assignment**, chromosome with the highest fitness value is selected as the assignment. The server with the *maximum resources available* is selected as the leader.

**Genetic Algorithm will run after some fixed time intervals and select an optimized leader**

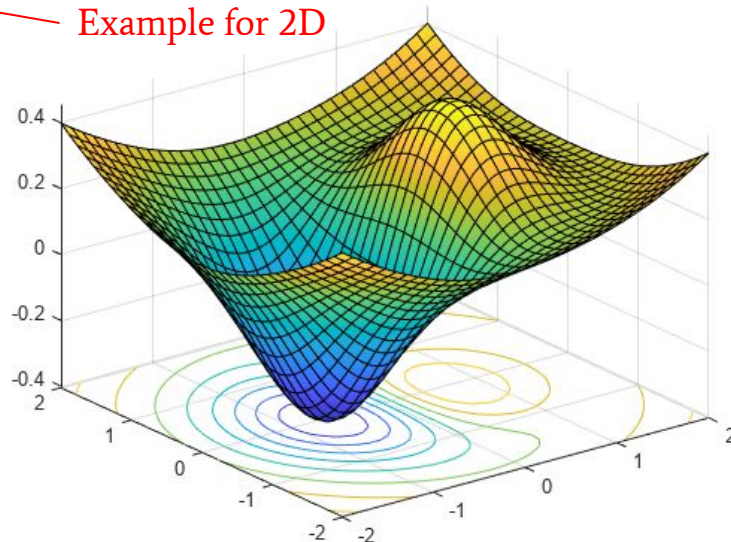


# Crow Search Algorithm



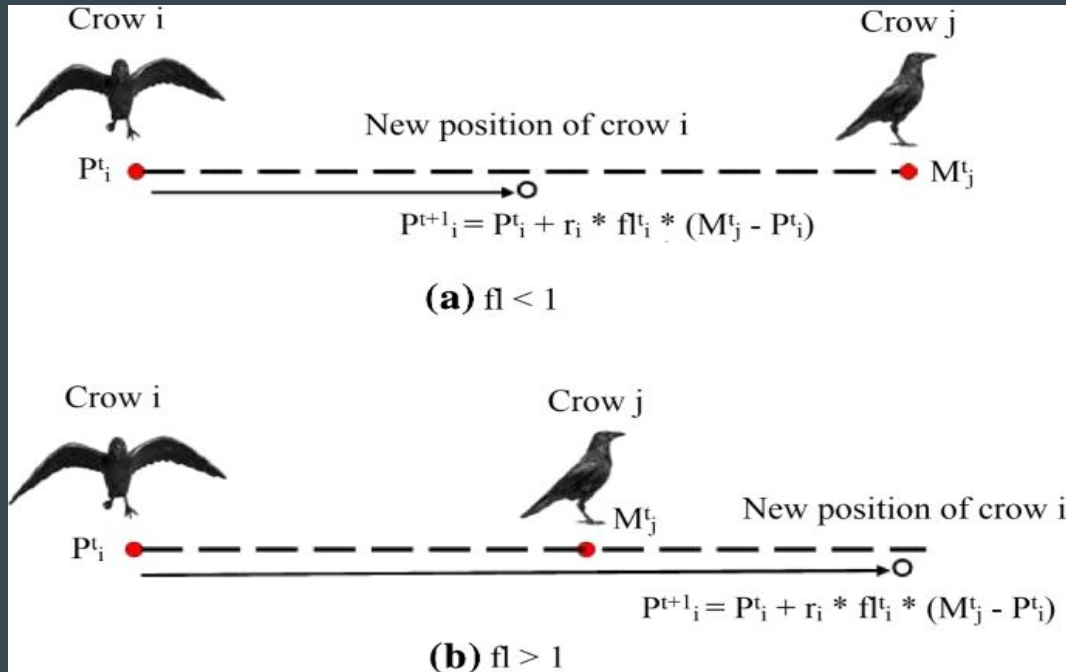
Flight Length and  
Awareness Probability

Example for 2D



# Crow Search Algorithm

Update stage:



# Crow Search Algorithm in Leader Election

- Each crow represents assignment of each task to any server.
- Crow has memory of its own. It means the current assignment of the tasks.
- Fitness function is same as genetic algorithm, weighted sum of resources available.
- When a crow follow other crows position(hidden place), it may or may not change its current memory based on whether the new position has a better outcome than his memory.
- Finally the memory of the crows represent the optimise assignment of the task and then we can compute the leader among the servers.

# Problem faced in GA and CSA

In the paper using GA, use of Eqn (1) to find the leader [Eqn (1) is used for cross-over]

We used most relevant equation that takes resources into consideration

In the paper introducing CSA, gives the equation for multiplication and addition of assignment, which does not make sense

We thought of using vector like structure for task assignment

Leader Selection, selects the node with maximum resources

We think it should be maximum **available** resources