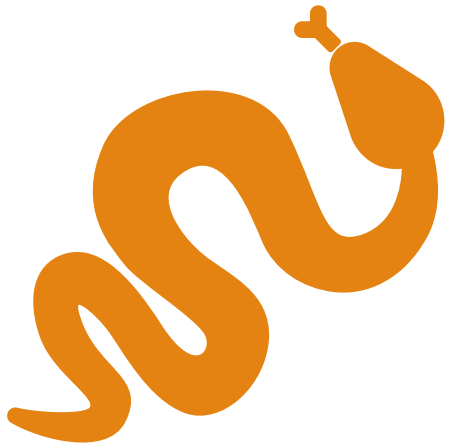


TSP & Genetic Algorithm

ICDF PYTHON

2022-01-15

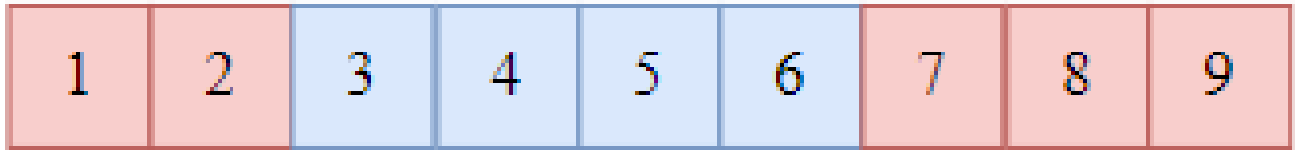
Content

- Introduction to Genetic Algorithm.
- Population Initialization.
- Parents Selection.
- Crossover.
- Mutation.

Genetic Algorithm

- **String:** Solution representation (chromosome).
- **Fitness:** Objective function value of a given solution.
- **Population:** Set of strings/solutions.
- **Generation:** Set of strings/solutions for a given iteration.
- **Crossover:** Mechanism to generate new solutions (offspring) from old solutions (parents).
- **Mutation:** Modify a given solution (offspring) within a neighborhood.
- **Maintenance:** Mechanism to kill/remove solutions and keep population size.

Solution Representation for TSP

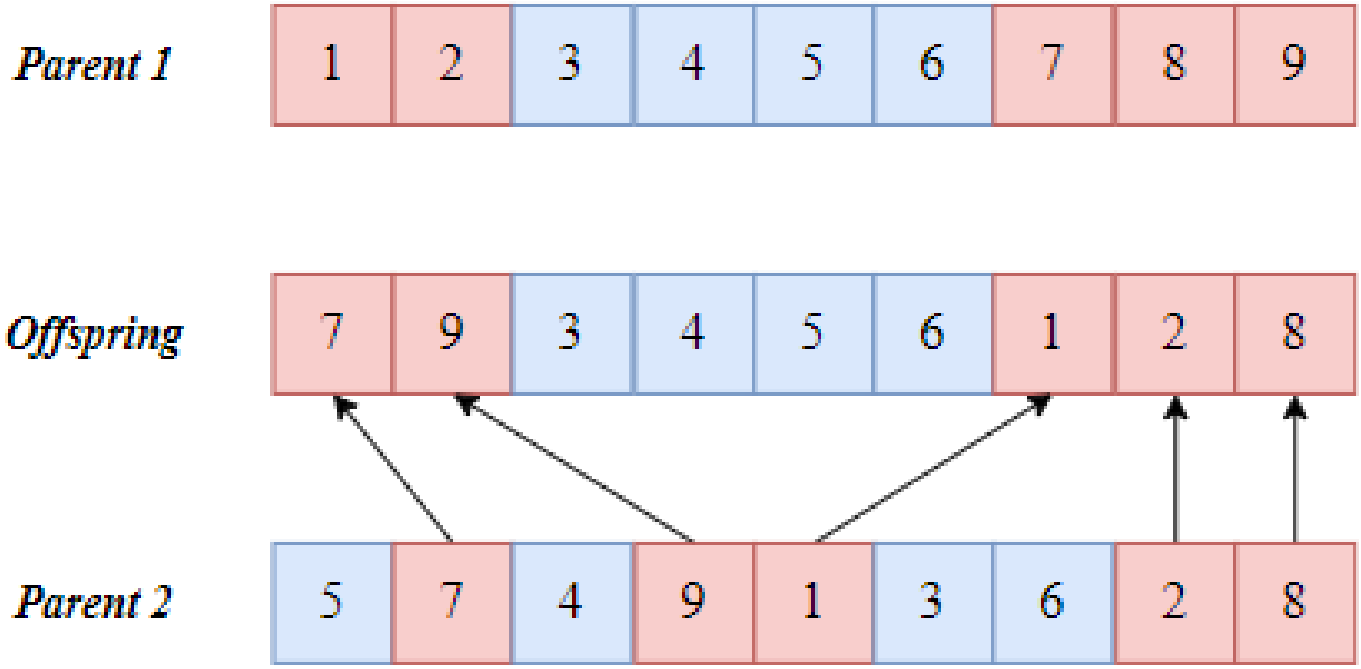


Genetic Algorithm

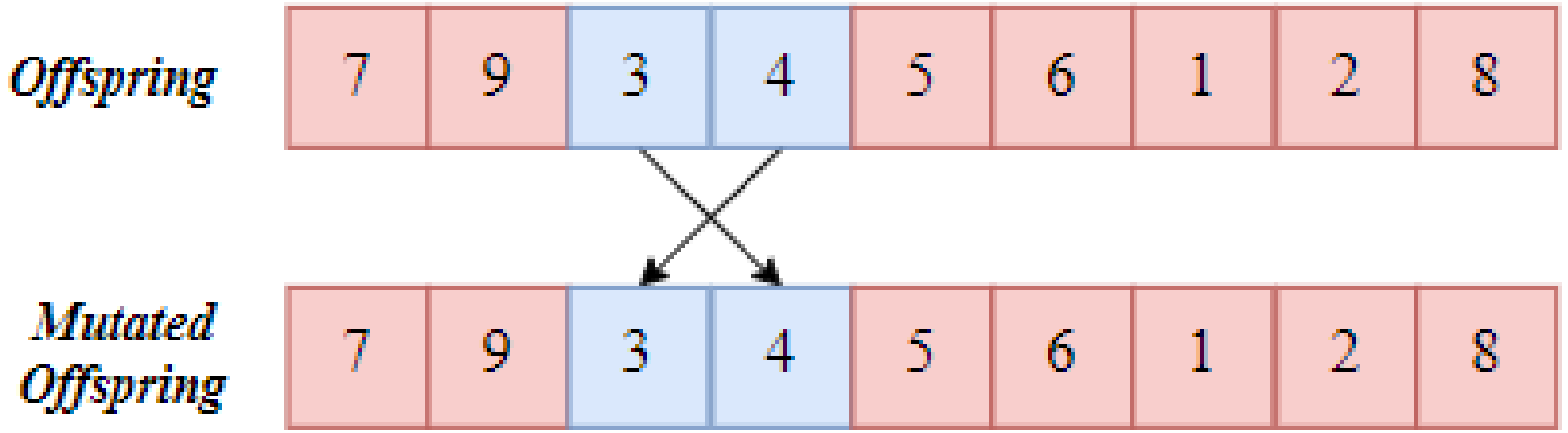
Algorithm 3: Genetic Algorithm

GA Parameters: p_c, p_m, g_{max}
Problem-specific parameters pop_{size}, $dims$, x_{min}, x_{max}
$x, f(x), g_{best}$ =INIT_POPULATION
for *generation* $g = 0, 1, 2, \ldots, g_{max}$ **do**
  for $i = 0, 1, 2, \ldots, pop_{size}//2$ **do**
    $idx_{parents}$ = SELECTION() ; /* Select index of parents */
    $parents = x[idx_{parents}]$; /* Get parents from current generation */
    $children$ = CROSSOVER(p_c) ; /* Crossover with probability p_c */
    $children$ = MUTATION(p_m) ; /* Mutate children with probability p_m */
    $new\_generation = [new\_generation, children]$; /* Append children */
  end
  $pooled\_population = [x, new\_generation]$; /* Parents + Children */
  x = MAINTENANCE($pooled\_population$) ; /* Maintenance with pooled population */
  $g_{best} = \text{argmin}\{f(x)\}$; /* Global minimum from survivors */
end
Output: x, g_{best}

Order Crossover (OX-1)



Mutation: Swap



Maintenance Mechanism

Tournament

Survival of the fittest