TSP & Genetic Algorithm

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Content

- Introduction to Genetic Algorithm.

- Population Initialization.

- Parents Selection.

- Crossover.

- Mutation.

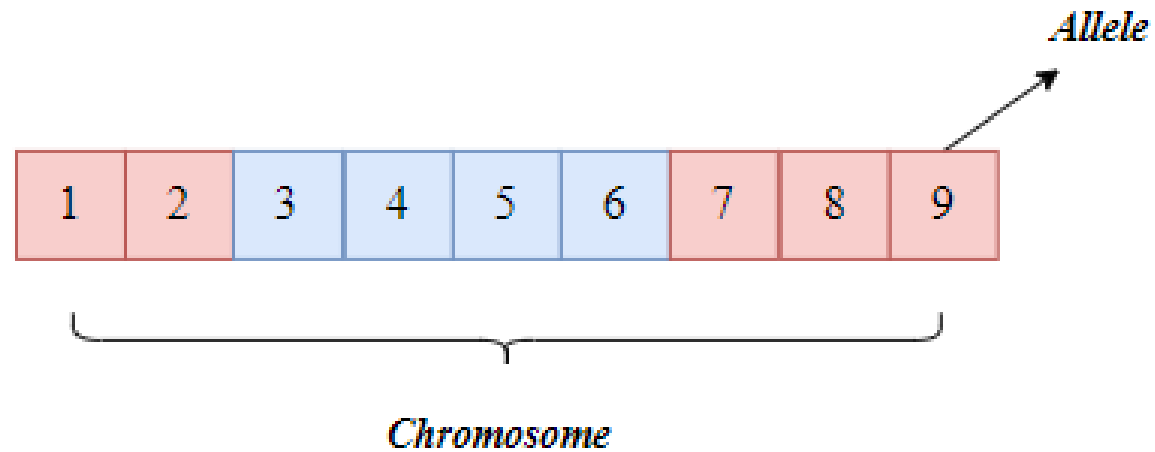# Genetic Algorithm

- **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 */
    $g_{best} = \arg\min\{f(x)\}$;   /* Global minimum from survivors */
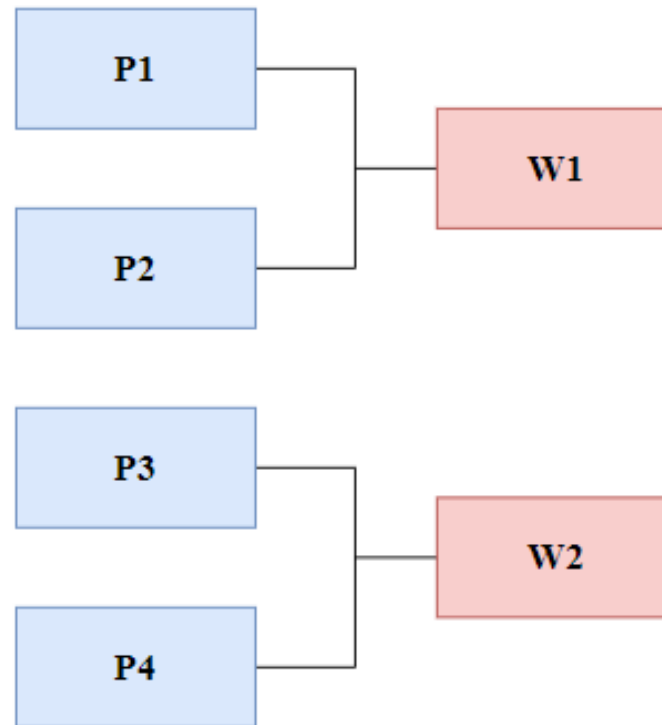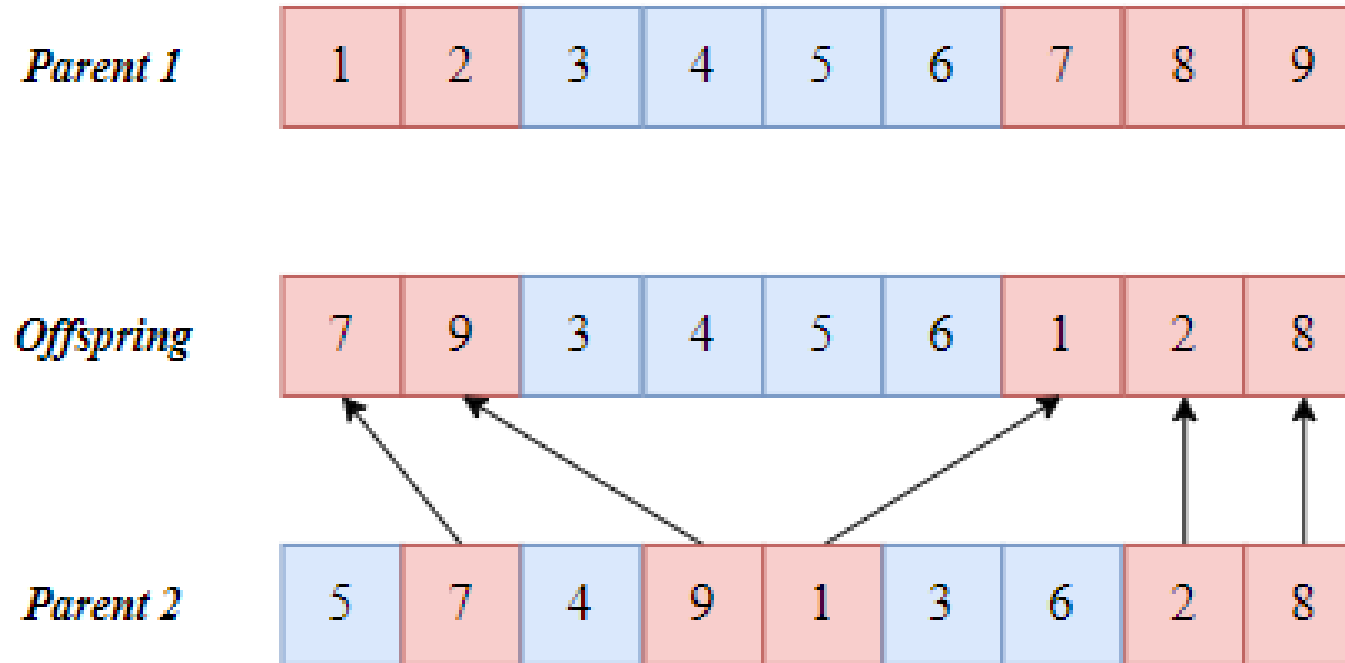**end**
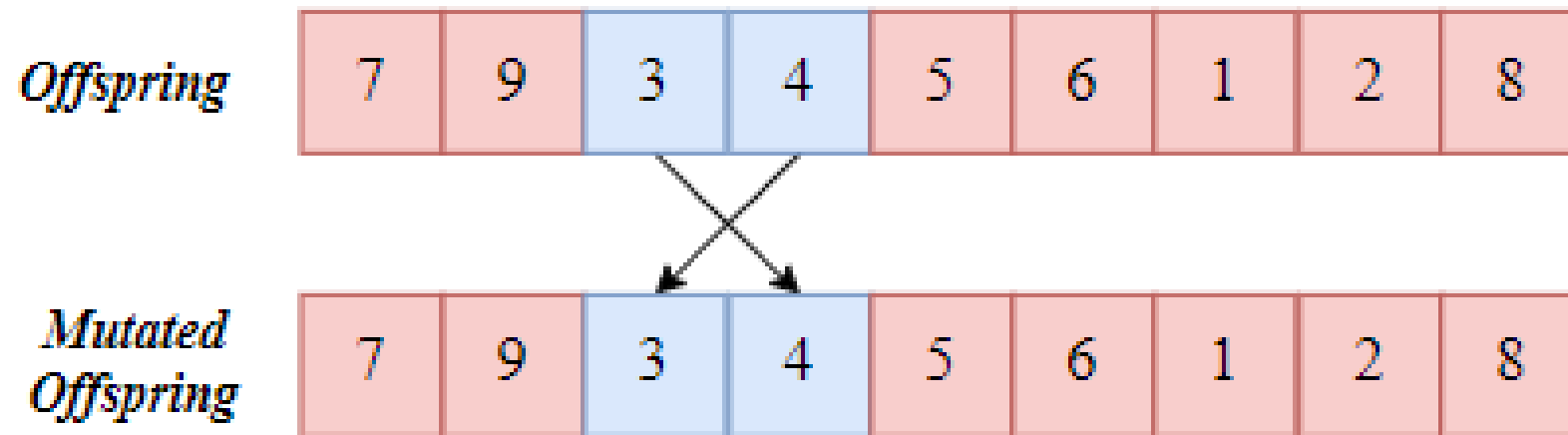**Output:** x, g_{best}

Tournament Selection

Order Crossover (OX-1)

Mutation: Swap

Maintenance Mechanism

Tournament

Survival of the fittest