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HOME WORK

1. If two fuzzy sets A and B are given with membership functions

$\mu_A(x) = \{0.2, 0.4, 0.8, 0.5, 0.1\}$

$\mu_B(x) = \{0.1, 0.3, 0.6, 0.3, 0.2\}$

Then the value of $\mu\ \overline{A \cap B}$ will be

A. {0.9, 0.7, 0.4, 0.7, 0.9}

B. {0.2, 0.4, 0.8, 0.5, 0.2}

C. {0.1, 0.3, 0.6, 0.3, 0.1}

D. {0.7, 0.3, 0.4, 0.2, 0.7}

❑ Approaches to AI

Content:

1. Genetic Algorithm (GA)
2. Introduction to Optimization
3. Operator of GA

GENETIC ALGORITHMS

GAs were developed by John Holland and his students and colleagues at the University of Michigan, most notably David E. Goldberg and has since been tried on various optimization problems with a high degree of success.

Genetic Algorithm (GA) is a search-based optimization technique based on the principles of Genetics and Natural Selection. It is frequently used to find optimal or near-optimal solutions to difficult problems which otherwise would take a lifetime to solve. It is frequently used to solve optimization problems, in research, and in machine learning.

Introduction to Optimization

Optimization is the process of making something better. In any process, we have a set of inputs and a set of outputs as shown in the following figure.

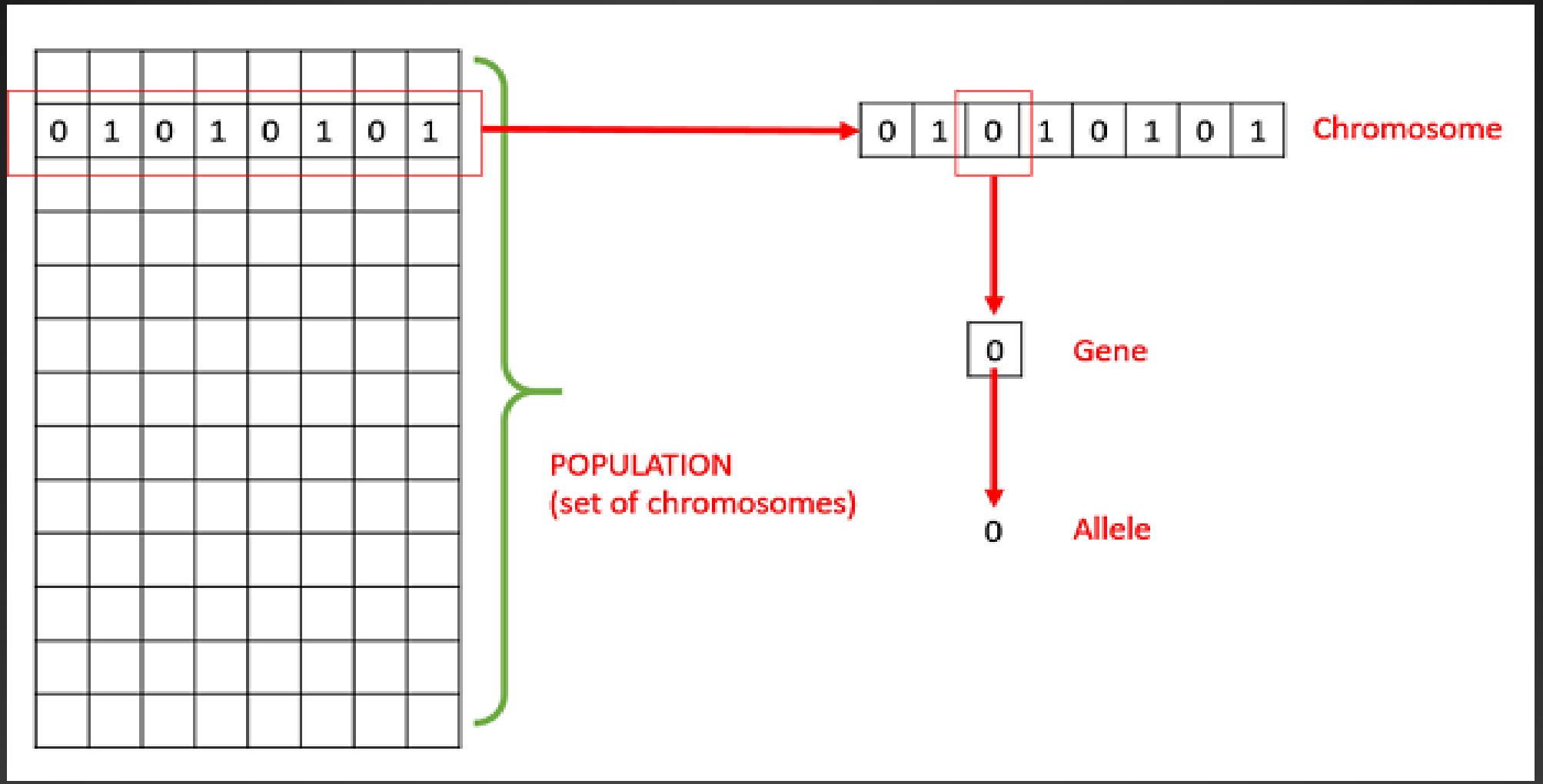
- Optimization refers to finding the values of inputs in such a way that we get the best output values. The definition of best varies from problem to problem

Basic Terminology

Before beginning a discussion on Genetic Algorithms, it is essential to be familiar with some basic terminology which will be used throughout this tutorial.

- **Population** - It is a subset of all the possible (encoded) solutions to the given problem. The population for a GA is analogous to the population for human beings except that instead of human beings, we have Candidate Solutions representing human beings.
- **Chromosomes** - A chromosome is one such solution to the given problem.
- **Gene** - A gene is one element position of a chromosome.

Allele - It is the value a gene takes for a particular chromosome.

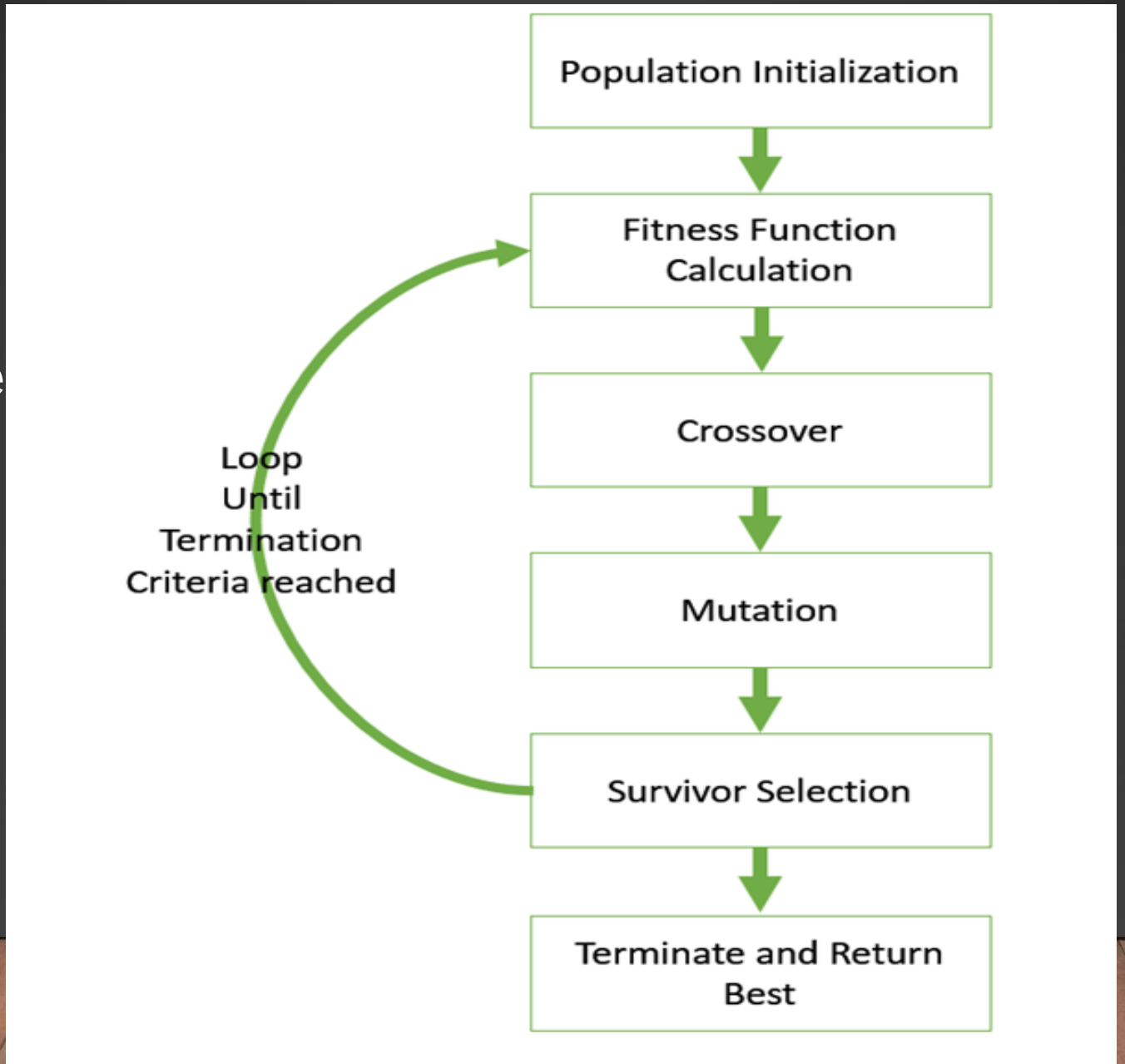


Genotype - Genotype is the population in the computation space. In the computation space, the solutions are represented in a way which can be easily understood and manipulated using a computing system.

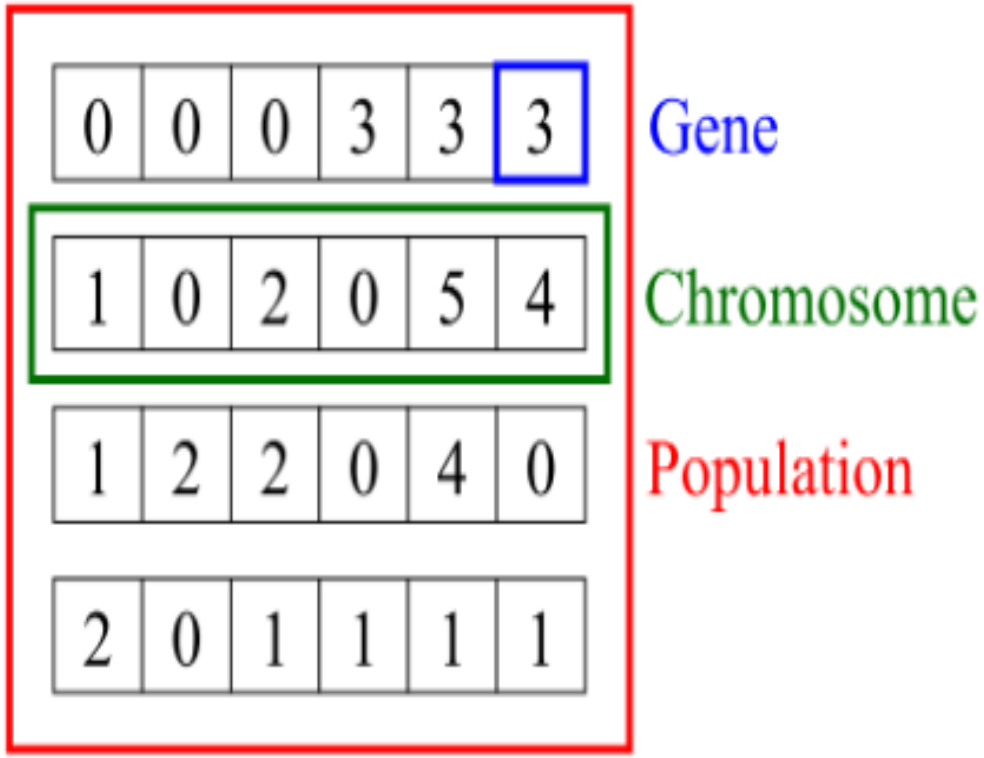
Phenotype - Phenotype is the population in the actual real world solution space in which solutions are represented in a way they are represented in real world situations.

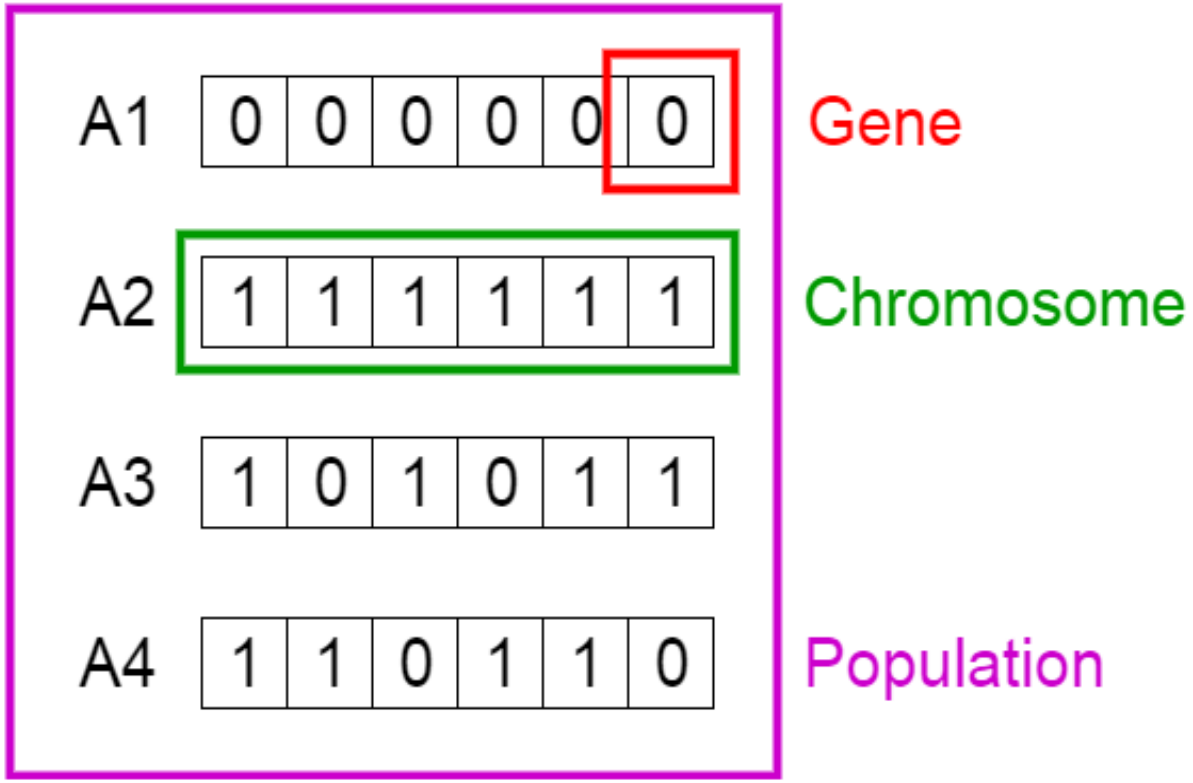
OPERATOR IN GA

basic structure of a GA



1. INITIALISATION : RANDOMLY GENERATE A POPULATION WITH MULTIPLE CHROMOSOMES.

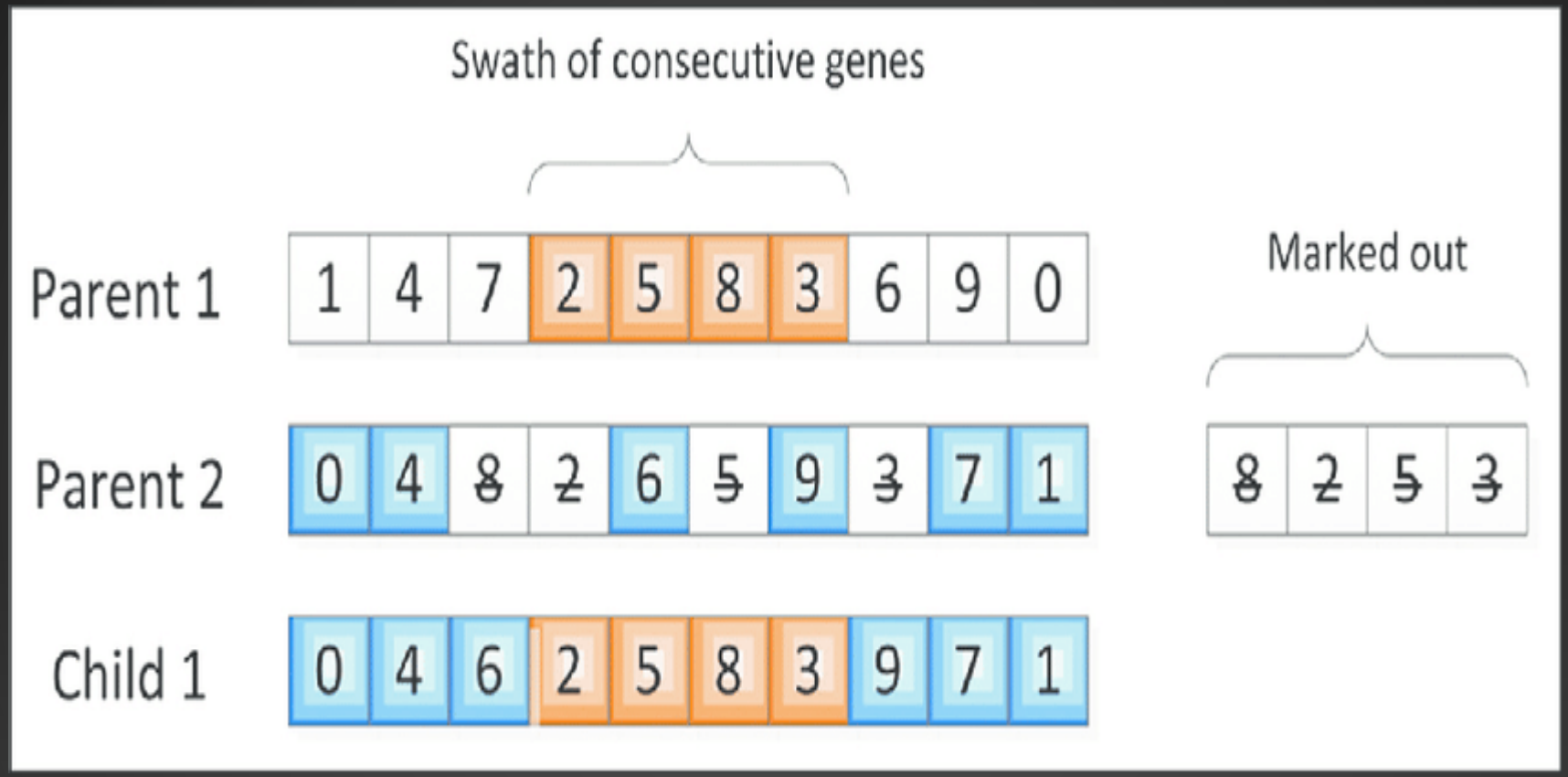




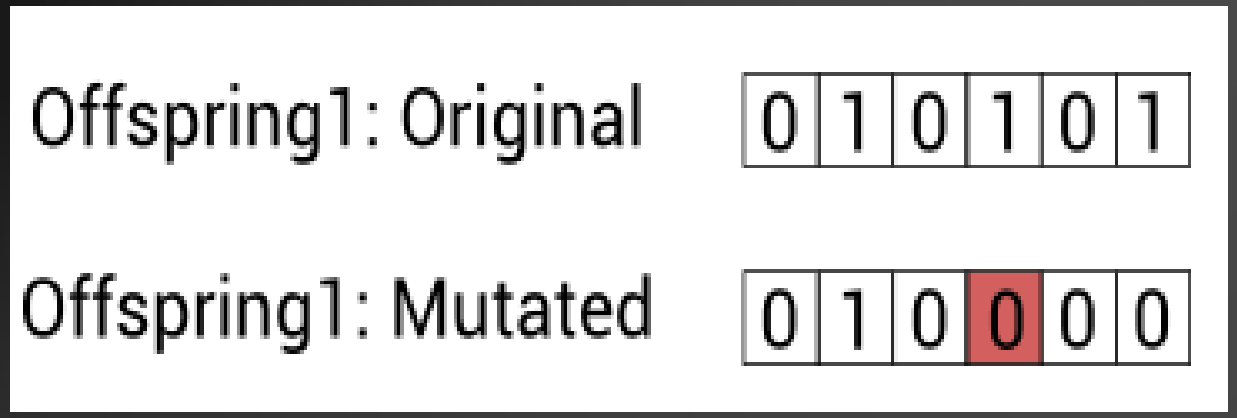
2. DEFINING THE FIT FUNCTION: Now we need to define the evaluation criteria for best chromosomes(solution). Each chromosome is assigned with a fitness score by the fitness function, which represents the goodness of the solution.

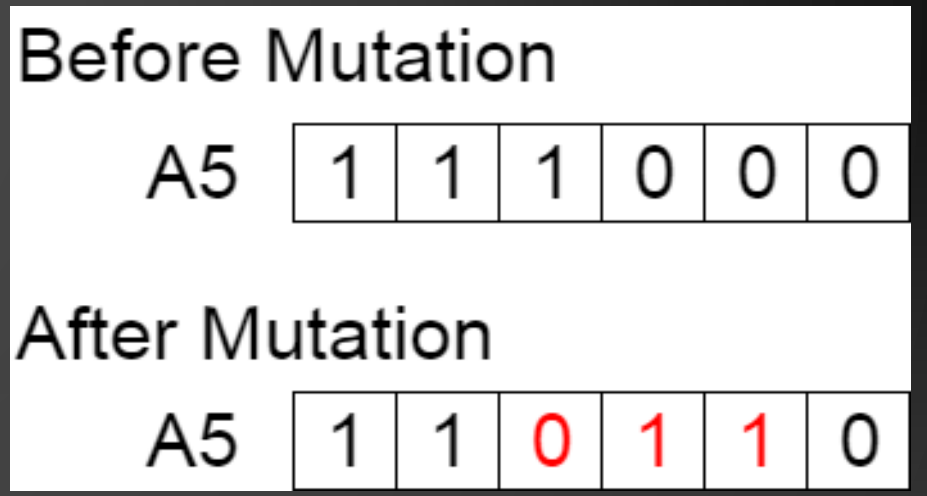
3. SELECTION : Selecting the top 2 fittest chromosomes for creating the next generation.

4. CROSSOVER : Crossover is the equivalent of two parents having a child. Each chromosome contributes a certain number of genes to the new individual. **Offspring** are created by exchanging the genes of parents among themselves until the crossover point is reached.



5. MUTATION: To avoid the duplicity(crossover generates offspring similar to parents) and to enhance the diversity in offspring we perform mutation. The mutation operator solves this problem by changing the value of some features in the offspring at random.





Basis of comparison	Informed search	Uninformed search
Basic knowledge	Uses knowledge to find the steps to the solution.	No use of knowledge
Efficiency	Highly efficient as consumes less time and cost.	Efficiency is mediatory
Cost	Low	Comparatively high
Performance	Finds the solution more quickly.	Speed is slower than the informed search.
Algorithms	Heuristic depth-first and breadth-first search, and A* search	Depth-first search, breadth-first search, and lowest cost first search

HOME WORK

Which of the following operation is responsible to jump from one hill to another hill?

1. Mutation
2. Cross Over
3. Fitness Function
4. Natural Selection


FEEDBACK

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