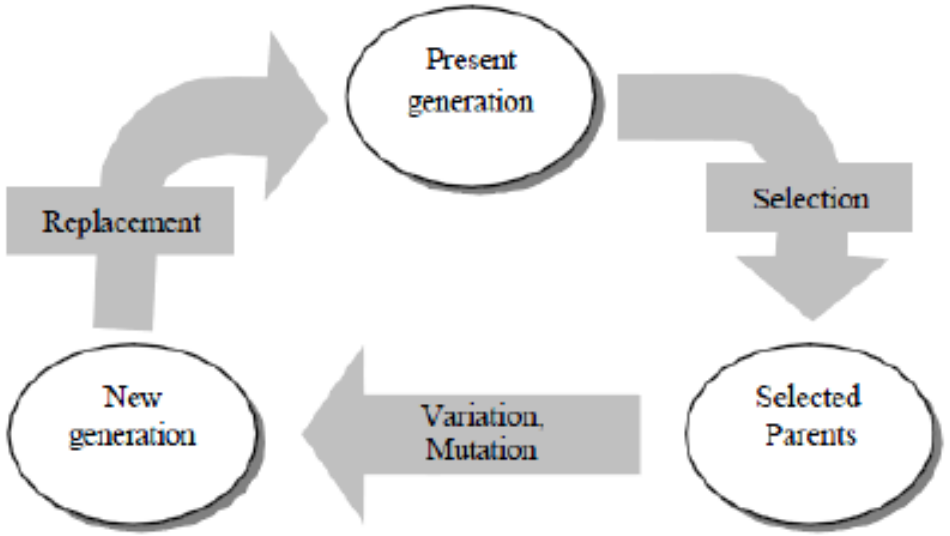
INTRODUCTION OF GENETIC ALGORITHM

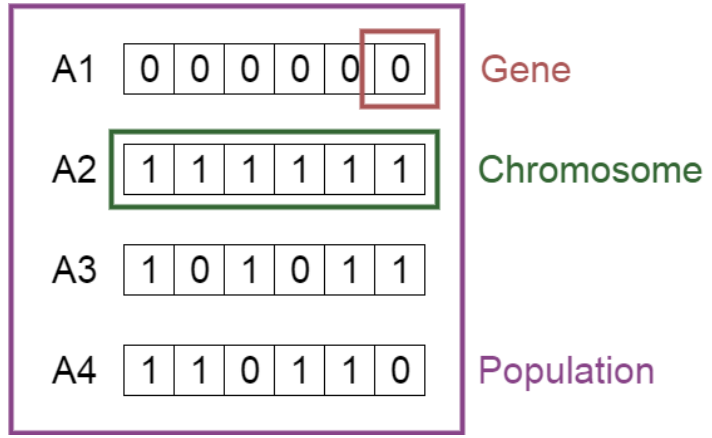
WHAT ARE GENETIC ALGORITHMS?

- Genetic algorithms (GA's) are a technique to solve problems which need optimization in search.
- Genetic Algorithms are search and optimization techniques based on Darwin's Principle of Natural Selection.
- Also known as evolutionary algorithms, genetic algorithms demonstrate self organization and adaptation similar to the way that the fittest biological organism survive and reproduce.
- A genetic algorithm is an iterative procedure that represents its candidate solutions as strings of genes called chromosomes.

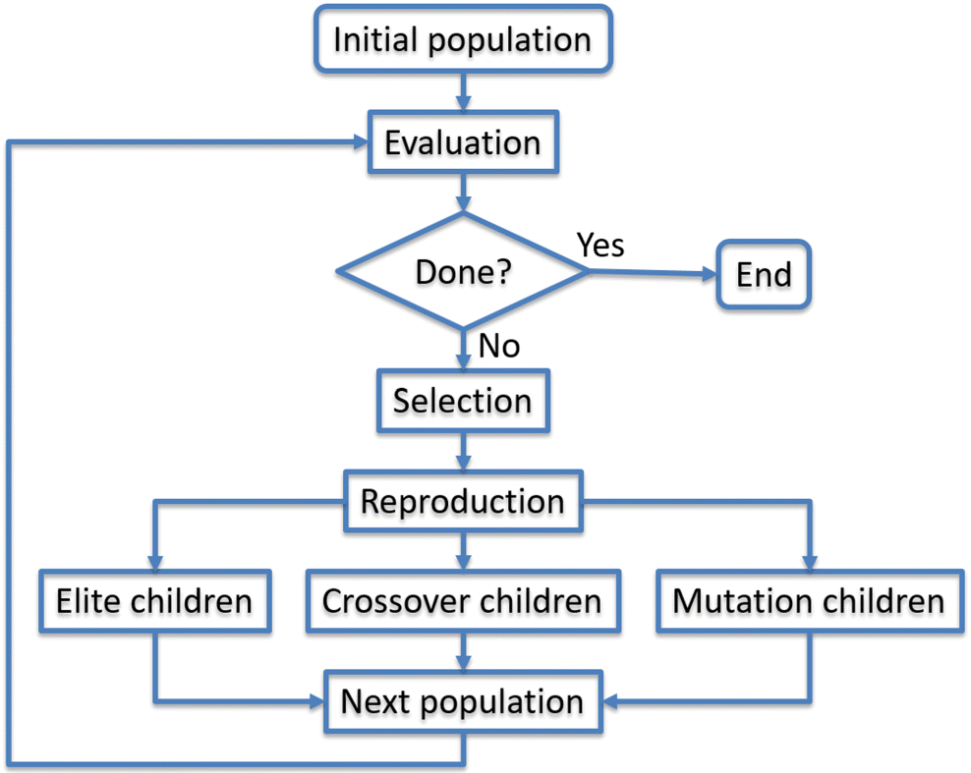


CONCEPTS

- **Population**: set of individuals each representing a possible solution to a given problem.
- **Gene**: a solution to problem represented as a set of parameters, these parameters known as genes.
- **Chromosome**: genes joined together to form a string of values called chromosome.
- **Selection:** the idea of selection phase is to select the fittest individuals and let them pass their genes to the next generation.
- **Fitness score (value):** every chromosome has fitness score can be inferred from the chromosome itself by using fitness function.



WORKING MECHANISM OF GA



AN EXAMPLE

$$2a^2 + b = 57$$

$$f(a,b) = |2a^2 + b - 57|$$

INITIALIZE POPULATION

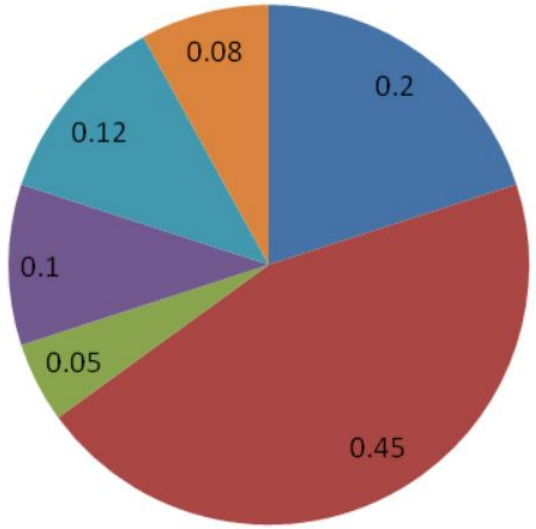
$$f(a,b) = |2a^2 + b - 57|$$

```
print(intial_popu)
##              [,1] [,2]
## Cromosome1    5    9
## Cromosome2    9    7
## Cromosome3    9    9
## Cromosome4    3    3
## Cromosome5    7    8
## Cromosome6    8    4
```

SELECTION

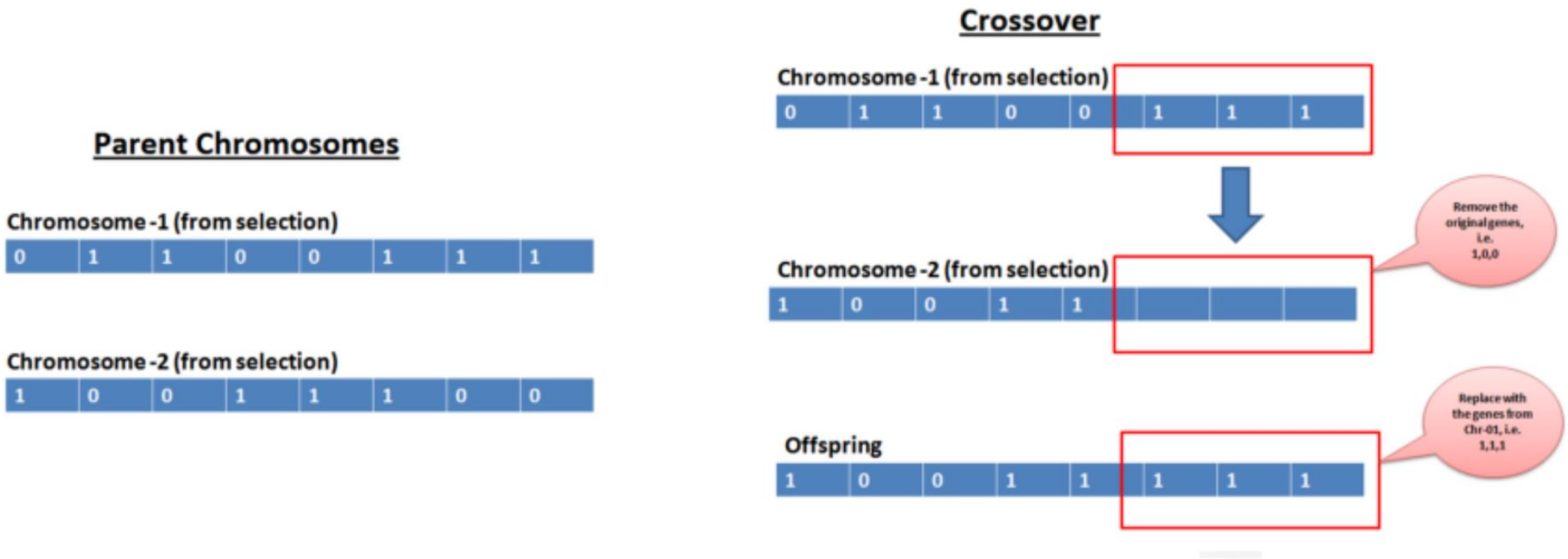
$$FP = \frac{F_i}{\sum_{i=1}^{n=6} F_i}$$

Where, FP = fitness probability of ith chromosome, Fi = fitness value of ith chromosome



Roulette wheel showing fitness probabilities of chromosomes

CROSSOVER


Parent Chromosomes
Chromosome -1 (from selection)
0 1 1 0 0 1 1 1
Chromosome -2 (from selection)
1 0 0 1 1 1 0 0
Crossover
Chromosome -1 (from selection)
0 1 1 0 0 1 1 1
Chromosome -2 (from selection)
1 0 0 1 1
Remove the original genes, i.e. 1,0,0
Offspring
1 0 0 1 1 1 1 1
Replace with the genes from Chr-01, i.e. 1,1,1

MUTATION

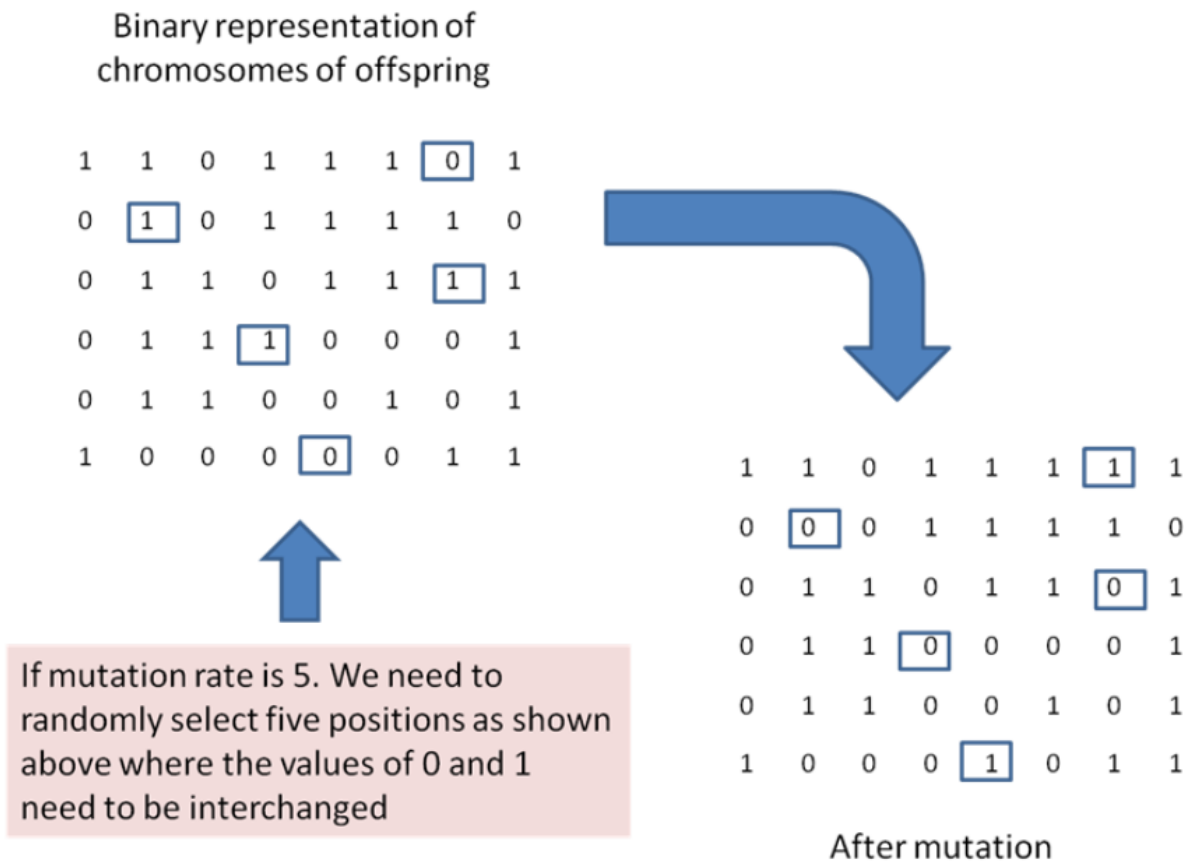


Illustration of mutation process

THANKS FOR YOUR ATTENTION