Genetic Algorithm

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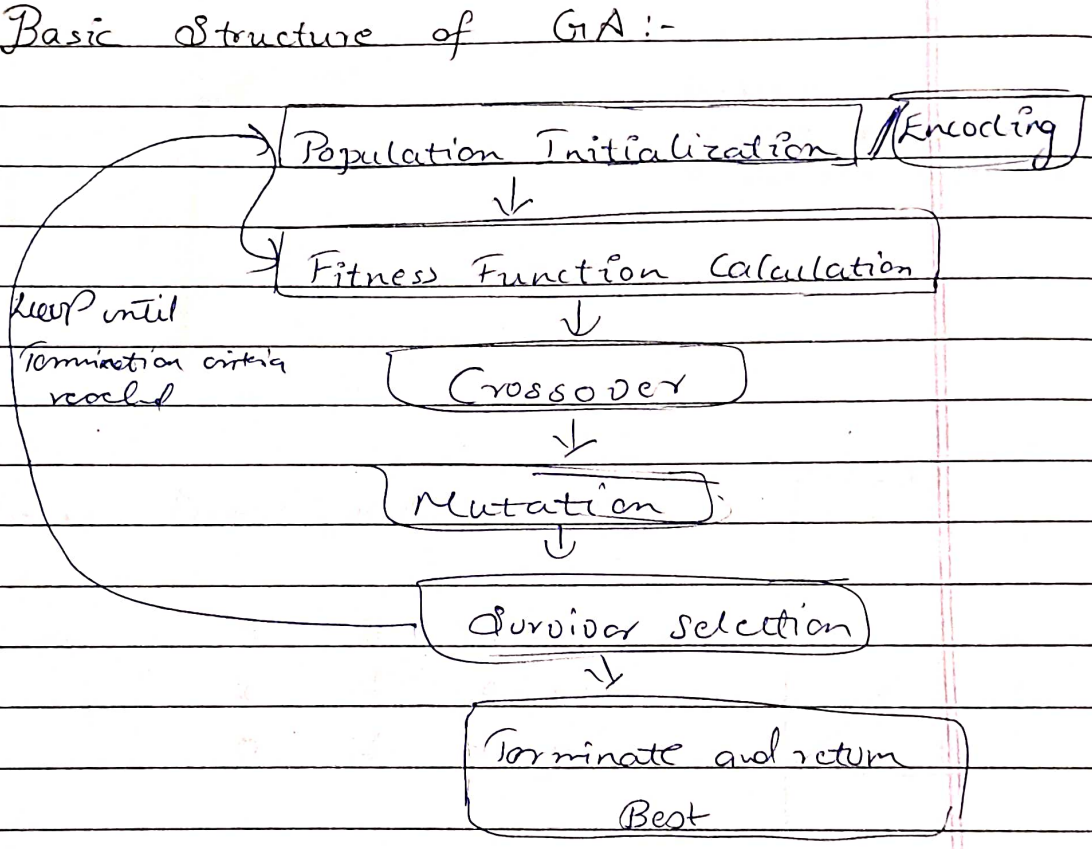
proposed by - John Holland

- Based on darwin's theory (survival of fittest)

⇒ Let's assume a problem $f(x) = y = x^2$

→ Basic structure of GA :-



(1) ENCODING :- It is a process of representing individual genes.

The process can be performed using bits, numbers, tree, array, list or any other object

Population Chromosomes Gene

*⟨α⟩→

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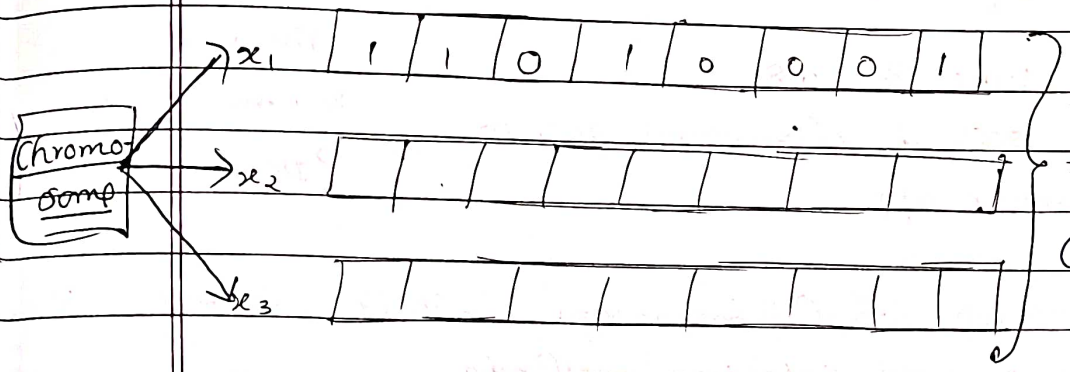
Possible solution of 'x'

The set of solution is denoted by 8 bit binary



Chromosomes - A chromosome is one such solution to the given problem

Gene - A gene is one element position of a chromosome.

Here (1/0) are gene.

* ⟨α⟩ → Fitness Function Evaluation

For every (x) will find f(x). here it is sinx
This is known as cost function / fitness function evolution

$x_1 \rightarrow y_1$, $x_2 \rightarrow y_2$, $x_3 \rightarrow y_3$ ---- $x_{10} \rightarrow y_{10}$

binary → decimal

after converting to decimal from binary, get value of f(x).

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* (3) → Cross Over Operation

Probability of crossover opr is always near to 1.

We take $P_c = 0.8$
So 80% of chromosome goes to crossover opr.

Till now
10 chromosons
↳ population = 10

To choose which chromosone will be selected, we have some selection methods.

1) Rank Selection.

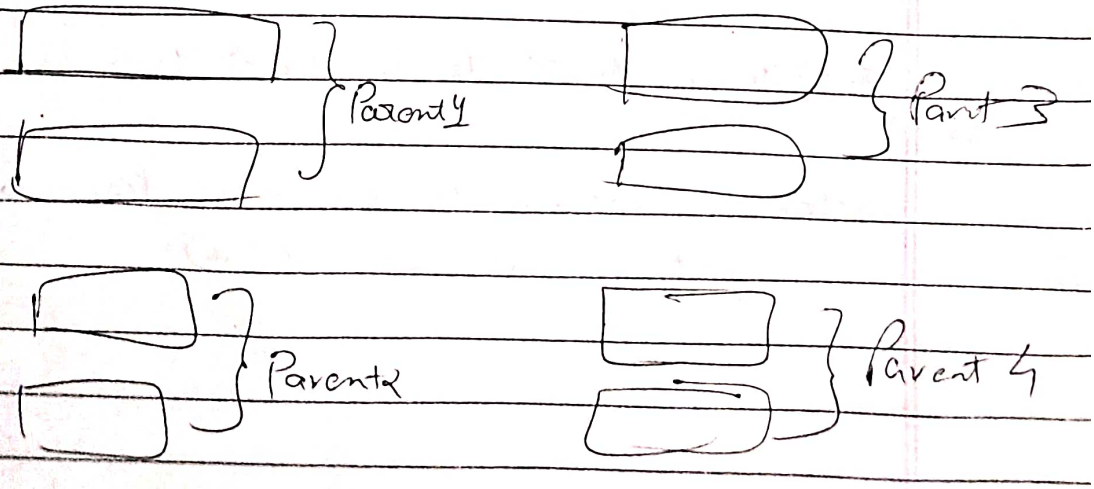
→ Top 8 chromosons selected, wlin the 10 chroms are are arranged rank-wise

2) Roulette Wheel Selection

3) Tournament Selection (Cricket Match)

→ We select a best chromosone from a pair of 2 chromosone.

Now 8 chromosomes which are selected will make pair of 2 and be called parent



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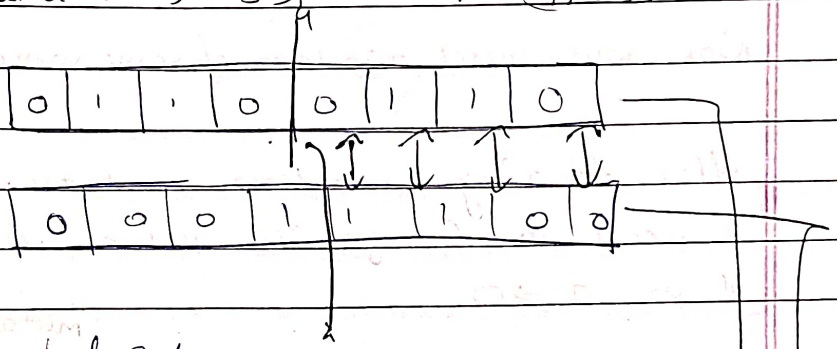
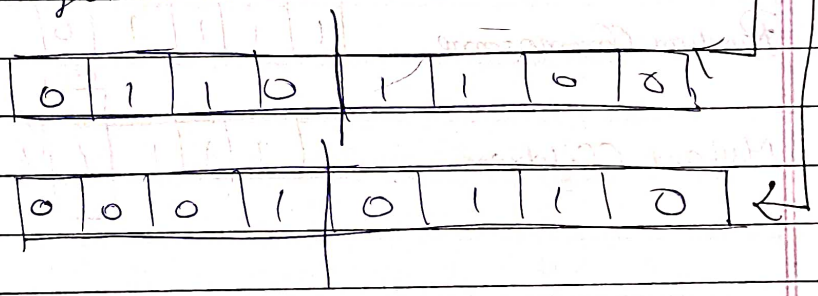
* One Point Crossover

Now to get the position of crossover we need to get some random value b/w 1 to 8

Ceil (rand (1,1) * 8) = 4 (suppose)

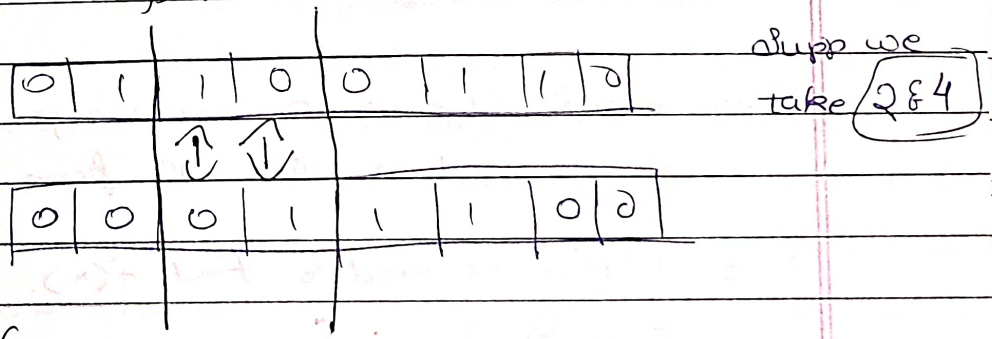


above changed value



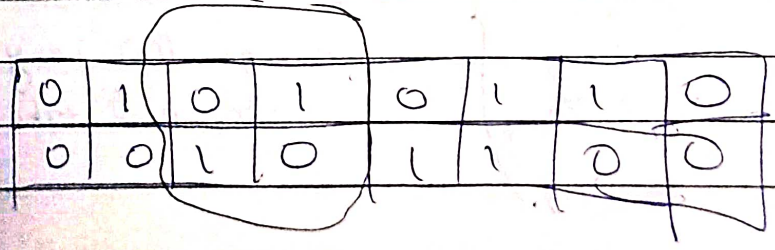
* Two Point Crossover

For this we'll get two random values for crossover points



suppose we take 2 & 4

new chromosome



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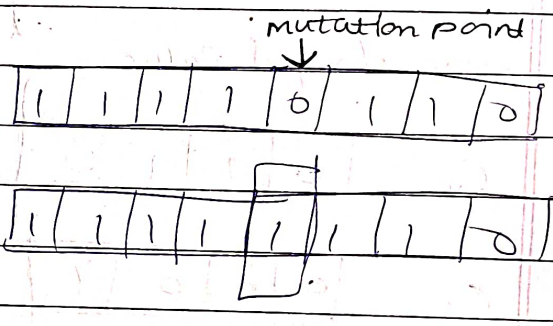
* (4) * Mutation

Probability of mutation should be $\cong 0$

Let's take $P_M = 0.1$

Now will select random chromosome

After finding random mutation point we need to change it's value i.e. if it is $0 \to 1$ if it $1 \to 0$



Now Population = total no. of chromosomes.

= 10 + 2 + ~~2~~ + 1

(10: original, 2: One point crossover, ~~2~~: ~~two point crossover~~, 1: ~~mutant~~ child)

= 15

Since initial value i.e 10 won't change

∴ we need to take 10 from 15

∴ to do this we need to find $f(x)$.

$C_1 \to Y_1$
$C_2 \to Y_2$
$C_3 \to Y_3$
$C_4 \to Y_4$
⋮
$C_{15} \to Y_{15}$

Since it is maximisation problem arrange $f(x)$ i.e y in decreasing order and take first 10