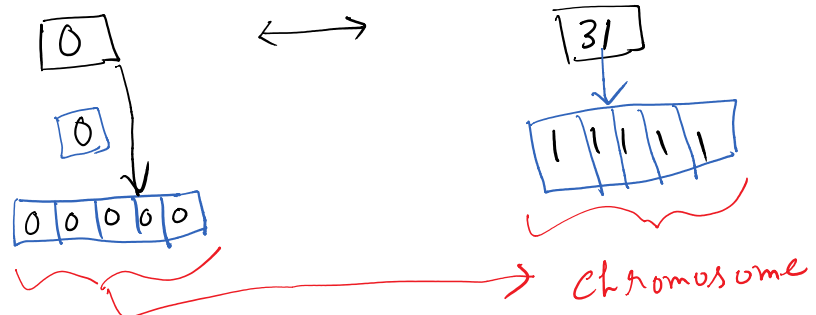# Genetic Algorithm

Steps:
1. Select encoding type
2. Choose population size
3. Randomly choose initial population
4. Select parental chromosomes
5. Crossover and mutation
6. Evaluation of Offsprings
7. Set stopping criteria or go to step 4

e.g. Let us consider a fun $f(x) = x^2$ where $x \in [0, 31]$

Fitness fun^n

Population

Step 1 :- Encoding type

population range:

0 $\longleftrightarrow$ 31

0

| 0 | 0 | 0 | 0 | 0 |

| 1 | 1 | 1 | 1 | 1 |

Chromosome

We have 32 chromosomes with size 5

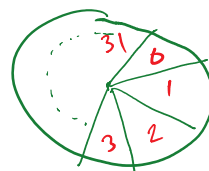Step 2 : Chromosome population size

De consider $n = 4$ (chromosome size) #

Step 3 :- Initial population

We choose | 13 | 24 | 8 | 19 | Randomly   [0 - 31]

Step 4 : Parental chromosomes

We choose parent chromosomes by Roulette wheel selection method

Fitness fun^b $f(x) = x^2$

169/1170 = Make

String No	Initial population	x value	f(x)	Probability Count	Expected Count	Actual Count
1	01101	13	119	0.16	169/293 0.58	1

String-No	Initial population	value	f(x)	...count	count	count	
1	01101	13	169	0.14	169/293 0.58	1	Make Parental Chromosome according to priority
2	11000 (2times)	24	576	0.49	576/293 1.97	2	
3	x 01000	8	64	0.06	64/293 0.22	0	
4	10011	19	361	0.31	361/293 0.23	1	
	Total		1170	1	4	4	
	Average		293				

Final Parental chromosomes:-

String2 : 11000 } → Parental chromosomes
String1 : 01101

String2 : 11000 } → Parental chromosomes
String4 : 10011

Step5 : Crossover and mutation:-

→ crossover point (randomly)

S2: 1 1 0 0 *0 ⟹ 1 1 0 0 1 } children chromosomes
S1: 0 1 1 0 1 ⟹ 0 1 1 0 0

S2: 1 1 | 0 0 0 ⟹ 1 1 0 1 1
S4: 1 0 | 0 1 1 ⟹ 1 0 0 0 0

→ crossover point (randomly)

Step 6: Evaluation of offsprings

String-No	off spring 1	x	$f(x)$
1	01100	12	144
2	11001	25	625
3	11011	27	729
4	10000	16	256

Objective: To optimize x using fitness fun $(f(x) = x^2)$

$$x \in [0, 31]$$

* Go to step 4: the maximum value ~~was~~ of x was 24 &

$$\boxed{f(x) = 576}$$
Generation 1

Now the maximum value of $x = 27$ & $\boxed{f(x) = 729}$

Generation 2

DRAWBACKS :-

0, 1, 2, 4, - - - - 31

$f(x) = x^2$
$f(x) = x^3$
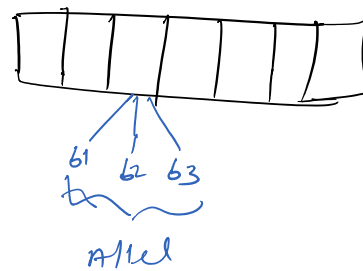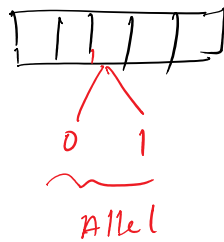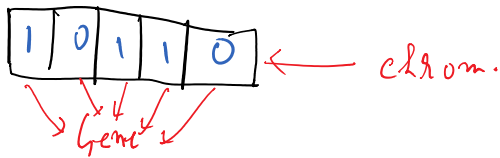$f(x) = 7x^2 + 5$
X $f(x) = x/y$

Initial Population can be:

0 0 0 0 0 ,   0 0 0 1 0 ,   0 0 0 0 1 ,   0 0 0 1 1

Parents

    0 0 0 1 0 ✓   1 0 1 0 0 &   1 0 1 1 ?   1 0 1 - - - -

Gene:

← chrom.

Genes

0   1

Allel

b_1 b_2 b_3

Allel

Blue eye ← b_1
Black eye ← b_2
Brown eye ← b_3