Solved Example:

Maximize $f(x) = x^2$

where $x \to 0$ to 31

$$\begin{array}{ccccc} 16 & 8 & 4 & 2 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{array}$$

Step 1: Select Encoding Technique

Use Binary encoding.

$Min = 0$ (00000) $max - 31$ (11111)

Step 2: select Initial population Randomly

Here ^{let} population Size = 4

[Chosen based on the requirement
and application]

StringNo	Initial Population (Random)	X Value	Fitness func $f(x) = x^2$	Prob	%Prob	Expected Count	Actual Count
1	01100	12	144	$\frac{144}{1155} = 0.1247$	12.47	$\frac{144}{288.75}$ $= 0.4987$	1
2	11001	25	625	0.5411	54.11	$= 2.1645$	2
3	00101	5	25	0.0216	21.6	0.0866	0
4	10011	19	181	0.3126	31.26	1.2502	1
Sum			1155	1.0	100	4	4
Average			288.75	0.25	25	1	1
Maximum			625	0.5411	54.11	2.1645	2

(For Initial Population)

Select solns from 4 Chromosomes, so calculate probability

$$Prob = \frac{f(n)}{\Sigma f(n)}$$

$$Expected \ Count = \frac{f(x)}{Avg(\Sigma f(x))}$$

Actual count → round off the expected count.
We need to select few of this soln, can be done
with Actual count.

Actual count (0) & chromosome will not be
selected further. Actual count (2) will be selected
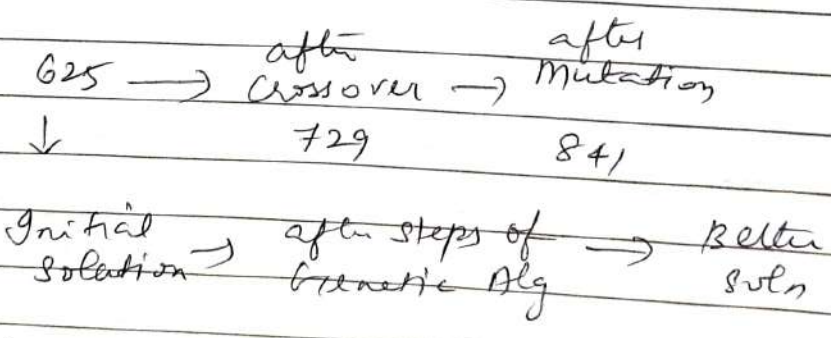2 times which will be selected for mating pool.
       Apply the Cross over on the
chromosome in Mating pool. First, we need
to find cross over point (Randomly)

String No	Mating pool	crossover point	offspring after crossover 8 4 2 1	X Value	Fitness f(x)=x²
1	01100	4	01101	13	169
2	11001		11000	24	576
3	11001	2	11011	27	729
4	10011		10001	17	289
Sum					1763
Average					440.75
Max					729

Original 625 after Crossover 729.

Next step is Mutation → to add diversity in the Offspring.

String No	Offspring after Crossover	Mutation Chromosome after flipping	offspring after mutation	X Value	Fitness f(x)=x²
1	01101	10000 First bit	11101	29	841
2	11000	00000 / no	11000	24	576
3	11011	00000 / flip	11011	27	729
4	10001	00101	10100	20	400
Sum		↓			2546
Avg		randomly			636.5
Max		Chosen			(841)

625 → after Crossover → after Mutation

↓   729   841

Initial Solution → after steps of Genetic Alg → Better Soln

We need to repeat the steps again till we reach convergence / maximum value for this function.