Job Shop Problem ↗ quantity manufactured

Manufacturing Schedule → { 20, 35, 15 }

3 Manufacturing Units M₁, M₂ and M₃

↓

Will Manufacture different product

M ⟨ ON (manufacturing)
    OFF (not manufacturing)

Chromosome { 1, 0, 1 }

Objective → Find type of schedule that optimize the entire chain

We need to find Optimal Solution which yields maximum profit { 1, 1, 1 }

Steps to makeup the GA

1) Chromosome solution { 1, 0, 1 }

2) Define Fitness Function

$$f(\text{solution}) = [\text{convert } (G_1, G_2, G_3)]_{10}$$

$$f(\{1, 0, 1\}) = (101)_{10} \quad \text{decimal equivalent}$$

$$\boxed{f(\{1, 0, 1\}) = 5}$$

3) Select a population of the solution and calculate their fitness value

Let Intialized Population be

→ Solution	Fitness
{0,0,1}	1
{0,1,0}	2
{1,1,0}	6
{1,0,1}	5

Let Population Size N = 4

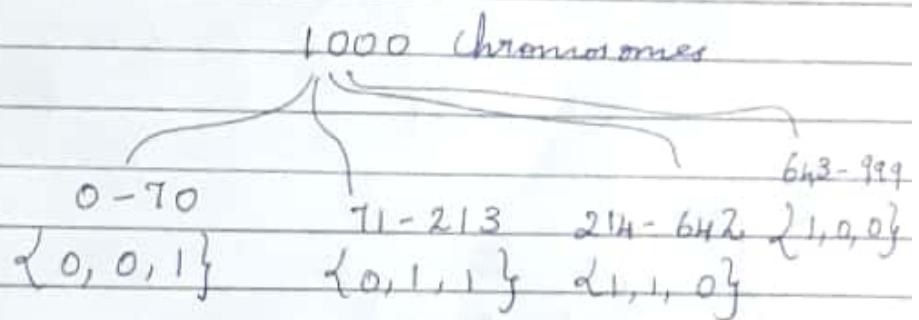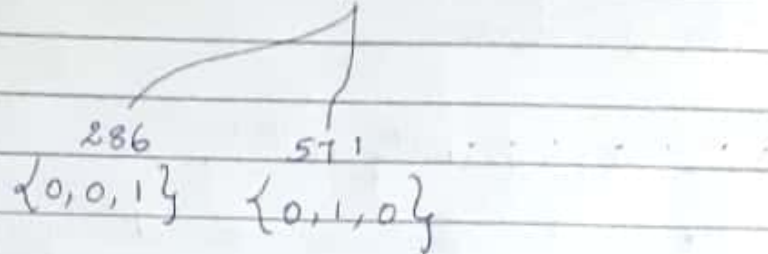3 Operators   Reproduction
Crossover
Mutation

4) Applying Reproduction

• Suppose we generate 500 sets of such solution

• Resulting Population   500 × 4 = 2000 chromosomes

•

Among these 2000 chromosomes find one with high fitness value.
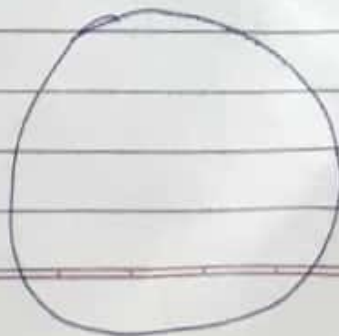
- Suppose we generate 1000 sets of such solution

- 1000 × 4 = 4000 chromosomes

$$
\underbrace{\quad\quad}
$$

286   571
{0,0,1}   {0,1,0}

1000 chromosomes

$$
\overbrace{\quad\quad\quad\quad}
$$

0 - 70   71 - 213   214 - 642   643 - 999

{0,0,1}   {0,1,1}   {1,1,0}   {1,0,0}

With this as our mode of selection, generate 4 random numbers to select 4 chromosomes for next generation

Value	Solution
265	{1,1,0}
801	{1,0,1}
515	{1,1,0}
85	{0,1,0}

Roulette Wheel Method is used for Selection

bit posistion ← Crossing sites

$$\{ \underset{Gene 1,}{\downarrow_0} \underset{Gene 2,}{\downarrow_1} \underset{Gene 3}{\downarrow_2} \}$$

5) Crossover

Crossover is the process of swapping portions of the two selected chromosomes.

Crossover Probability (P_c) remains constant

Now Select 2 chromosomes randomly, Crossing Sites = 2

$$\left. \begin{array}{c} \{1, 0, \underline{1}\} \\ \{1, 1, \underline{0}\} \end{array} \right\} \longrightarrow \underset{4}{\{1, 0, 0\}} \text{ and } \underset{7}{\{1, 1, 1\}}$$

Crossing sites = 1

$$\left. \begin{array}{c} \{1, 1, 0\} \\ \{0, 1, 0\} \end{array} \right\} \longrightarrow \underset{6}{\{1, 1, 0\}} \text{ and } \underset{2}{\{0, 1, 0\}}$$

Solution	Fitness
$\{1, 0, 0\}$	04
$\{1, 1, 1\}$	07
$\{1, 1, 0\}$	6
$\{0, 1, 0\}$	2

6) Applying Mutation (Mutation Probability P_m)

- Lets select chromosome $\{0, 1, 0\}$ to be mutated

After flipping

$$\{1, 1, 0\}$$
$$\{0, 0, 0\}$$
$$\{0, 1, 1\}$$

Solution	Fitness Value
$\{1, 1, 0\}$	6
$\{0, 0, 0\}$	0
$\{0, 1, 1\}$	3

So we Cannot generate a better solution with this chromosomes

Conclusion

$\{1, 1, 1\}$ = 7 fitness Maximum value
  ↓
  optimal solution indicating all
              Units are turned on
                    &
        Resultant Profit is high