

IT 426

Riyadh Season Trip Planner Using GA Optimization

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Genetic Algorithms

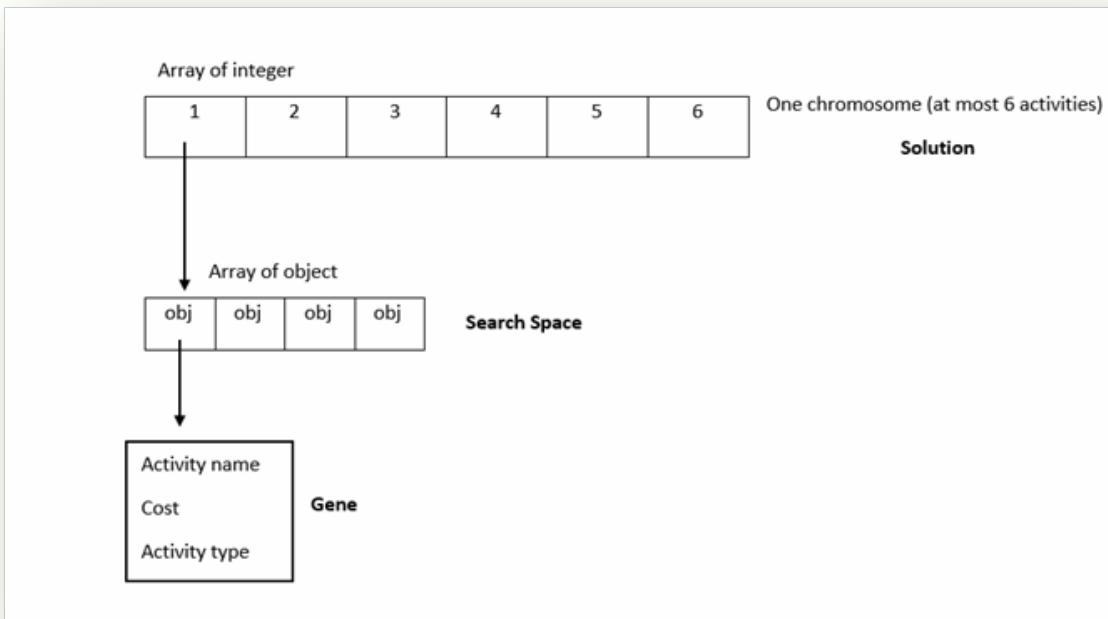
PROBLEM INTRODUCTION

A CEO of an AI company which builds and sells AI software to different types of clients. A client is a tourism company that plans trips for tourists visiting Riyadh during the weekend (for three days) that fit their budget and their preferences. The company wants you to build a software that plans a trip for a tourist. The tourist experience should vary according to their Budget, Experience Type, and No. of Activities. Therefore, we need to develop a genetic algorithm that can optimize the tourist experience in Riyadh considering their preferences.

SOLUTION REPRESENTATION

The solution is to optimize the Activity plan for (three days) by using genetic algorithms. The solution will begin with the user entering inputs, number of activities per a day, the type of the activity and the budget of three days. The individual(chromosome) is stored as an array and represented as a set of activity in the three days, and each index(gene) represent an object of the activity (name, type, cost) in one day. Then the population will be created with the population size =100, and the fitness function will be computed for each chromosome.

SOLUTION REPRESENTATION



Figure#1 representation

FITNESS FUNCTION

Fitness value states whether the optimal solution is resulted or not. The fitness value is obtained from a formula that has been determined based on the problem to be solved.

Fitness function will calculate the fitness for each chromosome according to three criteria which are:

- 1) budget weight=0.25
- 2) activity weight=0.25
- 3) type weight=0.50 which is has the most priority.

And function will return array of fitness in each chromosome in same indexes of initial population.

Genetic operators

1- Crossover

```
double CROSS = 0.6 ;// the probability of crossover
if(Math.random() < CROSS){
    int pos = new Random().nextInt(n);
    for(int i=pos; i<n; i++){
        int t = parentOne[i];
        parentOne[i] = parentTwo[i];
        parentTwo[i] = t;
    }
}
```

Figure#2 Crossover

In crossover we will select two parents according to (RouletteSelection) method to do the crossover between them and generate new children. We will do one point crossover which will be at 0.6 or less.

Genetic operators

2- Mutation

```
double MUTATE = 0.06; //probability of mutation
if(Math.random() < MUTATE){
    int i = new Random().nextInt(n); //position random
    if(Math.random() > 0.5){ //probability of the change is 50%
        Random randomgeneration = new Random();
        int random1 = randomgeneration.nextInt(36);
        parentOne[i] = random1 ; //flip
    }else{
        Random randomgeneration = new Random();
        int random2 = randomgeneration.nextInt(36);
        parentTwo[i] = random2; //flip
    }
}
```

Figure#3 Mutation

After doing crossover we will do the mutation, we choose a random number between 1/pop-size and 1/chromosome-length which is the probability of doing the mutation it = 0.06. And since our chromosome represent the index of the activity, we will do the mutation by generate random number between 0-35 .

Genetic operators

3- Selection by roulette wheel selection.

```
//Select
public static int RouletteSelection(double sumFitness[]){
    double sumAllFitness = 0 ;
    for(int i=0; i<sumFitness.length; i++){
        sumAllFitness+= sumFitness[i] ;
    }

    double rand = Math.random() * sumAllFitness;      //0-1
    double sum = 0;

    for(int i=0; i<sumFitness.length; i++){
        sum += sumFitness[i];
        if(sum >= rand)
            return i;
    }
    return 0;//impossible
}
```

Figure#4 Selection

In the select function we will calculate the total sum of fitness of the population and the function will return the index of the parent that will be the next parent to do the crossover.

Genetic operators

4- Replacement

```
int [][] newGeneration = new int [population.length][36]; //array for new children
```

```
newGeneration[2*index] = parentOne; //even  
newGeneration[2*index+1] = parentTwo; //odd
```

In this array we replace parents' generation to children generation.

Termination condition

```

    //// Termention when we find the optimal soloutuin =1 :)
while (true) {
    generationAvg.push(GenericAlgorithm(fitnessArr)); //n3be al stack
    fitnessArr = Fitness (population); //y7sb alfitness ll new genertion
    if (fitnessArr[MaxFitness()] == 1) //optimal solution w8f
        break;
} // 5lss
    
```

Figure#5 Termination

Generating new generation will stop if we found the optimal solution which is =1

Input:

```

Output - AlprojectPhase#2Final (run) ×
run:
Please Enter Your Name :
sara
HI sara Please enter your trip duration in days.
Please enter number of activities you prefer to do in Day1 (1 or 2):
1
Please enter number of activities you prefer to do in Day2 (1 or 2):
1
Please enter number of activities you prefer to do in Day3 (1 or 2):
1
Please enter your activity preference (E for Exciting,
S for Shopping &
Restaurants and N for Nature)
s
Please enter your budget in SAR :
1000
    
```

Figure#6 Input

Output:

```

Avrege of Genertion number 19 : 0.7483333333333333
Avrege of Genertion number 18 : 0.7533333333333334
Avrege of Genertion number 17 : 0.7375
Avrege of Genertion number 16 : 0.73000000000000001
Avrege of Genertion number 15 : 0.72750000000000001
Avrege of Genertion number 14 : 0.7233333333333333
Avrege of Genertion number 13 : 0.71250000000000001
Avrege of Genertion number 12 : 0.7324999999999998
Avrege of Genertion number 11 : 0.7233333333333334
Avrege of Genertion number 10 : 0.71750000000000001
Avrege of Genertion number 9 : 0.7033333333333335
Avrege of Genertion number 8 : 0.67750000000000003
Avrege of Genertion number 7 : 0.6316666666666673
Avrege of Genertion number 6 : 0.6058333333333336
Avrege of Genertion number 5 : 0.5766666666666663
Avrege of Genertion number 4 : 0.5516666666666667
Avrege of Genertion number 3 : 0.5458333333333332
Avrege of Genertion number 2 : 0.51
Avrege of Genertion number 1 : 0.4416666666666665
Avrege of Genertion number 0 : 0.4416666666666665
Run Aavrge : 0.6495833333333334

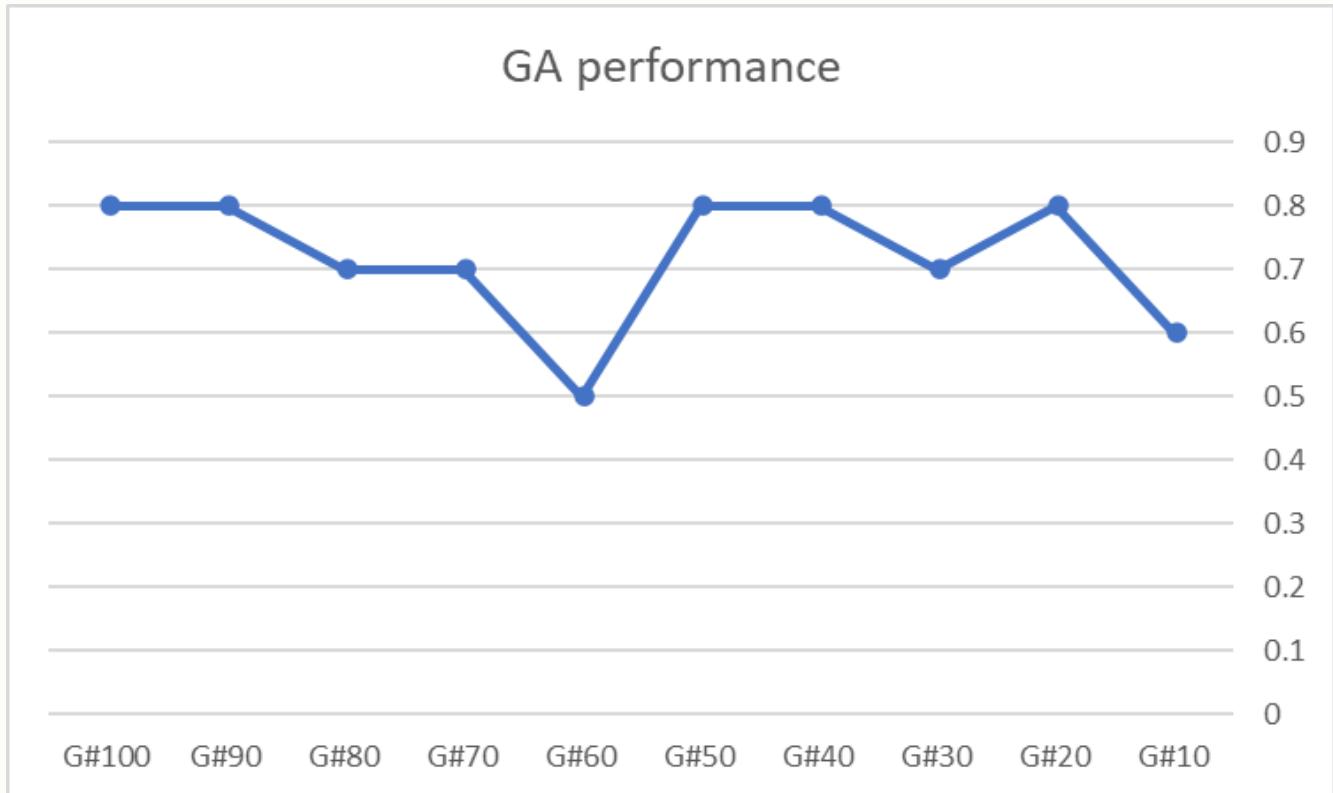
```

Output - AlprojectPhase#2Final (run) X	
	Chromosom Fittness Score
Generation 0:[13,5,17,]	: 0.8333333333333333
Generation 1:[13,17,14,]	: 0.5833333333333333
Generation 2:[35,12,5,]	: 0.8333333333333333
Generation 3:[13,2,15,]	: 0.5833333333333333
Generation 4:[9,6,14,]	: 0.75
Generation 5:[9,12,5,]	: 1.0
Generation 6:[35,5,15,]	: 0.8333333333333333
Generation 7:[13,12,21,]	: 0.8333333333333333
Generation 8:[24,17,15,]	: 0.6666666666666666
Generation 9:[13,12,15,]	: 0.75
Generation 10:[35,2,15,]	: 0.6666666666666666
Generation 11:[35,5,15,]	: 0.8333333333333333
Generation 12:[13,12,15,]	: 0.75
Generation 13:[13,5,17,]	: 0.8333333333333333
Generation 14:[35,12,15,]	: 0.8333333333333333
Generation 15:[19,12,15,]	: 0.8333333333333333
Generation 16:[24,5,15,]	: 0.8333333333333333
Generation 17:[13,12,5,]	: 0.75
Generation 18:[4,12,15,]	: 0.75
Generation 19:[35,12,17,]	: 0.6666666666666666
Generation 20:[6,14,15,]	: 0.75
Generation 21:[19,12,5,]	: 0.8333333333333333
Generation 22:[19,12,17,]	: 0.6666666666666666
Generation 23:[35,5,15,]	: 0.8333333333333333
Generation 24:[4,12,15,]	: 0.75
Generation 25:[24,12,5,]	: 0.8333333333333333

Figure#7 Output after finding the optimal solution

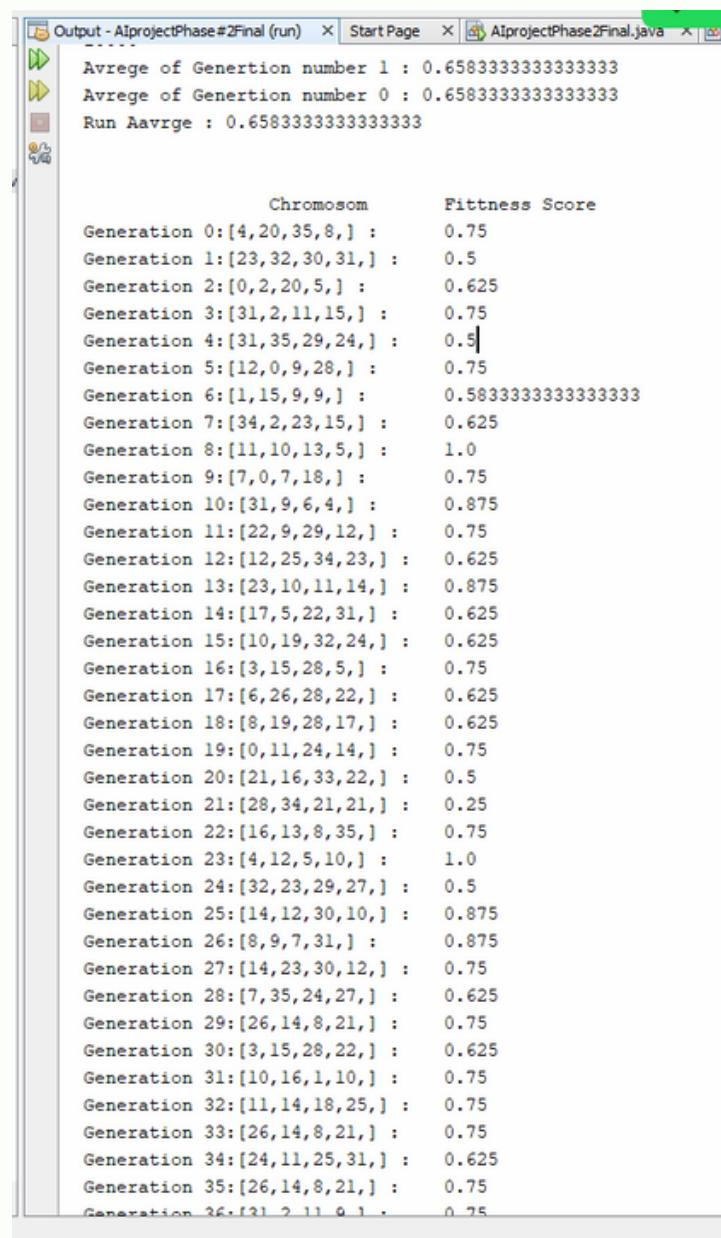
As we can see the code stopped at generation 19 since we find the optimal solution.

Graph of GA performance



We take 10 generation from 100 generation the best fitness was 0.8 in generation 20, 40, 50, 90 and 100 while the worst generation was in generation 60 which equal 0.5.

Experimental Results



The screenshot shows a Java IDE interface with three tabs at the top: "Output - AliprojectPhase#2Final (run)", "Start Page", and "AliprojectPhase2Final.java". The "Output" tab displays the following text:

```
Avrege of Genertion number 1 : 0.6583333333333333
Avrege of Genertion number 0 : 0.6583333333333333
Run Aavrge : 0.6583333333333333

Chromosom      Fitness Score
Generation 0:[4,20,35,8,] : 0.75
Generation 1:[23,32,30,31,] : 0.5
Generation 2:[0,2,20,5,] : 0.625
Generation 3:[31,2,11,15,] : 0.75
Generation 4:[31,35,29,24,] : 0.5
Generation 5:[12,0,9,28,] : 0.75
Generation 6:[1,15,9,9,] : 0.5833333333333333
Generation 7:[34,2,23,15,] : 0.625
Generation 8:[11,10,13,5,] : 1.0
Generation 9:[7,0,7,18,] : 0.75
Generation 10:[31,9,6,4,] : 0.875
Generation 11:[22,9,29,12,] : 0.75
Generation 12:[12,25,34,23,] : 0.625
Generation 13:[23,10,11,14,] : 0.875
Generation 14:[17,5,22,31,] : 0.625
Generation 15:[10,19,32,24,] : 0.625
Generation 16:[3,15,28,5,] : 0.75
Generation 17:[6,26,28,22,] : 0.625
Generation 18:[8,19,28,17,] : 0.625
Generation 19:[0,11,24,14,] : 0.75
Generation 20:[21,16,33,22,] : 0.5
Generation 21:[28,34,21,21,] : 0.25
Generation 22:[16,13,8,35,] : 0.75
Generation 23:[4,12,5,10,] : 1.0
Generation 24:[32,23,29,27,] : 0.5
Generation 25:[14,12,30,10,] : 0.875
Generation 26:[8,9,7,31,] : 0.875
Generation 27:[14,23,30,12,] : 0.75
Generation 28:[7,35,24,27,] : 0.625
Generation 29:[26,14,8,21,] : 0.75
Generation 30:[3,15,28,22,] : 0.625
Generation 31:[10,16,1,10,] : 0.75
Generation 32:[11,14,18,25,] : 0.75
Generation 33:[26,14,8,21,] : 0.75
Generation 34:[24,11,25,31,] : 0.625
Generation 35:[26,14,8,21,] : 0.75
Generation 36:[21,2,11,0,1 .. 0.75
```

Figure#8 First Run

Output - AlprojectPhase#2Final (run) × Start Page × AlprojectPhase2Final.java × Activity.java

```

Avrage of Genertion number 1 : 0.6174999999999999
Avrage of Genertion number 0 : 0.6174999999999999
Run Aavrge : 0.6174999999999999

Chromosom      Fitness Score
Generation 0:[11,19,1,] : 0.6666666666666666
Generation 1:[20,4,7,] : 0.8333333333333333
Generation 2:[8,7,6,] : 1.0
Generation 3:[35,24,16,] : 0.5
Generation 4:[20,18,26,] : 0.5
Generation 5:[22,35,17,] : 0.5
Generation 6:[32,20,27,] : 0.5
Generation 7:[4,0,17,] : 0.6666666666666666
Generation 8:[24,10,20,] : 0.6666666666666666
Generation 9:[28,14,13,] : 0.5033333333333333
Generation 10:[15,30,16,] : 0.6666666666666666
Generation 11:[7,10,16,] : 0.8333333333333333
Generation 12:[9,18,26,] : 0.6666666666666666
Generation 13:[10,0,29,] : 0.6666666666666666
Generation 14:[9,18,6,] : 0.8333333333333333
Generation 15:[14,22,26,] : 0.6666666666666666
Generation 16:[21,2,16,] : 0.5
Generation 17:[31,19,7,] : 0.6666666666666666
Generation 18:[5,4,1,] : 0.8333333333333333
Generation 19:[20,5,5,] : 0.5
Generation 20:[4,14,15,] : 1.0
Generation 21:[15,30,16,] : 0.6666666666666666
Generation 22:[32,8,21,] : 0.6666666666666666
Generation 23:[13,4,35,] : 0.8333333333333333
Generation 24:[20,11,9,] : 0.8333333333333333
Generation 25:[4,0,6,] : 0.8333333333333333
Generation 26:[30,1,9,] : 0.6666666666666666
Generation 27:[9,29,25,] : 0.6666666666666666
Generation 28:[16,31,12,] : 0.6666666666666666
Generation 29:[26,19,5,] : 0.6666666666666666
Generation 30:[20,28,33,] : 0.25
Generation 31:[1,11,35,] : 0.6666666666666666
Generation 32:[13,10,16,] : 0.8333333333333333
Generation 33:[7,23,1,] : 0.6666666666666666
Generation 34:[9,18,9,] : 0.8333333333333333
Generation 35:[8,23,26,] : 0.6666666666666666
Generation 36:[17,6,9,1] : 0.8333333333333333

```

Figure#9 Run#2

Output - AlprojectPhase#2Final (run) × Start Page × AlprojectPhase2Final.java × Activity.java

```

Avrage of Genertion number 1 : 0.49375
Avrage of Genertion number 0 : 0.49375
Run Aavrge : 0.49375

Chromosom      Fitness Score
Generation 0:[11,17,33,1,] : 0.5
Generation 1:[24,31,30,28,] : 0.5
Generation 2:[28,2,12,16,] : 0.5
Generation 3:[17,29,14,14,] : 0.4166666666666663
Generation 4:[5,6,3,4,] : 0.375
Generation 5:[0,14,29,29,] : 0.3333333333333333
Generation 6:[17,9,12,18,] : 0.5
Generation 7:[17,28,8,2,] : 0.375
Generation 8:[2,7,12,6,] : 0.625
Generation 9:[17,9,12,2,] : 0.625
Generation 10:[0,34,5,16,] : 0.875
Generation 11:[7,16,10,4,] : 0.375
Generation 12:[11,31,6,23,] : 0.375
Generation 13:[33,2,7,31,] : 0.625
Generation 14:[11,31,16,3,] : 0.625
Generation 15:[29,2,6,23,] : 0.5
Generation 16:[19,28,27,17,] : 0.25
Generation 17:[26,1,26,17,] : 0.625
Generation 18:[11,19,8,18,] : 0.25
Generation 19:[17,28,17,4,] : 0.25
Generation 20:[30,2,7,31,] : 0.625
Generation 21:[33,10,5,28,] : 0.375
Generation 22:[30,10,23,27,] : 0.375
Generation 23:[25,1,5,28,] : 0.375
Generation 24:[13,4,34,18,] : 0.375
Generation 25:[35,30,0,0,] : 0.75
Generation 26:[3,23,7,12,] : 0.625
Generation 27:[25,1,23,27,] : 0.375
Generation 28:[0,14,9,32,] : 0.5
Generation 29:[28,16,29,29,] : 0.3333333333333333
Generation 30:[17,13,35,11,] : 0.375
Generation 31:[29,2,16,3,] : 1.0
Generation 32:[26,3,19,2,] : 0.75
Generation 33:[25,13,9,22,] : 0.25
Generation 34:[16,3,19,2,] : 0.875
Generation 35:[25,3,15,13,] : 0.375
Generation 36:[3,31,13,0,1] : 0.625

```

Figure#10 Run#3

```

Output - AIprojectPhase#2Final (run)  Start Page  AIprojectPhase2Final.java  Activity.java
Avrege of Genertion number 1 : 0.6449999999999997
Avrege of Genertion number 0 : 0.6449999999999997
Run Aavrge : 0.6449999999999997

          Chromosom      Fittness Score
Generation 0:[0,34,22,] : 0.6666666666666666
Generation 1:[27,14,29,] : 0.6666666666666666
Generation 2:[15,24,7,] : 0.6666666666666666
Generation 3:[8,26,23,] : 0.8333333333333333
Generation 4:[26,5,7,] : 0.6666666666666666
Generation 5:[8,7,29,] : 0.5
Generation 6:[25,30,22,] : 0.8333333333333333
Generation 7:[0,18,18,] : 0.5
Generation 8:[10,8,13,] : 0.5
Generation 9:[22,17,13,] : 0.8333333333333333
Generation 10:[13,23,28,] : 0.5833333333333333
Generation 11:[19,15,32,] : 0.6666666666666666
Generation 12:[5,27,0,] : 0.6666666666666666
Generation 13:[6,33,27,] : 0.6666666666666666
Generation 14:[15,6,16,] : 0.5
Generation 15:[15,6,30,] : 0.5
Generation 16:[35,17,11,] : 0.6666666666666666
Generation 17:[10,30,21,] : 0.6666666666666666
Generation 18:[35,31,1,] : 0.5
Generation 19:[27,16,12,] : 0.6666666666666666
Generation 20:[21,19,33,] : 0.8333333333333333
Generation 21:[29,30,16,] : 0.5
Generation 22:[27,14,10,] : 0.6666666666666666
Generation 23:[10,8,13,] : 0.5
Generation 24:[15,9,7,] : 0.5
Generation 25:[21,13,32,] : 0.6666666666666666
Generation 26:[21,13,13,] : 0.5
Generation 27:[10,8,14,] : 0.5
Generation 28:[32,6,6,] : 0.25
Generation 29:[16,11,17,] : 0.6666666666666666
Generation 30:[6,33,25,] : 0.6666666666666666
Generation 31:[31,16,1,] : 0.5
Generation 32:[32,17,6,] : 0.6666666666666666
Generation 33:[16,6,7,] : 0.5
Generation 34:[18,35,26,] : 0.8333333333333333
Generation 35:[34,30,29,] : 0.5
Generation 36:[21,19,33,1] : 0.8333333333333333

```

Figure#11 Run#4

```

Output - AIprojectPhase#2Final (run)  Start Page  AIprojectPhase2Final.java  Activity.java
Avrege of Genertion number 8 : 0.6783333333333332
Avrege of Genertion number 7 : 0.6620833333333332
Avrege of Genertion number 6 : 0.6408333333333333
Avrege of Genertion number 5 : 0.6020833333333333
Avrege of Genertion number 4 : 0.5920833333333333
Avrege of Genertion number 3 : 0.5775
Avrege of Genertion number 2 : 0.5449999999999999
Avrege of Genertion number 1 : 0.4991666666666665
Avrege of Genertion number 0 : 0.4991666666666665
Run Aavrge : 0.5884722222222221

          Chromosom      Fittness Score
Generation 0:[6,3,10,17,] : 0.75
Generation 1:[14,22,26,33,] : 0.625
Generation 2:[14,3,10,1,] : 0.5
Generation 3:[3,9,10,12,] : 0.875
Generation 4:[10,21,4,25,] : 0.75
Generation 5:[4,23,16,10,] : 0.75
Generation 6:[3,1,17,10,] : 0.625
Generation 7:[5,35,6,15,] : 0.875
Generation 8:[5,22,9,25,] : 0.75
Generation 9:[35,24,26,17,] : 0.5
Generation 10:[5,23,16,12,] : 0.75
Generation 11:[4,13,10,12,] : 0.75
Generation 12:[2,35,13,12,] : 0.75
Generation 13:[2,21,13,12,] : 0.75
Generation 14:[6,3,10,24,] : 0.75
Generation 15:[9,5,20,33,] : 0.75
Generation 16:[2,21,13,22,] : 0.625
Generation 17:[5,24,4,25,] : 0.75
Generation 18:[9,16,10,25,] : 0.75
Generation 19:[35,22,15,12,] : 0.75
Generation 20:[14,3,10,25,] : 0.75
Generation 21:[2,21,13,33,] : 0.625
Generation 22:[9,22,26,17,] : 0.625
Generation 23:[5,34,35,35,] : 0.4166666666666663
Generation 24:[10,32,15,22,] : 0.5
Generation 25:[10,32,15,22,] : 0.5
Generation 26:[33,30,17,10,] : 0.625
Generation 27:[3,1,13,28,] : 0.375
Generation 28:[4,13,10,12,] : 0.75
Generation 29:[12,7,17,10,1] : 0.875

```

Figure#12 Run#5

Output - AliprojectPhase#2Final (run) Start Page AliprojectPhase2Final.java

```

Avrege of Genertion number 1 : 0.57125
Avrege of Genertion number 0 : 0.57125
Run Aavrge : 0.57125

          Chromosom      Fittness Score
Generation 0:[4,1,16,15,] : 0.5
Generation 1:[29,15,11,23,] : 0.375
Generation 2:[26,29,15,10,] : 0.625
Generation 3:[26,6,11,4,] : 0.375
Generation 4:[26,0,12,24,] : 0.75
Generation 5:[4,16,0,27,] : 0.375
Generation 6:[33,31,10,35,] : 0.5
Generation 7:[21,34,13,9,] : 0.625
Generation 8:[5,14,21,31,] : 0.625
Generation 9:[18,12,0,17,] : 0.75
Generation 10:[14,19,6,15,] : 0.625
Generation 11:[29,15,16,13,] : 0.5
Generation 12:[30,16,10,14,] : 0.5
Generation 13:[25,11,9,12,] : 0.625
Generation 14:[29,3,27,19,] : 0.5
Generation 15:[24,0,34,34,] : 0.41666666666666663
Generation 16:[25,3,27,19,] : 0.875
Generation 17:[17,31,22,33,] : 0.75
Generation 18:[6,3,1,10,] : 0.5
Generation 19:[14,0,25,3,] : 0.625
Generation 20:[25,16,10,14,] : 0.625
Generation 21:[35,27,8,8,] : 0.41666666666666663
Generation 22:[22,5,4,16,] : 0.625
Generation 23:[2,21,12,34,] : 0.625
Generation 24:[0,10,0,5,] : 0.5
Generation 25:[33,7,0,28,] : 0.375
Generation 26:[14,0,26,23,] : 0.75
Generation 27:[5,30,18,4,] : 0.375
Generation 28:[23,11,27,27,] : 0.3333333333333333
Generation 29:[25,32,10,33,] : 0.625
Generation 30:[20,19,22,27,] : 1.0
Generation 31:[18,35,18,21,] : 0.875
Generation 32:[21,29,22,4,] : 0.75
Generation 33:[20,19,22,27,] : 1.0
Generation 34:[2,21,12,34,] : 0.625
Generation 35:[18,12,24,7,] : 0.75
Generation 36:[17,12,21,30,] : 0.75

```

Figure#13 Run#6

Output - AliprojectPhase#2Final (run) Start Page AliprojectPhase2Final.java Activity.java

```

Avrege of Genertion number 1 : 0.6116666666666666
Avrege of Genertion number 0 : 0.6116666666666666
Run Aavrge : 0.6116666666666666

          Chromosom      Fittness Score
Generation 0:[34,5,18,] : 0.6666666666666666
Generation 1:[8,0,5,] : 0.5833333333333333
Generation 2:[13,30,24,] : 0.6666666666666666
Generation 3:[26,13,12,] : 0.8333333333333333
Generation 4:[20,0,8,] : 0.6666666666666666
Generation 5:[13,8,19,] : 0.8333333333333333
Generation 6:[13,3,20,] : 0.6666666666666666
Generation 7:[1,8,8,] : 0.5
Generation 8:[34,13,25,] : 0.6666666666666666
Generation 9:[6,2,6,] : 0.8333333333333333
Generation 10:[19,8,20,] : 0.6666666666666666
Generation 11:[23,4,7,] : 0.8333333333333333
Generation 12:[27,11,29,] : 0.41666666666666663
Generation 13:[8,13,4,] : 0.75
Generation 14:[3,28,27,] : 0.25
Generation 15:[26,13,12,] : 0.8333333333333333
Generation 16:[1,20,30,] : 0.25
Generation 17:[11,34,19,] : 0.6666666666666666
Generation 18:[16,6,30,] : 0.6666666666666666
Generation 19:[34,6,17,] : 0.6666666666666666
Generation 20:[23,10,13,] : 0.8333333333333333
Generation 21:[10,5,10,] : 1.0
Generation 22:[5,7,25,] : 0.8333333333333333
Generation 23:[33,6,2,] : 0.6666666666666666
Generation 24:[17,11,16,] : 0.6666666666666666
Generation 25:[10,34,26,] : 0.6666666666666666
Generation 26:[27,13,4,] : 0.5833333333333333
Generation 27:[8,34,32,] : 0.41666666666666663
Generation 28:[10,14,6,] : 1.0
Generation 29:[1,12,4,] : 0.8333333333333333
Generation 30:[8,13,4,] : 0.75
Generation 31:[34,15,35,] : 0.6666666666666666
Generation 32:[18,24,12,] : 0.6666666666666666
Generation 33:[7,13,0,] : 0.5833333333333333
Generation 34:[20,26,14,] : 0.6666666666666666
Generation 35:[12,27,15,] : 0.5833333333333333
Generation 36:[20,0,19,] : 0.5

```

Figure#14 Run#7

```

Output - AliprojectPhase#2Final (run) × Start Page × AliprojectPhase2Final.java × ⌂
Avrege of Genertion number 1 : 0.48833333333333306
Avrege of Genertion number 0 : 0.48833333333333306
Run Aavrge : 0.48833333333333306

W Chromosom Fitness Score
Generation 0:[6,14,19,] : 0.5
Generation 1:[0,35,20,] : 0.833333333333333
Generation 2:[6,1,0,] : 0.583333333333333
Generation 3:[11,15,22,] : 0.25
Generation 4:[20,35,15,] : 0.6666666666666666
Generation 5:[20,35,15,] : 0.6666666666666666
Generation 6:[33,25,32,] : 0.833333333333333
Generation 7:[34,32,33,] : 1.0
Generation 8:[32,8,32,] : 0.583333333333333
Generation 9:[3,25,25,] : 0.5
Generation 10:[16,9,32,] : 0.833333333333333
Generation 11:[22,4,0,] : 0.4166666666666666
Generation 12:[12,17,22,] : 0.5
Generation 13:[15,16,12,] : 0.6666666666666666
Generation 14:[12,31,19,] : 0.6666666666666666
Generation 15:[28,17,22,] : 0.25
Generation 16:[16,4,0,] : 0.833333333333333
Generation 17:[3,27,35,] : 0.583333333333333
Generation 18:[20,35,15,] : 0.6666666666666666
Generation 19:[28,22,28,] : 0.25
Generation 20:[24,6,23,] : 0.5
Generation 21:[20,33,26,] : 0.6666666666666666
Generation 22:[3,8,32,] : 0.583333333333333
Generation 23:[35,0,21,] : 0.833333333333333
Generation 24:[10,13,19,] : 0.6666666666666666
Generation 25:[6,35,20,] : 0.6666666666666666
Generation 26:[15,9,4,] : 0.25
Generation 27:[3,8,32,] : 0.583333333333333
Generation 28:[22,12,4,] : 0.5
Generation 29:[34,32,33,] : 1.0
Generation 30:[3,8,32,] : 0.583333333333333
Generation 31:[7,11,32,] : 0.4166666666666663
Generation 32:[13,5,0,] : 0.4166666666666663
Generation 33:[33,16,16,] : 0.75
Generation 34:[29,19,7,] : 0.4166666666666663
Generation 35:[7,11,20,] : 0.25
Generation 36:[11,10,8,] : 0.25

```

Figure#15 Run#8

```

Output - AliprojectPhase#2Final (run) × Start Page × AliprojectPhase2Final.java × ⌂
Avrege of Genertion number 12 : 0.6579166666666667
Avrege of Genertion number 11 : 0.6516666666666668
Avrege of Genertion number 10 : 0.62
Avrege of Genertion number 9 : 0.595
Avrege of Genertion number 8 : 0.57875
Avrege of Genertion number 7 : 0.5779166666666666
Avrege of Genertion number 6 : 0.5679166666666667
Avrege of Genertion number 5 : 0.5595833333333333
Avrege of Genertion number 4 : 0.522083333333332
Avrege of Genertion number 3 : 0.5004166666666667
Avrege of Genertion number 2 : 0.4904166666666667
Avrege of Genertion number 1 : 0.42625
Avrege of Genertion number 0 : 0.42625
Run Aavrge : 0.5518589743589742

W Chromosom Fitness Score
Generation 0:[31,35,33,1,] : 0.75
Generation 1:[31,13,3,0,] : 0.625
Generation 2:[35,12,19,33,] : 0.75
Generation 3:[30,13,17,0,] : 0.5
Generation 4:[35,27,7,0,] : 0.5
Generation 5:[31,16,17,32,] : 0.625
Generation 6:[31,1,28,0,] : 0.625
Generation 7:[35,27,7,35,] : 0.5
Generation 8:[16,12,35,35,] : 0.5833333333333333
Generation 9:[3,23,19,35,] : 0.5
Generation 10:[3,12,34,35,] : 0.625
Generation 11:[35,16,19,35,] : 0.875
Generation 12:[3,12,16,29,] : 0.625
Generation 13:[3,12,19,35,] : 0.75
Generation 14:[31,16,17,32,] : 0.625
Generation 15:[13,3,0,0,] : 0.3333333333333333
Generation 16:[16,23,19,1,] : 0.5
Generation 17:[31,0,5,35,] : 0.625
Generation 18:[31,35,33,34,] : 0.75
Generation 19:[35,12,26,1,] : 0.5
Generation 20:[16,23,19,35,] : 0.75
Generation 21:[16,23,34,35,] : 0.875
Generation 22:[1,32,23,20,] : 0.5
Generation 23:[3,12,19,35,] : 0.75
Generation 24:[16,23,19,35,] : 0.75
Generation 25:[12,13,22,1,] : 0.875

```

Figure#16 Run#9

Output X Start Page X AIprojectPhase2Final.java X Activity.java X

AIprojectPhase#2Final (run) X AIprojectPhase#2Final (run) #2 X

```

Avrege of Genertion number 6 : 0.6083333333333333
Avrege of Genertion number 5 : 0.5791666666666668
Avrege of Genertion number 4 : 0.5599999999999998
Avrege of Genertion number 3 : 0.5299999999999997
Avrege of Genertion number 2 : 0.4841666666666666
Avrege of Genertion number 1 : 0.46
Avrege of Genertion number 0 : 0.46
Run Aavrge : 0.525952380952381

Chromosom Fitness Score
Generation 0:[14,25,25,] : 0.5
Generation 1:[6,17,12,] : 0.6333333333333333
Generation 2:[17,15,10,] : 0.6333333333333333
Generation 3:[11,4,15,] : 0.75
Generation 4:[10,13,21,] : 0.5833333333333333
Generation 5:[27,13,21,] : 0.4166666666666666
Generation 6:[17,4,15,] : 0.5833333333333333
Generation 7:[17,4,22,] : 0.6666666666666666
Generation 8:[14,7,10,] : 0.75
Generation 9:[25,25,25,] : 0.25
Generation 10:[27,35,4,] : 0.4166666666666666
Generation 11:[25,13,4,] : 0.5833333333333333
Generation 12:[11,15,25,] : 0.5833333333333333
Generation 13:[12,4,22,] : 0.5833333333333333
Generation 14:[14,17,12,] : 0.6333333333333333
Generation 15:[6,5,26,] : 0.5833333333333333
Generation 16:[25,12,4,] : 0.5833333333333333
Generation 17:[25,35,27,] : 0.25
Generation 18:[27,13,4,] : 0.5833333333333333
Generation 19:[27,13,4,] : 0.5833333333333333
Generation 20:[3,35,15,] : 0.4166666666666666
Generation 21:[6,7,15,] : 0.75
Generation 22:[25,35,5,] : 0.6666666666666666
Generation 23:[12,24,24,] : 0.5
Generation 24:[25,12,21,] : 0.6666666666666666
Generation 25:[8,14,15,] : 0.75
Generation 26:[9,13,21,] : 0.5833333333333333
Generation 27:[10,26,15,] : 0.5833333333333333
Generation 28:[12,23,5,] : 0.8333333333333333
Generation 29:[16,24,33,] : 0.5

```

Figure#16 Run#10

Output X Start Page X AIprojectPhase2Final.java X Activity.java X

AIprojectPhase#2Final (run) X AIprojectPhase#2Final (run) #2 X

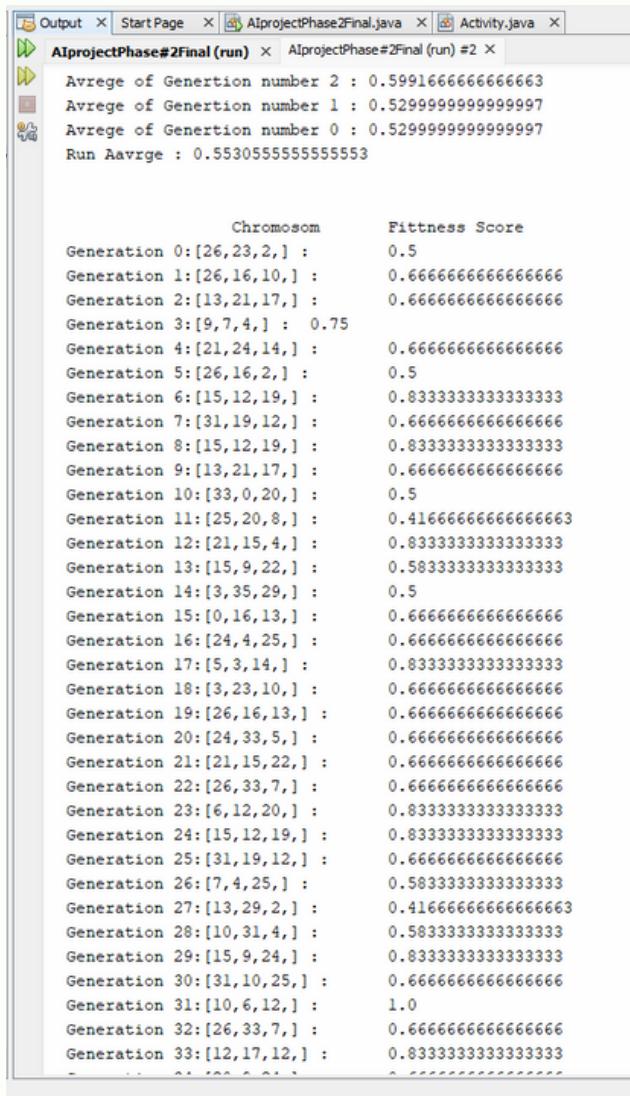
```

Avrege of Genertion number 3 : 0.6125
Avrege of Genertion number 2 : 0.5633333333333331
Avrege of Genertion number 1 : 0.5125
Avrege of Genertion number 0 : 0.5125
Run Aavrge : 0.5502083333333333

Chromosom Fitness Score
Generation 0:[33,25,16,] : 0.8333333333333333
Generation 1:[13,35,0,] : 0.8333333333333333
Generation 2:[31,33,23,] : 0.8333333333333333
Generation 3:[17,19,33,] : 0.6666666666666666
Generation 4:[17,7,23,] : 0.5
Generation 5:[8,29,13,] : 0.4166666666666666
Generation 6:[18,21,3,] : 0.4166666666666666
Generation 7:[21,0,10,] : 0.6666666666666666
Generation 8:[35,0,10,] : 0.8333333333333333
Generation 9:[21,30,3,] : 0.5833333333333333
Generation 10:[35,33,26,] : 0.8333333333333333
Generation 11:[35,33,26,] : 0.8333333333333333
Generation 12:[14,35,0,] : 0.8333333333333333
Generation 13:[24,29,33,] : 0.8333333333333333
Generation 14:[10,21,3,] : 0.6666666666666666
Generation 15:[10,19,33,] : 0.6666666666666666
Generation 16:[28,21,31,] : 0.4166666666666666
Generation 17:[14,16,1,] : 0.8333333333333333
Generation 18:[17,9,20,] : 0.5
Generation 19:[13,20,35,] : 0.6666666666666666
Generation 20:[6,15,27,] : 0.25
Generation 21:[10,33,0,] : 0.8333333333333333
Generation 22:[7,17,32,] : 0.4166666666666666
Generation 23:[2,4,35,] : 0.8333333333333333
Generation 24:[17,23,26,] : 0.5
Generation 25:[10,21,3,] : 0.6666666666666666
Generation 26:[5,35,0,] : 0.8333333333333333
Generation 27:[13,19,3,] : 0.6666666666666666
Generation 28:[10,21,3,] : 0.6666666666666666
Generation 29:[14,35,0,] : 0.8333333333333333
Generation 30:[24,2,26,] : 0.6666666666666666
Generation 31:[11,27,9,] : 0.25
Generation 32:[13,35,33,] : 0.8333333333333333

```

Figure#17 Run#11



```

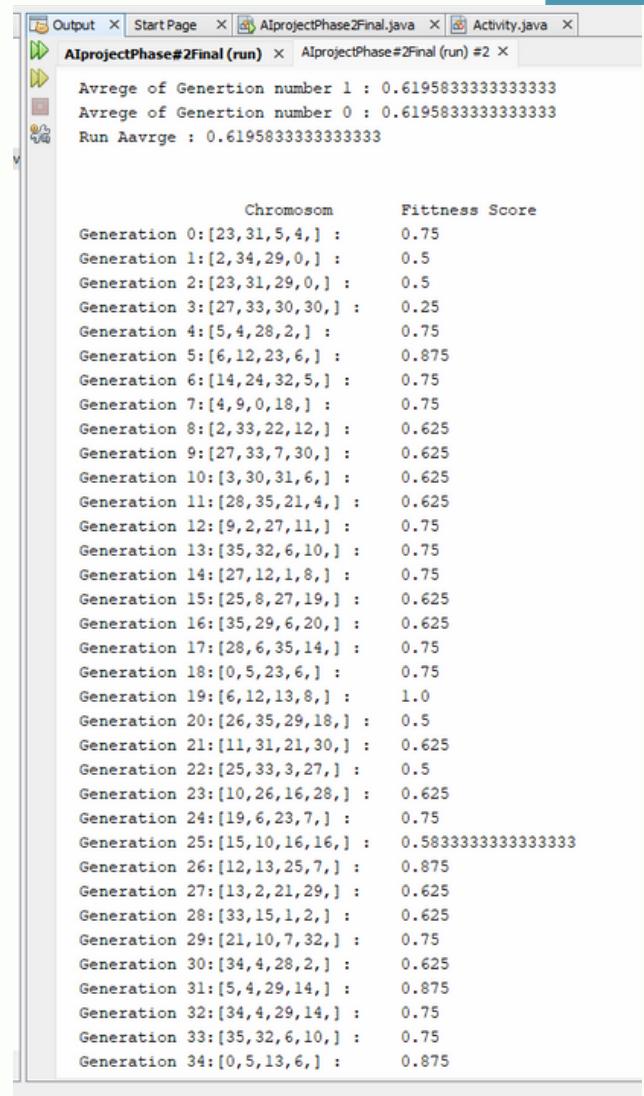
Output × Start Page × AlprojectPhase2Final.java × Activity.java ×
AlprojectPhase#2Final (run) × AlprojectPhase#2Final (run) #2 ×

Avrage of Genertion number 2 : 0.5991666666666666
Avrage of Genertion number 1 : 0.5299999999999997
Avrage of Genertion number 0 : 0.5299999999999997
Run Aavrge : 0.5530555555555553

Chromosom      Fitness Score
Generation 0:[26,23,2,] : 0.5
Generation 1:[26,16,10,] : 0.6666666666666666
Generation 2:[13,21,17,] : 0.6666666666666666
Generation 3:[9,7,4,] : 0.75
Generation 4:[21,24,14,] : 0.6666666666666666
Generation 5:[26,16,2,] : 0.5
Generation 6:[15,12,19,] : 0.8333333333333333
Generation 7:[31,19,12,] : 0.6666666666666666
Generation 8:[15,12,19,] : 0.8333333333333333
Generation 9:[13,21,17,] : 0.6666666666666666
Generation 10:[33,0,20,] : 0.5
Generation 11:[25,20,8,] : 0.4166666666666663
Generation 12:[21,15,4,] : 0.8333333333333333
Generation 13:[15,9,22,] : 0.5833333333333333
Generation 14:[3,35,29,] : 0.5
Generation 15:[0,16,13,] : 0.6666666666666666
Generation 16:[24,4,25,] : 0.6666666666666666
Generation 17:[5,3,14,] : 0.8333333333333333
Generation 18:[3,23,10,] : 0.6666666666666666
Generation 19:[26,16,13,] : 0.6666666666666666
Generation 20:[24,33,5,] : 0.6666666666666666
Generation 21:[21,15,22,] : 0.6666666666666666
Generation 22:[26,33,7,] : 0.6666666666666666
Generation 23:[6,12,20,] : 0.8333333333333333
Generation 24:[15,12,19,] : 0.8333333333333333
Generation 25:[31,19,12,] : 0.6666666666666666
Generation 26:[7,4,25,] : 0.5833333333333333
Generation 27:[13,29,2,] : 0.4166666666666663
Generation 28:[10,31,4,] : 0.5833333333333333
Generation 29:[15,9,24,] : 0.8333333333333333
Generation 30:[31,10,25,] : 0.6666666666666666
Generation 31:[10,6,12,] : 1.0
Generation 32:[26,33,7,] : 0.6666666666666666
Generation 33:[12,17,12,] : 0.8333333333333333

```

Figure#18 Run#12



```

Output × Start Page × AlprojectPhase2Final.java × Activity.java ×
AlprojectPhase#2Final (run) × AlprojectPhase#2Final (run) #2 ×

Avrage of Genertion number 1 : 0.6195833333333333
Avrage of Genertion number 0 : 0.6195833333333333
Run Aavrge : 0.6195833333333333

Chromosom      Fitness Score
Generation 0:[23,31,5,4,] : 0.75
Generation 1:[2,34,29,0,] : 0.5
Generation 2:[23,31,29,0,] : 0.5
Generation 3:[27,33,30,30,] : 0.25
Generation 4:[5,4,28,2,] : 0.75
Generation 5:[6,12,23,6,] : 0.875
Generation 6:[14,24,32,5,] : 0.75
Generation 7:[4,9,0,18,] : 0.75
Generation 8:[2,33,22,12,] : 0.625
Generation 9:[27,33,7,30,] : 0.625
Generation 10:[3,30,31,6,] : 0.625
Generation 11:[28,35,21,4,] : 0.625
Generation 12:[9,2,27,11,] : 0.75
Generation 13:[35,32,6,10,] : 0.75
Generation 14:[27,12,1,8,] : 0.75
Generation 15:[25,8,27,19,] : 0.625
Generation 16:[35,29,6,20,] : 0.625
Generation 17:[28,6,35,14,] : 0.75
Generation 18:[0,5,23,6,] : 0.75
Generation 19:[6,12,13,8,] : 1.0
Generation 20:[26,35,29,18,] : 0.5
Generation 21:[11,31,21,30,] : 0.625
Generation 22:[25,33,3,27,] : 0.5
Generation 23:[10,26,16,28,] : 0.625
Generation 24:[19,6,23,7,] : 0.75
Generation 25:[15,10,16,16,] : 0.5833333333333333
Generation 26:[12,13,25,7,] : 0.875
Generation 27:[13,2,21,29,] : 0.625
Generation 28:[33,15,1,2,] : 0.625
Generation 29:[21,10,7,32,] : 0.75
Generation 30:[34,4,28,2,] : 0.625
Generation 31:[5,4,29,14,] : 0.875
Generation 32:[34,4,29,14,] : 0.75
Generation 33:[35,32,6,10,] : 0.75
Generation 34:[0,5,13,6,] : 0.875

```

Figure#19 Run#13

Output Start Page AlprojectPhase2Final.java Activity.java

AlprojectPhase#2Final (run) AlprojectPhase#2Final (run) #2

```

Avrege of Genertion number 1 : 0.64125
Avrege of Genertion number 0 : 0.64125
Run Aavrge : 0.64125

Chromosom Fittness Score
Generation 0:[34,25,3,3,] : 0.5833333333333333
Generation 1:[34,20,27,7,] : 0.625
Generation 2:[35,31,2,22,] : 0.875
Generation 3:[9,33,8,7,] : 0.625
Generation 4:[17,28,19,29,] : 0.625
Generation 5:[35,1,19,9,] : 0.75
Generation 6:[26,27,35,20,] : 0.625
Generation 7:[17,3,10,2,] : 0.75
Generation 8:[21,31,2,22,] : 0.75
Generation 9:[35,11,1,0,] : 0.875
Generation 10:[33,29,8,35,] : 0.875
Generation 11:[10,27,32,23,] : 0.625
Generation 12:[0,2,32,29,] : 1.0
Generation 13:[26,15,13,30,] : 0.625
Generation 14:[28,12,16,32,] : 0.75
Generation 15:[32,18,7,35,] : 0.75
Generation 16:[25,0,4,23,] : 0.625
Generation 17:[10,27,32,15,] : 0.625
Generation 18:[2,5,27,31,] : 0.75
Generation 19:[11,23,15,23,] : 0.5
Generation 20:[25,8,7,12,] : 0.5
Generation 21:[16,20,0,13,] : 0.75
Generation 22:[34,6,9,27,] : 0.625
Generation 23:[17,35,29,23,] : 0.75
Generation 24:[20,7,6,17,] : 0.5
Generation 25:[2,34,30,7,] : 0.875
Generation 26:[19,8,33,3,] : 0.75
Generation 27:[33,13,15,13,] : 0.625
Generation 28:[10,27,9,24,] : 0.5
Generation 29:[19,17,32,23,] : 0.625
Generation 30:[9,12,32,33,] : 0.75
Generation 31:[33,29,8,35,] : 0.875
Generation 32:[0,3,21,29,] : 0.875
Generation 33:[0,3,21,29,] : 0.875
Generation 34:[0,2,20,14,] : 0.75

```

Figure#20 Run#14

AlprojectPhase#2Final (run) AlprojectPhase#2Final (run) #2

```

Avrege of Genertion number 2 : 0.635
Avrege of Genertion number 1 : 0.5945833333333332
Avrege of Genertion number 0 : 0.5945833333333332
Run Aavrge : 0.6080555555555555

Chromosom Fittness Score
Generation 0:[9,25,14,19,] : 0.75
Generation 1:[25,35,2,0,] : 0.5
Generation 2:[4,6,29,7,] : 0.875
Generation 3:[4,15,7,12,] : 1.0
Generation 4:[21,14,24,7,] : 0.75
Generation 5:[15,5,24,12,] : 0.875
Generation 6:[22,23,0,25,] : 0.5
Generation 7:[31,6,9,6,] : 0.875
Generation 8:[4,15,7,7,] : 0.75
Generation 9:[14,9,28,5,] : 0.625
Generation 10:[6,13,28,29,] : 0.5
Generation 11:[34,30,7,7,] : 0.4166666666666666
Generation 12:[30,0,12,0,] : 0.625
Generation 13:[30,0,12,0,] : 0.625
Generation 14:[11,22,32,4,] : 0.75
Generation 15:[14,34,18,9,] : 0.75
Generation 16:[25,11,2,32,] : 0.625
Generation 17:[29,35,33,29,] : 0.5
Generation 18:[6,30,33,5,] : 0.75
Generation 19:[5,21,5,20,] : 0.75
Generation 20:[8,19,30,20,] : 0.625
Generation 21:[5,21,5,25,] : 0.75
Generation 22:[20,21,7,13,] : 0.75
Generation 23:[14,34,18,9,] : 0.75
Generation 24:[34,13,26,16,] : 0.625
Generation 25:[3,29,8,23,] : 0.625
Generation 26:[9,25,2,25,] : 0.625
Generation 27:[8,19,30,0,] : 0.625
Generation 28:[18,35,6,33,] : 0.625
Generation 29:[25,35,14,19,] : 0.625
Generation 30:[11,22,32,20,] : 0.625
Generation 31:[15,22,17,30,] : 0.625
Generation 32:[30,31,25,25,] : 0.25
Generation 33:[31,6,9,6,] : 0.875

```

Figure#21 Run#15

```

Output X StartPage X AIprojectPhase2Final.java X Activity.java X
AIprojectPhase#2Final (run) X AIprojectPhase#2Final (run) #2 X

Avrege of Genertion number 1 : 0.6270833333333333
Avrege of Genertion number 0 : 0.6270833333333333
Run Aavrge : 0.6270833333333333

Chromosom Fittness Score
Generation 0:[13,35,11,5,] : 0.625
Generation 1:[2,0,7,11,] : 0.75
Generation 2:[31,17,14,10,] : 0.625
Generation 3:[35,15,2,27,] : 0.75
Generation 4:[14,24,34,17,] : 0.625
Generation 5:[27,7,32,22,] : 0.375
Generation 6:[10,18,0,3,] : 0.75
Generation 7:[10,18,0,3,] : 0.75
Generation 8:[5,0,8,6,] : 0.625
Generation 9:[22,23,13,6,] : 0.5
Generation 10:[1,20,24,11,] : 0.625
Generation 11:[2,14,16,2,] : 0.875
Generation 12:[19,9,35,26,] : 0.625
Generation 13:[1,13,17,0,] : 0.75
Generation 14:[26,7,33,3,] : 0.75
Generation 15:[24,13,14,30,] : 0.625
Generation 16:[33,1,0,13,] : 0.875
Generation 17:[3,1,0,29,] : 1.0
Generation 18:[23,28,1,26,] : 0.375
Generation 19:[16,5,14,33,] : 0.75
Generation 20:[10,6,10,11,] : 0.5
Generation 21:[13,35,7,15,] : 0.625
Generation 22:[17,21,9,0,] : 0.625
Generation 23:[1,11,0,30,] : 0.625
Generation 24:[6,33,29,18,] : 0.75
Generation 25:[10,11,12,12,] : 0.25
Generation 26:[10,19,28,33,] : 0.625
Generation 27:[18,31,4,3,] : 0.75
Generation 28:[33,24,12,3,] : 0.75
Generation 29:[2,11,32,23,] : 0.75
Generation 30:[6,10,6,23,] : 0.5
Generation 31:[7,30,25,27,] : 0.375
Generation 32:[10,6,10,34,] : 0.625
Generation 33:[35,14,18,15,] : 0.625
Generation 34:[35,19,28,33,] : 0.75

```

Figure#22 Run#16

```

Output X StartPage X AIprojectPhase2Final.java X Activity.java X
AIprojectPhase#2Final (run) X AIprojectPhase#2Final (run) #2 X

Avrege of Genertion number 1 : 0.5929166666666665
Avrege of Genertion number 0 : 0.5929166666666665
Run Aavrge : 0.5929166666666665

Chromosom Fittness Score
Generation 0:[4,21,3,11,] : 0.625
Generation 1:[14,12,13,26,] : 0.625
Generation 2:[7,17,28,34,] : 0.5
Generation 3:[21,23,34,18,] : 0.875
Generation 4:[0,19,10,22,] : 0.75
Generation 5:[12,30,1,31,] : 0.5
Generation 6:[9,24,13,26,] : 0.75
Generation 7:[19,34,12,15,] : 0.625
Generation 8:[7,23,10,31,] : 0.625
Generation 9:[27,25,34,18,] : 0.875
Generation 10:[33,22,17,9,] : 0.75
Generation 11:[23,25,18,10,] : 0.875
Generation 12:[15,24,32,2,] : 0.625
Generation 13:[22,26,25,23,] : 1.0
Generation 14:[2,13,35,24,] : 0.625
Generation 15:[28,7,23,29,] : 0.5
Generation 16:[10,20,14,15,] : 0.625
Generation 17:[5,34,30,11,] : 0.5
Generation 18:[30,3,1,28,] : 0.375
Generation 19:[23,5,30,35,] : 0.625
Generation 20:[7,26,35,23,] : 0.75
Generation 21:[25,32,16,21,] : 0.75
Generation 22:[14,21,3,11,] : 0.625
Generation 23:[1,26,20,8,] : 0.75
Generation 24:[30,15,16,16,] : 0.25
Generation 25:[23,16,9,26,] : 0.75
Generation 26:[6,21,1,2,1] : 0.625
Generation 27:[10,20,30,11,] : 0.625
Generation 28:[23,25,18,9,] : 0.875
Generation 29:[2,13,35,29,] : 0.5
Generation 30:[19,25,35,16,] : 0.75
Generation 31:[32,0,20,20,] : 0.4166666666666663
Generation 32:[11,27,13,32,] : 0.375
Generation 33:[2,13,35,29,] : 0.5
Generation 34:[0,17,28,34,] : 0.5

```

Figure#23 Run#17

AIprojectPhase#2Final (run) x AIprojectPhase#2Final (run) #2 x

```

Avrege of Genertion number 1 : 0.625
Avrege of Genertion number 0 : 0.625
Run Aavrge : 0.625

Chromosom      Fitness Score
Generation 0:[24,5,31,16,] : 0.75
Generation 1:[30,11,16,30,] : 0.875
Generation 2:[6,7,23,18,] : 0.5
Generation 3:[12,27,16,13,] : 0.625
Generation 4:[19,29,27,15,] : 0.625
Generation 5:[27,22,29,11,] : 0.625
Generation 6:[16,10,3,16,] : 0.875
Generation 7:[13,30,8,13,] : 0.625
Generation 8:[9,19,17,25,] : 0.5
Generation 9:[28,10,9,3,] : 0.625
Generation 10:[32,30,7,0,] : 0.875
Generation 11:[31,24,31,3,] : 0.875
Generation 12:[35,7,18,3,] : 0.75
Generation 13:[0,23,31,6,] : 0.75
Generation 14:[27,22,29,11,] : 0.625
Generation 15:[7,16,11,32,] : 0.75
Generation 16:[10,9,7,5,] : 0.5
Generation 17:[33,4,17,17,] : 0.41666666666666663
Generation 18:[16,1,11,11,] : 0.5833333333333333
Generation 19:[19,28,12,0,] : 0.625
Generation 20:[11,6,32,11,] : 0.625
Generation 21:[32,30,31,3,] : 1.0
Generation 22:[33,23,31,26,] : 0.75
Generation 23:[32,4,7,5,] : 0.625
Generation 24:[3,4,1,9,] : 0.75
Generation 25:[8,22,30,0,] : 0.75
Generation 26:[13,10,16,33,] : 0.75
Generation 27:[16,24,29,8,] : 0.75
Generation 28:[7,16,28,31,] : 0.75
Generation 29:[8,19,11,32,] : 0.625
Generation 30:[4,15,30,30,] : 0.41666666666666663
Generation 31:[0,3,7,22,] : 0.75
Generation 32:[32,16,29,29,] : 0.75
Generation 33:[25,0,33,3,] : 0.875
Generation 34:[14,31,26,2,] : 0.75

```

Figure#24 Run#18

AIprojectPhase#2Final (run) x AIprojectPhase#2Final (run) #2 x

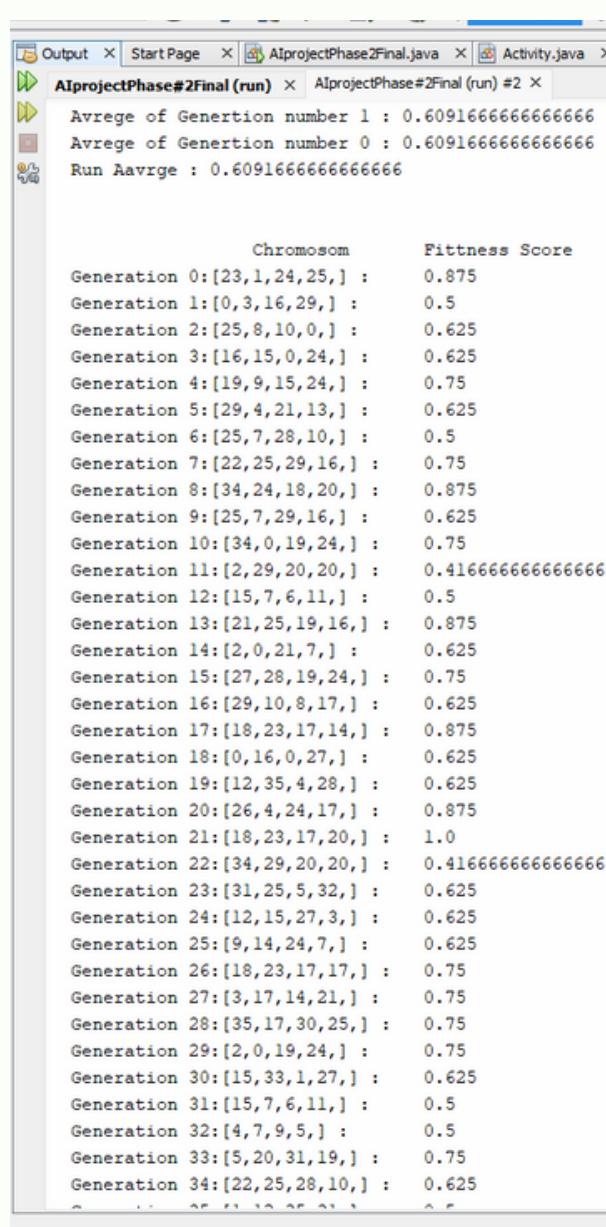
```

Avrege of Genertion number 3 : 0.67625
Avrege of Genertion number 2 : 0.64125
Avrege of Genertion number 1 : 0.61333333333333334
Avrege of Genertion number 0 : 0.6133333333333334
Run Aavrge : 0.6360416666666666666

Chromosom      Fitness Score
Generation 0:[8,19,0,18,] : 0.625
Generation 1:[13,34,22,25,] : 0.625
Generation 2:[28,33,32,35,] : 0.875
Generation 3:[3,8,22,34,] : 0.75
Generation 4:[9,32,0,18,] : 0.75
Generation 5:[13,34,30,12,] : 0.75
Generation 6:[22,2,35,20,] : 0.75
Generation 7:[22,17,32,3,] : 0.75
Generation 8:[26,34,23,29,] : 0.75
Generation 9:[13,34,0,18,] : 0.75
Generation 10:[30,4,1,24,] : 0.75
Generation 11:[22,17,32,3,] : 0.75
Generation 12:[17,29,35,20,] : 0.75
Generation 13:[13,34,4,18,] : 0.625
Generation 14:[30,15,2,11,] : 0.75
Generation 15:[9,33,34,22,] : 0.75
Generation 16:[18,2,14,2,] : 0.75
Generation 17:[11,32,10,31,] : 0.75
Generation 18:[6,29,24,0,] : 0.75
Generation 19:[17,34,13,8,] : 0.625
Generation 20:[23,15,28,21,] : 0.5
Generation 21:[26,35,29,6,] : 0.75
Generation 22:[6,32,21,33,] : 0.75
Generation 23:[9,14,16,23,] : 0.625
Generation 24:[9,32,30,18,] : 0.75
Generation 25:[25,3,24,12,] : 0.625
Generation 26:[6,29,2,11,] : 0.75
Generation 27:[9,33,35,20,] : 0.75
Generation 28:[28,22,20,3,] : 0.625
Generation 29:[8,2,3,5,] : 0.75
Generation 30:[19,6,4,18,] : 0.5
Generation 31:[13,34,2,30,] : 0.875
Generation 32:[11,32,30,25,] : 0.75

```

Figure#25 Run#19



The screenshot shows a Java IDE interface with several tabs at the top: Output, StartPage, AIprojectPhase2Final.java, and Activity.java. The AIprojectPhase2Final.java tab is active. The code area contains the following output:

```
Output X StartPage X AIprojectPhase2Final.java X Activity.java X
AIprojectPhase#2Final (run) X AIprojectPhase#2Final (run) #2 X
Avrege of Genertion number 1 : 0.6091666666666666
Avrege of Genertion number 0 : 0.6091666666666666
Run Aavrge : 0.6091666666666666

          Chromosom      Fittness Score
Generation 0:[23,1,24,25,] : 0.875
Generation 1:[0,3,16,29,] : 0.5
Generation 2:[25,8,10,0,] : 0.625
Generation 3:[16,15,0,24,] : 0.625
Generation 4:[19,9,15,24,] : 0.75
Generation 5:[29,4,21,13,] : 0.625
Generation 6:[25,7,28,10,] : 0.5
Generation 7:[22,25,29,16,] : 0.75
Generation 8:[34,24,18,20,] : 0.875
Generation 9:[25,7,29,16,] : 0.625
Generation 10:[34,0,19,24,] : 0.75
Generation 11:[2,29,20,20,] : 0.4166666666666666
Generation 12:[15,7,6,11,] : 0.5
Generation 13:[21,25,19,16,] : 0.875
Generation 14:[2,0,21,7,] : 0.625
Generation 15:[27,28,19,24,] : 0.75
Generation 16:[29,10,8,17,] : 0.625
Generation 17:[18,23,17,14,] : 0.875
Generation 18:[0,16,0,27,] : 0.625
Generation 19:[12,35,4,28,] : 0.625
Generation 20:[26,4,24,17,] : 0.875
Generation 21:[18,23,17,20,] : 1.0
Generation 22:[34,29,20,20,] : 0.4166666666666666
Generation 23:[31,25,5,32,] : 0.625
Generation 24:[12,15,27,3,] : 0.625
Generation 25:[9,14,24,7,] : 0.625
Generation 26:[18,23,17,17,] : 0.75
Generation 27:[3,17,14,21,] : 0.75
Generation 28:[35,17,30,25,] : 0.75
Generation 29:[2,0,19,24,] : 0.75
Generation 30:[15,33,1,27,] : 0.625
Generation 31:[15,7,6,11,] : 0.5
Generation 32:[4,7,9,5,] : 0.5
Generation 33:[5,20,31,19,] : 0.75
Generation 34:[22,25,28,10,] : 0.625
Generation 35:[11,12,25,21,] : 0.5
```

Figure#26 Run#20

Run#	Generation Average	#Number of generations
1	0.658333333333333	2
2	0.617499999999999	2
3	0.49375	2
4	0.644999999999997	2
5	0.588472222222221	9
6	0.57125	2
7	0.611666666666666	2
8	0.488333333333306	2
9	0.5518589743589742	13
10	0.525952380952381	7
11	0.550208333333333	4
12	0.553055555555555	3
13	0.619583333333333	2
14	0.64125	2
15	0.608055555555555	3
16	0.627083333333333	2
17	0.592916666666665	2
18	0.625	2
19	0.636041666666666	4
20	0.609166666666666	2

