NAME: HAYDEN CORDEIRO BATCH: D ROLL NO.: 05

EXPERIMENT NO.: 02

AIM : To implement Genetic Algorithm

LEARNING OBJECTIVE : To understand Genetic algorithms and simulate the same in software

LEARNING OUTCOME : Student are able to successfully simulate a Genetic algorithm.

COURSE OUTCOME:

CSL703.1 To realize the basic techniques to build intelligent systems

PROGRAM OUTCOME:
(PO 3) Design/ development of solutions: Breadth and uniqueness of engineering problems i.e. the extent to which problems are original and to which solutions have previously been identified or codified
(PO 12) Lifelong Learning

BLOOM'S TAXONOMY LEVEL:

- Remembering
- Understanding

THEORY: Genetic Algorithms(GAs) are adaptive heuristic search algorithms that belong to the larger part of evolutionary algorithms. Genetic algorithms are based on the ideas of natural selection and genetics. They are commonly used to generate high-quality solutions for optimization problems and search problems.Genetic algorithms simulate the process of natural selection which means those species who can adapt to changes in their environment are able to survive and reproduce and go to next generation.Each generation consist of a population of individuals and each individual represents a point in search space and possible solution. Each individual is represented as a string of character/integer/float/bits.

ALGORITHM:
1) Randomly initialize populations p
2) Determine fitness of population
3) Until convergence repeat:
    a) Select parents from population
    b) Crossover and generate new population
    c) Perform mutation on new population
    d) Calculate fitness for new population

OUTPUT:

```
Initial Calculation
    x   f(x) parent  probability  Excpected Count  Actual
0  25  15850  11001     0.742389         2.969555       3
1  16   4240  10000     0.198595         0.794379       1
2  10   1090  01010     0.051054         0.204215       0
3   5    170  00101     0.007963         0.031850       0
Highest Fitness 15850

----------------------------------------------------------------------
Generation 1
  parent crossover mutation  xvalue   f(x)
0  11001     11000    11000      24  14040
1  10000     10001    10001      17   5066
    x   f(x) parent  probability  Excpected Count  Actual
0  24  14040  11001     0.734848         1.469695       1
1  17   5066  10000     0.265152         0.530305       1
Highest Fitness 14040

----------------------------------------------------------------------
Generation 2
  parent crossover mutation  xvalue  f(x)
0  11000     11001    01000       8   584
1  10001     10000    00001       1    10
   x  f(x) parent  probability  Excpected Count  Actual
0  8   584  11000     0.983165          1.96633       2
1  1    10  10001     0.016835          0.03367       0
Highest Fitness 584

----------------------------------------------------------------------
Generation 3
  parent crossover mutation  xvalue   f(x)
0  01000     00001    11000      24  14040
1  00001     01000    10001      17   5066
    x   f(x) parent  probability  Excpected Count  Actual
0  24  14040  01000     0.734848         1.469695       1
1  17   5066  00001     0.265152         0.530305       1
Highest Fitness 14040

----------------------------------------------------------------------
Generation 4
  parent crossover mutation  xvalue   f(x)
0  11000     11001    11010      26  17810
1  10001     10000    10011      19   7030
    x   f(x) parent  probability  Excpected Count  Actual
0  26  17810  11000     0.716989         1.433977       1
1  19   7030  10001     0.283011         0.566023       1
Highest Fitness 17810

----------------------------------------------------------------------
Generation 5
  parent crossover mutation  xvalue   f(x)
0  11010     10011    11110      30  27270
1  10011     11010    10111      23  12374
    x   f(x) parent  probability  Excpected Count  Actual
0  30  27270  11010     0.687872         1.375744       1
1  23  12374  10011     0.312128         0.624256       1
Highest Fitness 27270

Best Average 19822.0
```

CONCLUSION: The Genetic Algorithm is successfully implemented