GENETIC ALGORITHM

CODE:-

```
import random


POP_SIZE = 100

CHROM_LENGTH = 20

MAX_GEN = 100

MUTATION_RATE = 0.01


class Individual:

    def __init__(self):

        self.genes = [random.randint(0, 1) for _ in
range(CHROM_LENGTH)]

        self.fitness = self.evaluate_fitness()


    def evaluate_fitness(self):

        return sum(self.genes)


def initialize_population():

    return [Individual() for _ in range(POP_SIZE)]


def select_parent(population):
```

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    i, j = random.sample(range(POP_SIZE), 2)
    return population[i] if population[i].fitness >
population[j].fitness else population[j]

def crossover(parent1, parent2):
    point = random.randint(0, CHROM_LENGTH - 1)
    child_genes = parent1.genes[:point] +
parent2.genes[point:]
    return IndividualWithGenes(child_genes)

def mutate(individual):
    for i in range(CHROM_LENGTH):
        if random.random() < MUTATION_RATE:
            individual.genes[i] = 1 - individual.genes[i]
    individual.fitness = individual.evaluate_fitness()

class IndividualWithGenes(Individual):
    def __init__(self, genes):
        self.genes = genes
        self.fitness = self.evaluate_fitness()

def get_best_individual(population):
```

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    return max(population, key=lambda ind: ind.fitness)

def genetic_algorithm():
    population = initialize_population()
    for gen in range(MAX_GEN):
        new_population = []
        for _ in range(POP_SIZE):
            parent1 = select_parent(population)
            parent2 = select_parent(population)
            child = crossover(parent1, parent2)
            mutate(child)
            new_population.append(child)
        population = new_population
        best = get_best_individual(population)
        print(f"Generation {gen}: Best Fitness = {best.fitness}")

genetic_algorithm()
```
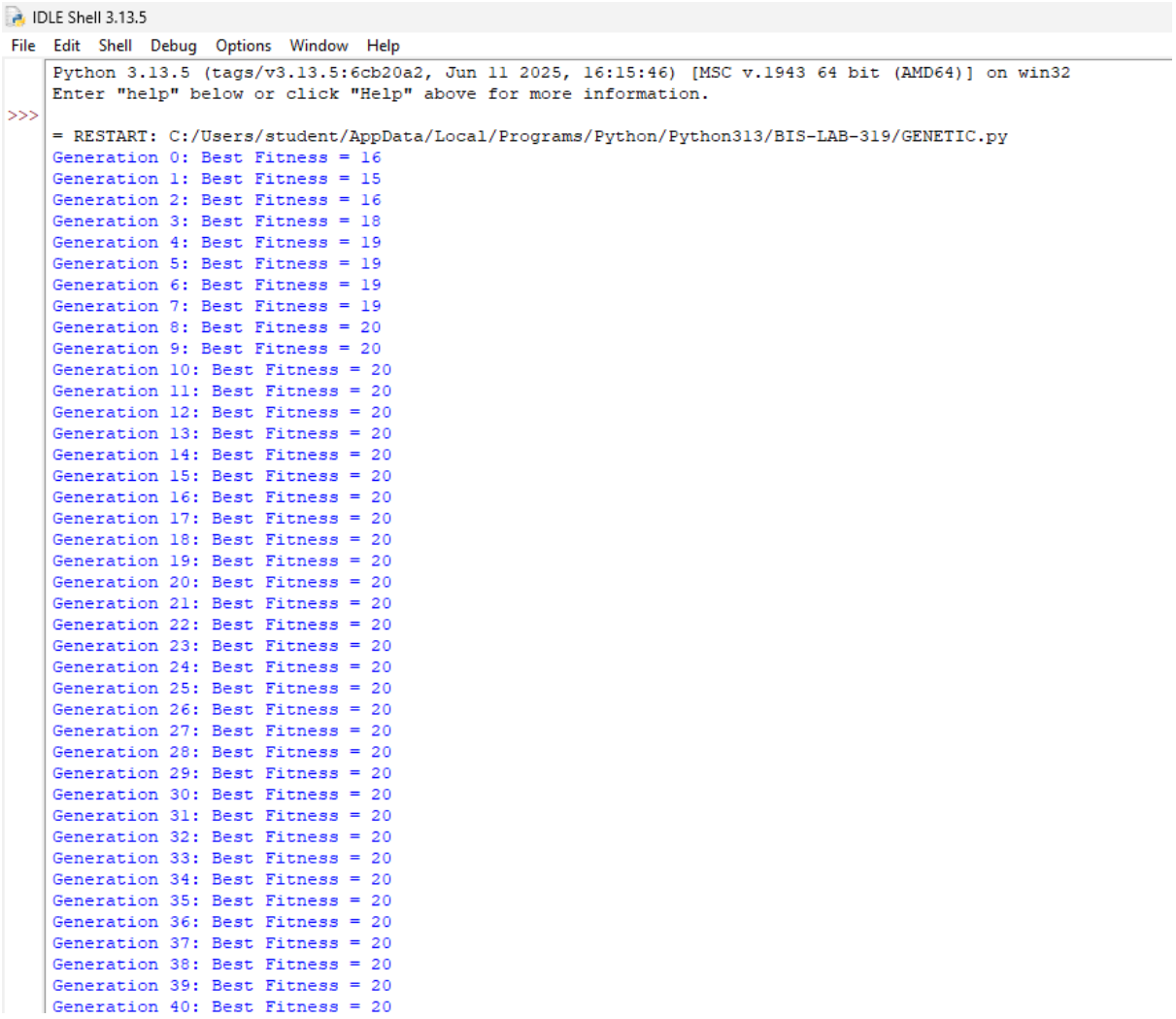

OUTPUT:-


IDLE Shell 3.13.5
File Edit Shell Debug Options Window Help
Python 3.13.5 (tags/v3.13.5:6cb20a2, Jun 11 2025, 16:15:46) [MSC v.1943 64 bit (AMD64)] on win32
Enter "help" below or click "Help" above for more information.
>>>
= RESTART: C:/Users/student/AppData/Local/Programs/Python/Python313/BIS-LAB-319/GENETIC.py
Generation 0: Best Fitness = 16
Generation 1: Best Fitness = 15
Generation 2: Best Fitness = 16
Generation 3: Best Fitness = 18
Generation 4: Best Fitness = 19
Generation 5: Best Fitness = 19
Generation 6: Best Fitness = 19
Generation 7: Best Fitness = 19
Generation 8: Best Fitness = 20
Generation 9: Best Fitness = 20
Generation 10: Best Fitness = 20
Generation 11: Best Fitness = 20
Generation 12: Best Fitness = 20
Generation 13: Best Fitness = 20
Generation 14: Best Fitness = 20
Generation 15: Best Fitness = 20
Generation 16: Best Fitness = 20
Generation 17: Best Fitness = 20
Generation 18: Best Fitness = 20
Generation 19: Best Fitness = 20
Generation 20: Best Fitness = 20
Generation 21: Best Fitness = 20
Generation 22: Best Fitness = 20
Generation 23: Best Fitness = 20
Generation 24: Best Fitness = 20
Generation 25: Best Fitness = 20
Generation 26: Best Fitness = 20
Generation 27: Best Fitness = 20
Generation 28: Best Fitness = 20
Generation 29: Best Fitness = 20
Generation 30: Best Fitness = 20
Generation 31: Best Fitness = 20
Generation 32: Best Fitness = 20
Generation 33: Best Fitness = 20
Generation 34: Best Fitness = 20
Generation 35: Best Fitness = 20
Generation 36: Best Fitness = 20
Generation 37: Best Fitness = 20
Generation 38: Best Fitness = 20
Generation 39: Best Fitness = 20
Generation 40: Best Fitness = 20