GENETIC ALGORITHM

Code :

```
import random

POP_SIZE = 100
CHROM_LENGTH = 20
MAX_GEN = 50
MUTATION_RATE = 0.05


class Individual:
    def __init__(self, genes=None):
        if genes is None:
            self.genes = [random.randint(0, 1) for _ in range(CHROM_LENGTH)]
        else:
            self.genes = genes
        self.fitness = self.evaluate_fitness()

    def evaluate_fitness(self):
        return sum(self.genes)

    def __str__(self):
        return f"Fitness: {self.fitness}"


def initialize_population():
    return [Individual() for _ in range(POP_SIZE)]

def select_parent(population):
    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(1, CHROM_LENGTH - 1)
    child_genes = parent1.genes[:point] + parent2.genes[point:]
    return Individual(child_genes)


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

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    individual.fitness = individual.evaluate_fitness()

def get_best_individual(population):
    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"Best Fitness = {best.fitness}")
    return best

best_solution = genetic_algorithm()
print(f"\nBest solution found:\n{best_solution}")
```

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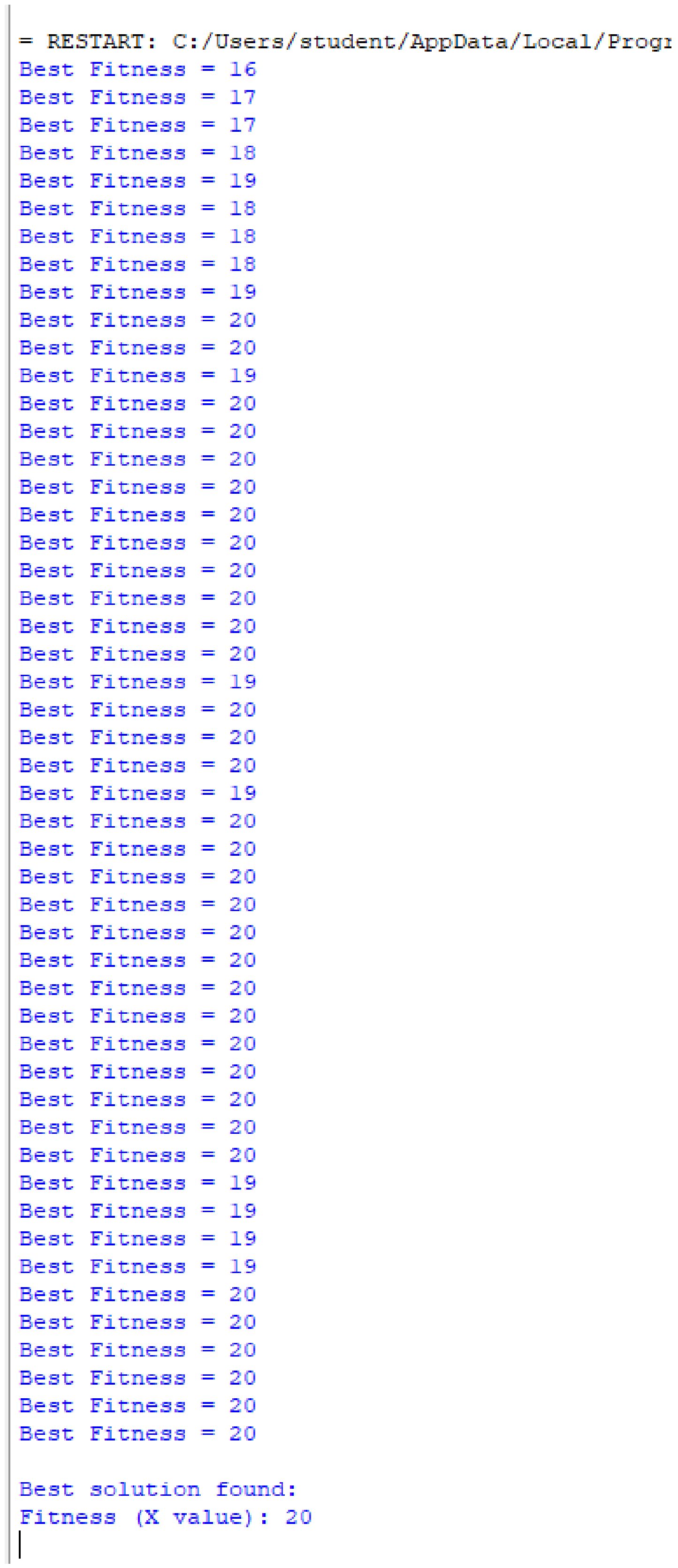
Solution :



```
= RESTART: C:/Users/student/AppData/Local/Progr
Best Fitness = 16
Best Fitness = 17
Best Fitness = 17
Best Fitness = 18
Best Fitness = 19
Best Fitness = 18
Best Fitness = 18
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Best solution found:
Fitness (X value): 20
```