

Quiz – 2 Artificial Intelligence BCS – 7A

Question- 1: Implement a simple genetic algorithm in Python to solve the "One-Max Problem." (20)

The One-Max Problem is an optimization problem where the goal is to maximize the number of ones in a binary string of a fixed length, N. You need to implement a genetic algorithm to find the binary string with the maximum number of ones.

Here are the requirements for your implementation:

1. Use a fixed-length binary string representation for the individuals in the population.
2. Initialize a population of size P with random binary strings.
3. Implement selection using the tournament selection method with a tournament size of T.
4. Implement crossover using the single-point crossover method with a crossover rate of C.
5. Implement mutation using the bit-flipping method with a mutation rate of M.

Run the algorithm for G generations and print the best individual found in each generation.

Your program should accept the following inputs:

- N: The length of the binary string (e.g., 50)
- P: The population size (e.g., 100)
- T: The tournament size (e.g., 3)
- C: The crossover rate (e.g., 0.8)
- M: The mutation rate (e.g., 0.02)
- G: The number of generations (e.g., 100)

As an output, your program should print the best individual found in each generation and the number of ones in that binary string. Once the program starts a reputation, exit the loop.

Remember to provide a clear structure to your code, including functions for initialization, selection, crossover, mutation, and main loop.

For Example,

For n=10

Initial population is : 1000001100

Goal is : 1111111111