GA for the 4 knights problem

By:

Aram al-shahateet 221020

Lames klawi 221049

1. What is the representation of a chromosome, and what is its length? Why?

- **Chromosome Representation:**
  بمثل الحل مش الهدف او البدايه

A1-C2	C2-A3	C1-A2	A2-C3	A3-C2	C2-A1	C3-A2	A2-C1

- **Chromosome Length:**
  بعتمد على عدد الحركات اللي بتوصلني للهدف

  The length of a chromosome depends on the number of moves required to achieve the target configuration.

2. Example of Two Parents and Their Offspring After Crossover

Parents:

Parent 1:

A1-B3	B3-C1	B1-C3	C3-A2
H1		T1	

Parent 2:

C2-A1	A1-B3	A2-C3	C3-B1
H1		T1	

Crossover Process:

Child 1:

A1-B3	B3-C1	A2-C3	C3-B1
H1		T2	

Child 2:

C2-A1	A1-B3	B1-C3	C3-A2
H2		T1	

2.Example of a Chromosome Before and After Mutation

Before Mutation:

C2-A1	A1-B3	B1-C3	C3-A2

After Mutation:

C2-A1	B1-C3	A1-B3	C3-A2

The mutation is swap

Write a detailed C++ code for the fitness function. Explain how it works.

```cpp
float fitness(vector[30]) {
    int score = 0;

    for (int i = 0; i < 4; ++i) {
        int x1 = cpositions[i].first;
        int y1 = cpositions[i].second;
        int x2 = gpositions[i].first;
        int y2 = gpositions[i].second;

        int distance = abs(x1 - x2) + abs(y1 - y2);
        score += distance;
    }
    return 1/(score+1);
}
```

حساب المسافه بين الهدف والموقع الحالي

(كلما زادت المسافه بتقل ال fitness)