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CS 461 Introduction to AI

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Genetic Algorithm Assignment

1. Source Code (Python)
   Link :
   https://drive.google.com/drive/folders/1ss7W0C2LxmfTUV9pzlrC_QOCAYlUME2R?usp=drive_link

2. Output (Generated text (.txt))
   Link :
   https://drive.google.com/drive/folders/1g_05izJ0kbHFBIATo0NAxlS1UCn6rYuB?usp=drive_link

   Population number : 500
   Generation : 100
   Mutation rate : 0.01
   Crossover rate : 0.5

   I'm using softmax method to decide the crossover process, some of the case that I try:
   - Output with regular mutation (100 Generation)
   - Output with mutation halved (m/2) (100 Generation)
   - Output with mutation halved again (m/4) (100 Generation)
   - Output with regular mutation but (1000 Generation)
   - Output with NO mutation (100 Generation)

3. Short Report
   Link :
   https://drive.google.com/drive/folders/1yIuLhrE9k5hLId5Jg5u7UHUMiIce3D2U?usp=drive_link

   a. What were the challenges in writing the program? Or did it seem to go smoothly from the beginning?
      - The main challenge of this program is how you build the fitness function, which can be quite complicated depends on the criteria of the goals itself
      - Another issue that I noticed is that the result is not quite of what I expected, basically the program find the best way to "cheat". To get the best fitness number, which can lead to another problem if we not clearly defined the criteria.

b. What do you think of the schedule your program produced? Does it have anything that still looks odd or out of place?
    - The result can be quite inconsistent (because of the stochastic approach), and as I say above, that the program try to maximize the fitness value by any means necessary (e.g find a loophole) which I noticed from the result.
    - The one thing that I notice is that they try to use the same room (and facilitator) quite frequently in different time schedule in order to maximize its value, which we must anticipated in much larger scale of program that this result can lead to another issue (underutilize, maintenance, fatigue etc) which we should refine in the fitness criteria.
    - Basically, they tend to use the "best" items or method over-and-over in order to maximize its fitness value, so the result given can be quite homogeneous.

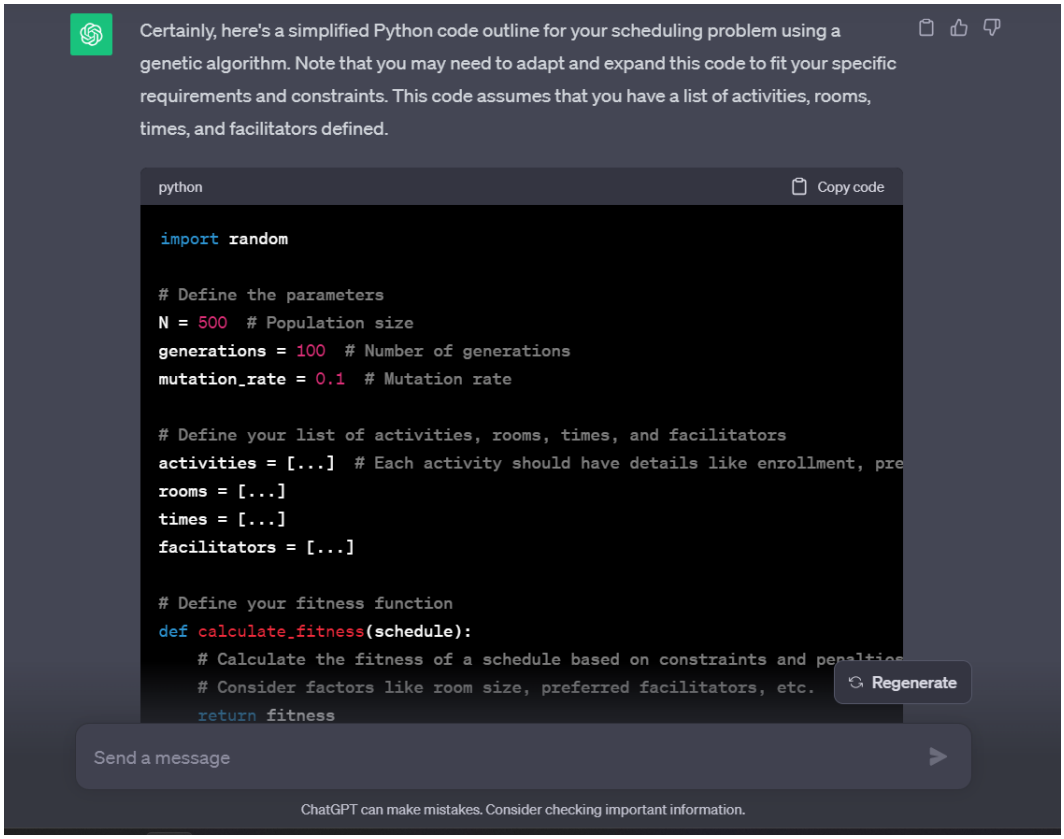
c. How would you improve the program, or change the fitness function?
    - I would say that I'd like to utilize the other room and facilitator that available, maybe give some penalty if using the same room or/and not using the facilitator available.

d. Anything else you feel like discussing, asking about, bragging about, etc.
    - In my opinion, genetic algorithm really depends on how you define the fitness criteria, which we should be more careful for unexpected behaviour or result that we may create. which in more complex task it can be quite daunting, in regards how to define the fitness criteria and how you evaluate the result created.
    - Another things that I fascinated about, without the mutation (problems) we can be quite stuck on a plateau. Which is very interesting if we see it from philosophical perspective.

Reference :

- I have also use Chat-GPT to build this program, which is very impressive (and frightening) on how well the result it created. But sometime the result it provided is not goes the way we expected (especially in fitness function) which is they can misunderstand the prompt given and infer something that is not related to the prompt raised, it is quite understood because they can't really assume the situation and can only infer information from the prompt.

  But it is impressive how they can improve with each prompt given.



can you create the selected schedules function and new population function that apply softmax function to the fitness scores

Certainly, you can use a softmax function to select schedules and create a new population. The softmax function is often used to convert fitness scores into probabilities for selection. Here's how you can implement the selection and new population creation functions using the softmax function in Python:

python Copy code

```python
import random
import math

# Assuming you have already defined the population and fitness_scores

def softmax_selection(population, fitness_scores, temperature=1.0):
    # Convert fitness scores to selection probabilities using the softmax fu
    prob_weights = [math.exp(score / temperature) for score in fitness_score
    total_weight = sum(prob_weights)
    probabilities = [weight / total_weight for weight in prob_weights]

    # Select schedules based on the calculated probabilities
    selected_indices = random.choices(range(len(population)), weights
```

Regenerate

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can you create a crossover function from a given population for a genetic algorithm and also apply its mutation?

Certainly! To create a crossover function for a genetic algorithm and apply mutation, you typically perform these operations on pairs of individuals from the population. Here's a Python function that demonstrates both crossover and mutation on a given population:

python Copy code

```python
import random

def crossover_population(population, crossover_rate):
    # Shuffle the population to ensure randomness
    random.shuffle(population)

    new_population = []

    for i in range(0, len(population), 2):
        if i + 1 < len(population):
            parent1 = population[i]
            parent2 = population[i + 1]

            if random.random() < crossover_rate:
```

Regenerate

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