Assignment 2

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Task 1:

Result tables:
Result of running the code for different population and same mutation rate, and different mutation rate and same population.

Table 1: The result for different population sizes with the same mutation rate value.

Population size	**Mutation Rate**	**The average of fitness score running 10 time**	**The average of time it took for 10 time running per second**
10	0,6	608.4041824316754	31.72583966255188
20	0,6	581.9325137169652	56.898580527305604
50	0,6	576.06149387141	137.9471215724945
100	0,6	539.3918291195746	275.9310800552368

Table 2: The result for different mutation rate values with the same population size.

Population size	**Mutation Rate**	**The average of fitness score running 10 time**	**The average of time it took for 10 time running per second**
100	0,1	553.4066910277294	210.46331260204315
100	0,3	569.4800411623276	230.71514163017272
100	0,6	522.798742246373	302.22099404335023
100	0,9	568.1175924415724	323.353249168396

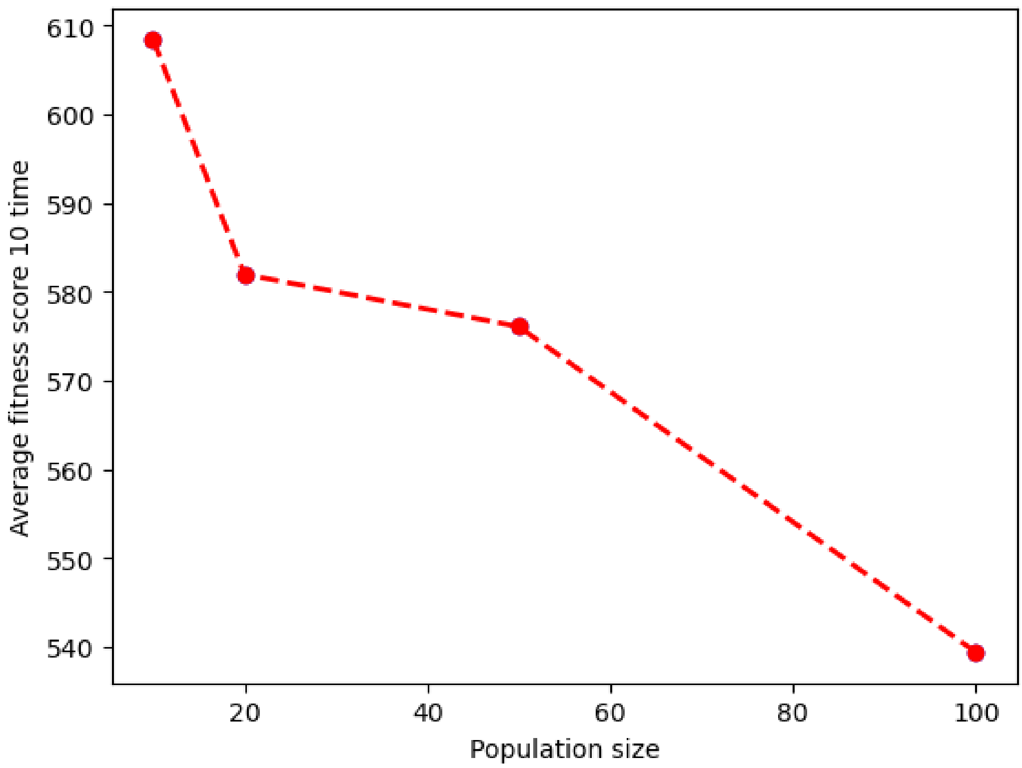

Figure 1 The result for different population sizes with the same mutation rate value and the average of fitness score running 10 time

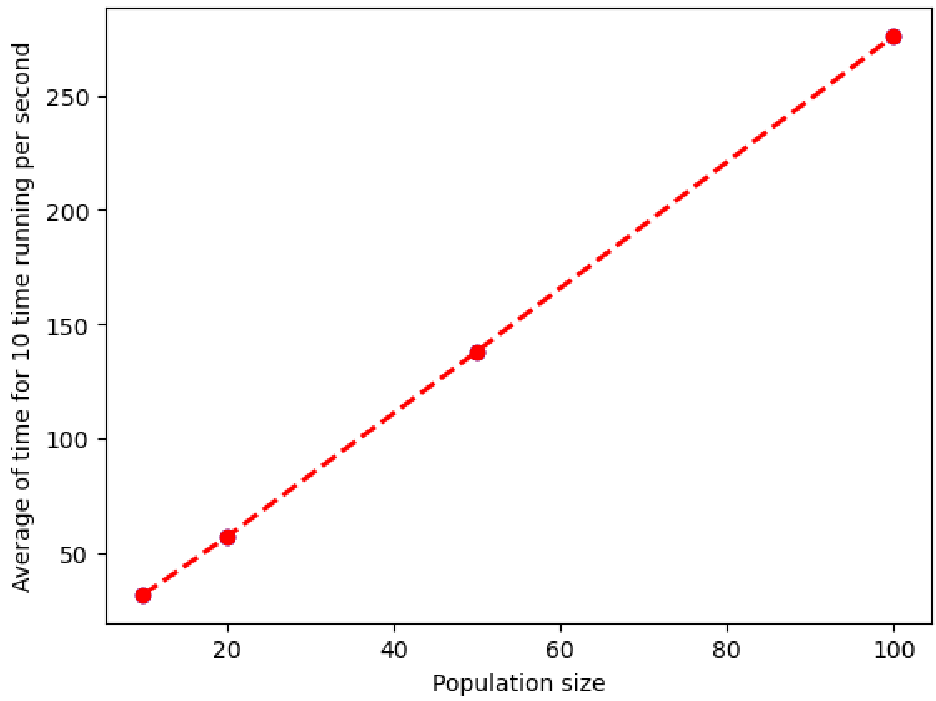

Figure 2 The result for different population sizes with the same mutation rate value and The average of time it took for 10 time running per second

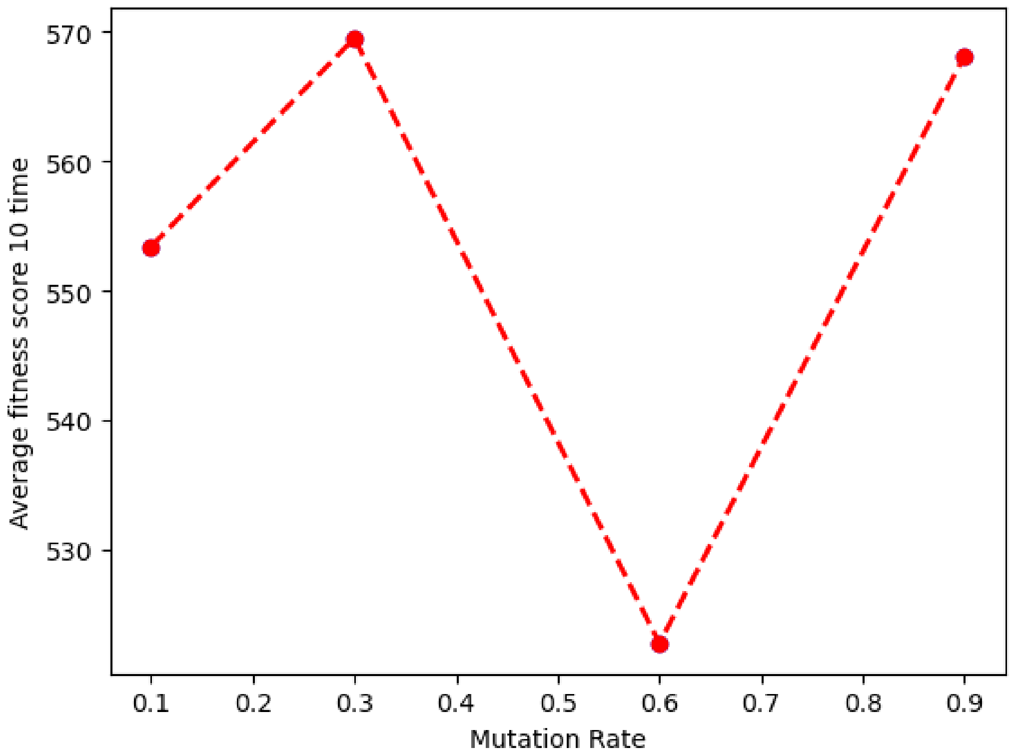

Figure 3 The result for different mutation rate values with the same population size. and the average of fitness score running 10 time

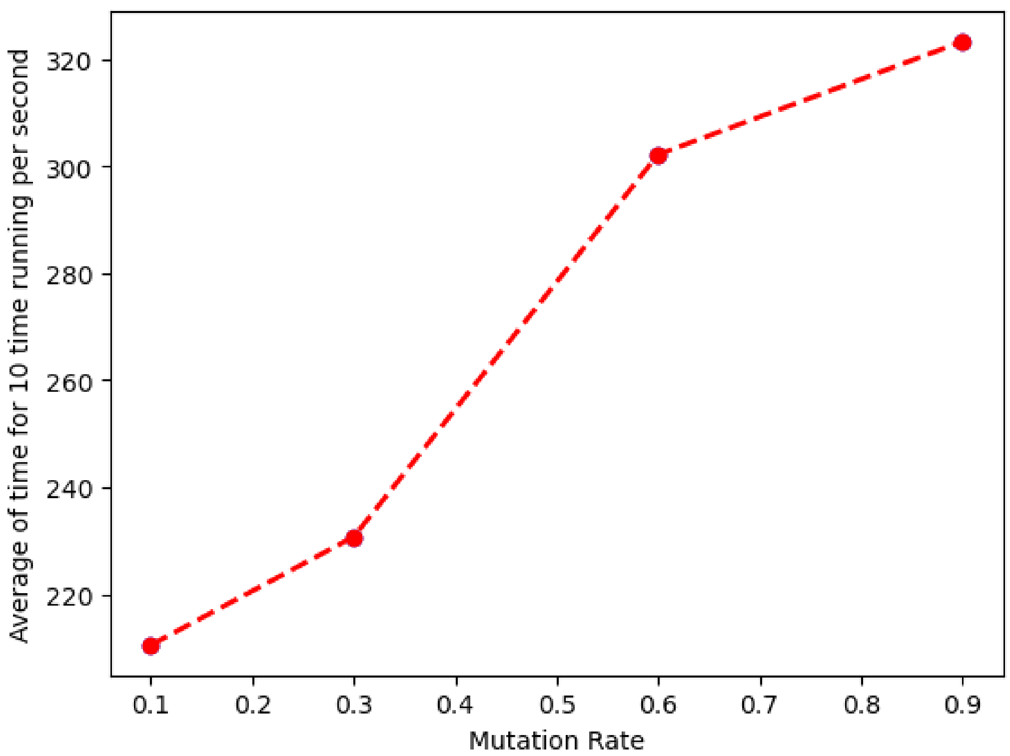

Figure 4 The result for different mutation rate values with the same population size. and The average of time it took for 10 time running per second

Summarize:

The goal of this task is to understand the relationship between population and mutation rate in Genetic Algorithms(GA). To get the goal we will run GA 10 times for the same mutation rate and different population and run it 10 times again for different mutation rate and same population. Then we will analyze and discuss the result.

Analyze & Discuss:

Same mutation rate different population:
From table 1 can we see the value for the fitness score column decreasing while at the same time the value for the population column increasing. To get a better view of the value can we look at figure 1. The fitness score decreased from 610 to 540. Which is around 11.5% decreased, when the population size increased from 10 to 100. Which is 1000% increased.

While figure 2 describes the different population with the time it tooks for each population. Here we can see an interesting thing, the time is increasing while the population is increasing too. Time is increasing with linear function, when the population is small “10” it tooks around 30 second but when the population is big “100” it tooks around 270 second. That means an increase of about 930%.

We can say that when we have more population and the same mutation rate, we get a better fitness score, but it takes more time. And that makes sense because we are generating more generations and that will get better value but it will take time.

Same population different mutation rate:
From table 2 we see the value for the fitness score column increasing then decreasing when the population is still the same. Figure 3 describing the value of fitness score, we can see the best value where we have mutation rate 0.6 and the population 100.
If we compare the same value with the previous table we can see that they are almost equal. First table has around 539 while the second has around 522. The time also took almost the same, for the first table was 275.

We can say that the best value we can get is when we have population = 100 and mutation rate = 0.6.

Well, the more population we have the better the score we get, no matter how big the mutation rate, but if mutation rate increases when the population is large then we will get as bad a score as if we had a small mutation rate and large population.

Task 2:

look at the cod.

Task 3:

So to put this logic in pseudo code we have:

determine chromosome representation
randomly create initial population

While stopping conditions not met:
    Compute fitness of chromosomes in the generation.
    From this, select some chromosomes for reproduction.
    crossover (aka recombine/reproduce/breed) the selected chromosomes to create a new generation.
    mutate some individuals in the new generation

Summary of Terms

Representation - The way you are representing your solution. Typically a list of 1's and 0's, or a list of values.

Chromosome/Individual - a single solution to a problem. Generation/Population - A batch of solutions to the problem.

Fitness - How effective a chromosome is at solving the problem.

Selection - The method you use to pick which chromosomes will be bred together to make the next generation.

Crossover - The recombination, or reproduction, of selected chromosomes to create a new generation.

Mutation - Randomly changing some values in chromosomes to create diversity in the population.