An Optimal Tour of HP using Genetic Algorithm

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Abstract—This research paper present the working of an application which give an optimal tour of Himachal Pradesh using AI technique of Genetic Algorithm. This paper presents a strategy to find the nearly optimized solution to these type of problems, using new crossover technique for genetic algorithm that generates high quality solution. The algorithm checks all possible combinations and then returns the best and fittest tour as the result.

1. INTRODUCTION

THE PROBLEM :

The problem which we are handling here is the problem of finding an optimal tour which is a kind of TSP problem. In the problem we are provided with a starting point from where we have to travel various tourist places of Himachal Pradesh. As this is a problem like TSP problem so This problem is known to be NP-hard, and cannot be solved exactly in polynomial time. Many exact and heuristic algorithms can be developed in the field of operations research to solve this problem. The problem is to find the shortest possible tour through a set of n cities so that each city is visited exactly once.

Genetic algorithm (GA)

Genetic algorithm (GA) as a computational intelligence method is a search technique used in computer science to find approximate

Solutions to combinatorial optimization problems. The genetic algorithms are more appropriately said to bean optimization technique based on natural evolution.They include the survival of the fittest idea algorithm.
The idea is to first “guess” the solutions and then combining the fittest solution to create a new generation of solutions which should be better than the previous generation. We also include a random mutation element to account for the occasional mishap. The genetic algorithm process consists of the following:

1. Encoding:

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A suitable encoding is found for the solution to our problem so that each possible solution has
unique encoding and the encoding is some form of a string.

2.Evaluation:

The initial population is then selected, usually at random though alternative techniques using heuristics have also been proposed. The fitness of each individual in the population is then computed that is, how well the individual fits the problem and whether it is near the optimum compared to the other individuals in the population.

3. Crossover:

The fitness is used to find the individual‟s probability of crossover. Crossover is where the two individuals are recombined to create new individuals which are copied into the new generation.

4. Mutation:

Next mutation occurs. Some individuals are chosen randomly to be mutated and then a mutation point is randomly chosen. The character in the corresponding position of the string is changed.

5. Decoding:

Once this is done, a new generation has been formed and the process is repeated until some stopping criteria has been reached. At this point the individuals which is closest to the optimum is decoded and the process is complete.

2. SOLUTION USING GENETIC ALGORITHM

A genetic algorithm can be used to find a solution is much less time. Although it might not find the best solution, It can find a near perfect solution for 100 city tour in less than a minute. There are a better than either parent couple of basic steps to solving the TSP using a GA.

First, create a group of many random tours in what is called a population. This algorithm uses a greedy initial population that gives preference to linking cities that are close to each other.

Second, pick 2 of the better (shorter) tours

Parents in the population and combine them to

make 2 new child tours. Hopefully, these children tour will be. A small percentage of the time, the child tours is mutated. This is done

to prevent all tours in the population from looking identical. The new child tours are inserted into the population replacing two of the longer tours. The size of the population remains the same. New children tours are repeatedly created until the desired goal is reached. The accuracy of solution in TSP

will depend upon factors such as :

- **Speed**
- **Population Size**

After comparing these factors in each solution the best one will be selected and hence will give the new shortest path in each iteration. The task of comparisons and then representing the solution in every iteration become complex with the increment in population size.

3. STEPS OF ALGORITHM

1. **[Start]** Generate random population of n chromosomes (suitable solutions for the problem)

2. **[Fitness]** Evaluate the fitness f(x) of each chromosome x in the population

3. **[New population]** Create a new population by repeating following steps until the new population is complete

i. **[Selection]** Select two parent chromosomes from a population according to their fitness (the better fitness, the bigger chance to be selected)

ii. **[Crossover]** with a crossover probability cross over the parents to form a new offspring (children). If no crossover was performed, offspring is an exact copy of parents.

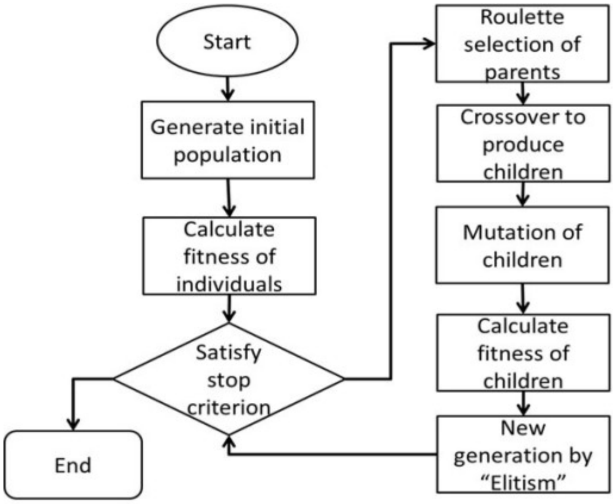
Iii. **[Mutation]** With a mutation probability mutate new offspring at each locus (position in chromosome).

iv. **[Accepting]** Place new offspring in a new population

4. **[Replace]** Use new generated population for a further run of algorithm

5. **[Test]** If the end condition is satisfied, stop, and return the best solution in current population

6. **[Loop]** Go to step 2


Start
Generate initial population
Calculate fitness of individuals
Satisfy stop criterion
End
Roulette selection of parents
Crossover to produce children
Mutation of children
Calculate fitness of children
New generation by "Elitism"

4. CONCLUSION

After going through various examples and execution of code applying genetic algorithm we observe that genetic algorithm is a fast way for finding an optimal tour. We can also solve this problem by using Branch and Bound algorithm or Brute force search or Heuristic approach but the genetic algorithm approach is much faster than these approaches.

5. REFERENCES

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