Addis Ababa Institute of Technology
School of Information Technology and Engineering
AI Assignment2 Report

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Submitted to Mr. Amanuel Negash

INTRODUCTION

Hill Climbing Algorithm is a local search algorithm which continuously moves in the direction of increasing elevation/value to find the peak of the mountain or best solution to the problem. It terminates when it reaches a peak value where no neighbor has a higher value.

Simulated Annealing Algorithm is a stochastic global search optimization algorithm.This means that it makes use of randomness as part of the search process. This makes the algorithm appropriate for nonlinear objective functions where other local search algorithms do not operate well.

Genetic Algorithm is a metaheuristic inspired by the process of natural selection that belongs to the larger class of evolutionary algorithms. Genetic algorithms are commonly used to generate high-quality solutions to optimization and search problems by relying on biologically inspired operators such as mutation, crossover and selection.

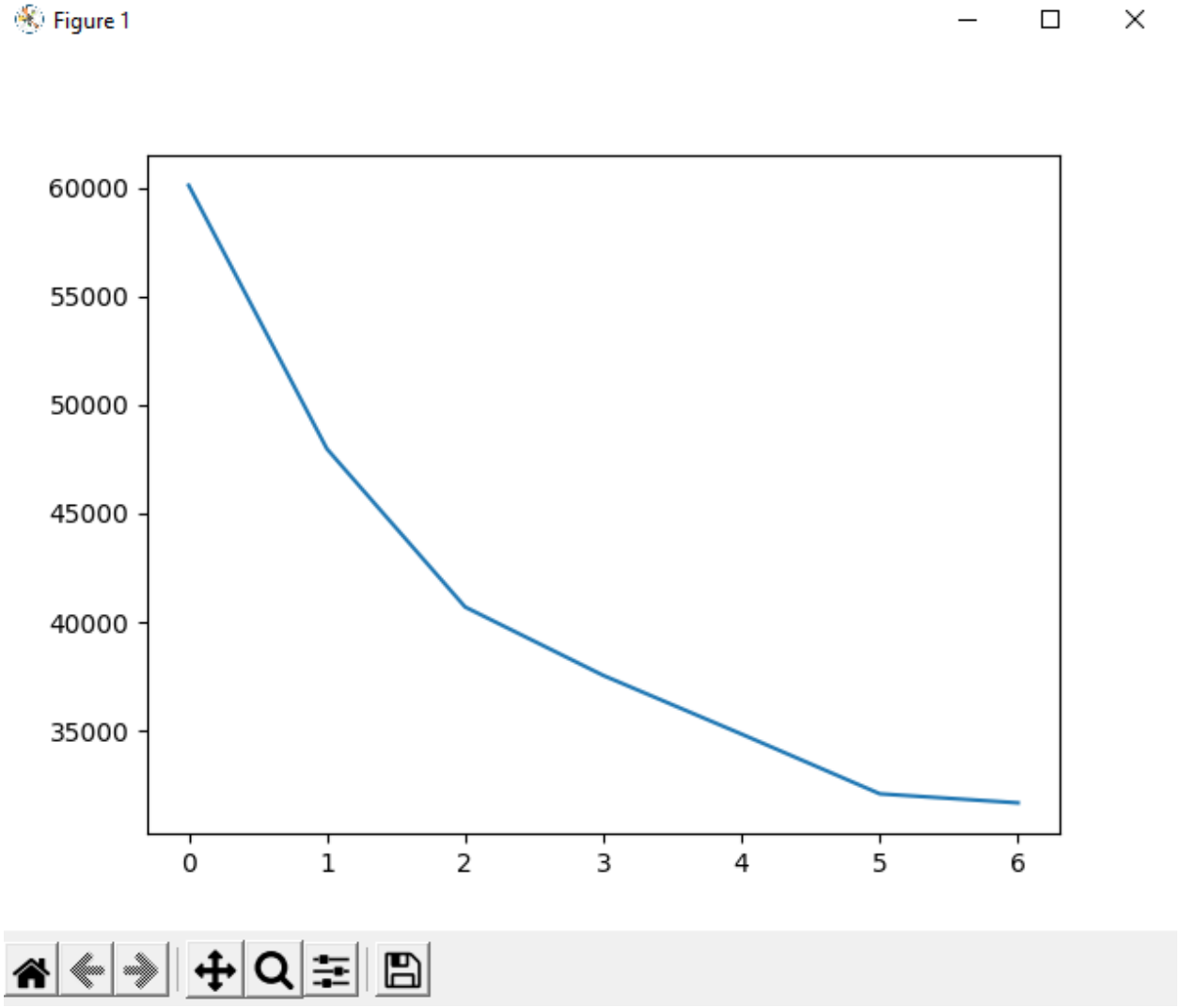
The Knapsack Problem is a problem in combinatorial optimization. Given a set of items, each with a weight and a value, determine the number of each item to include in a collection so that the total weight is less than or equal to a given limit and the total value is as large as possible.

The Traveling Salesman problem is an algorithmic problem tasked with finding the shortest route between a set of points and locations that must be visited.

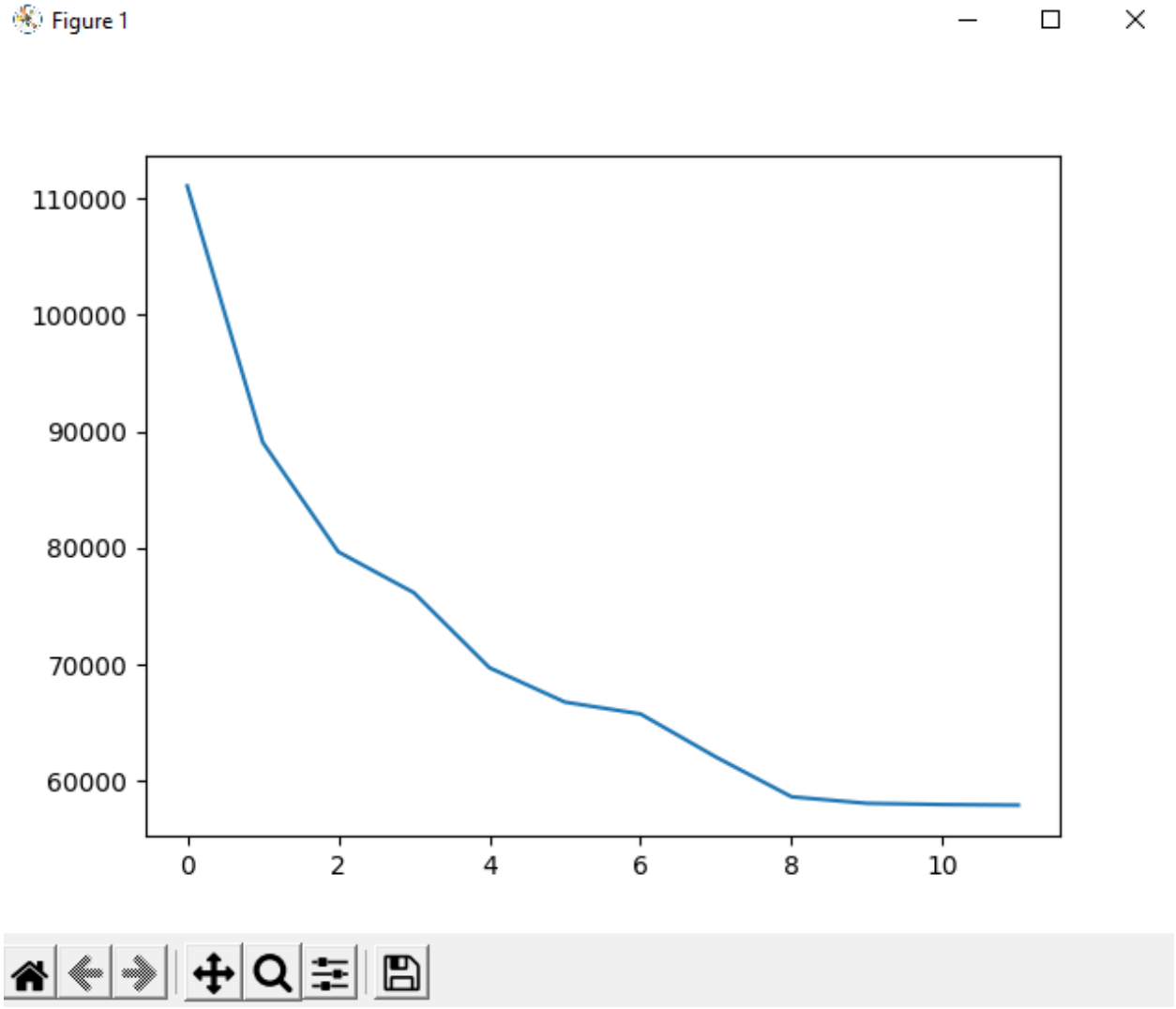
The Traveling salesman problems speed and performance analysis with the three algorithms

1. **Hill Climbing Algorithm**

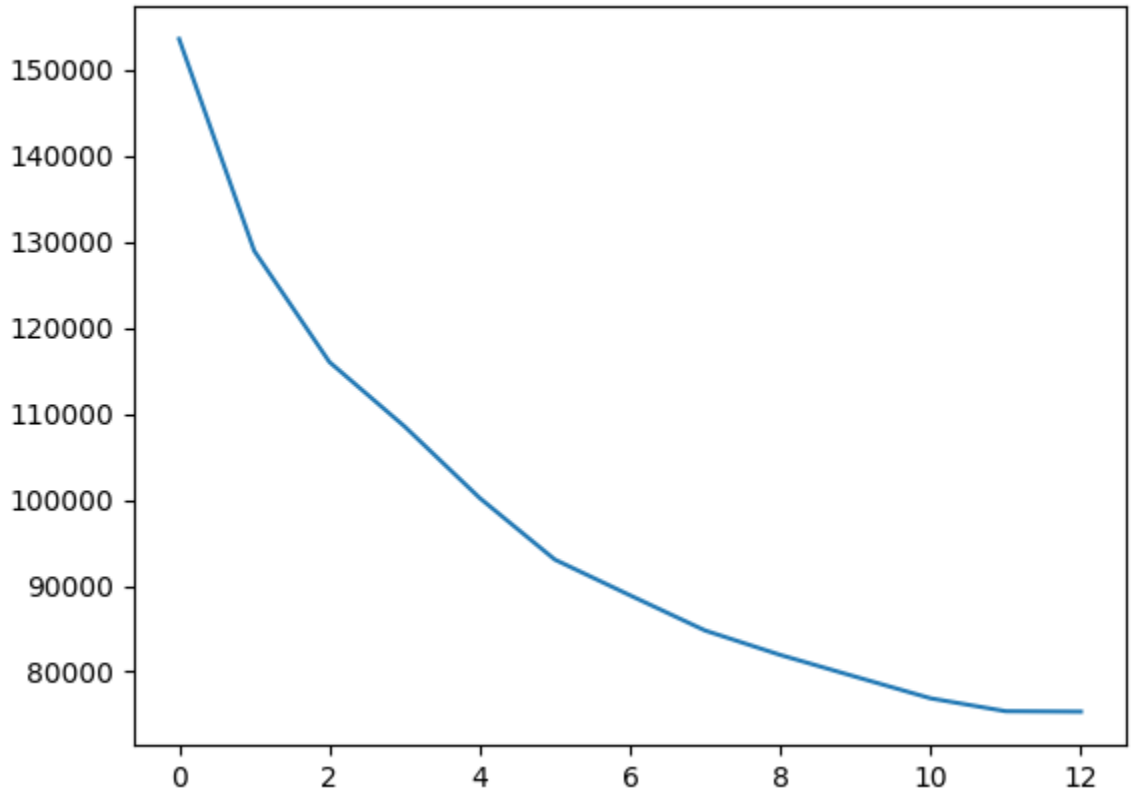
Traveling salesMan problem using Hill climbing algorithm on a graph containing 8 cities. This graph shows us that the hill-climbing algorithm only goes to the best possible neighbor to get the local minimum.



The following graph shows the Travelling salesman problem using hill climbing algorithm on 16 cities.



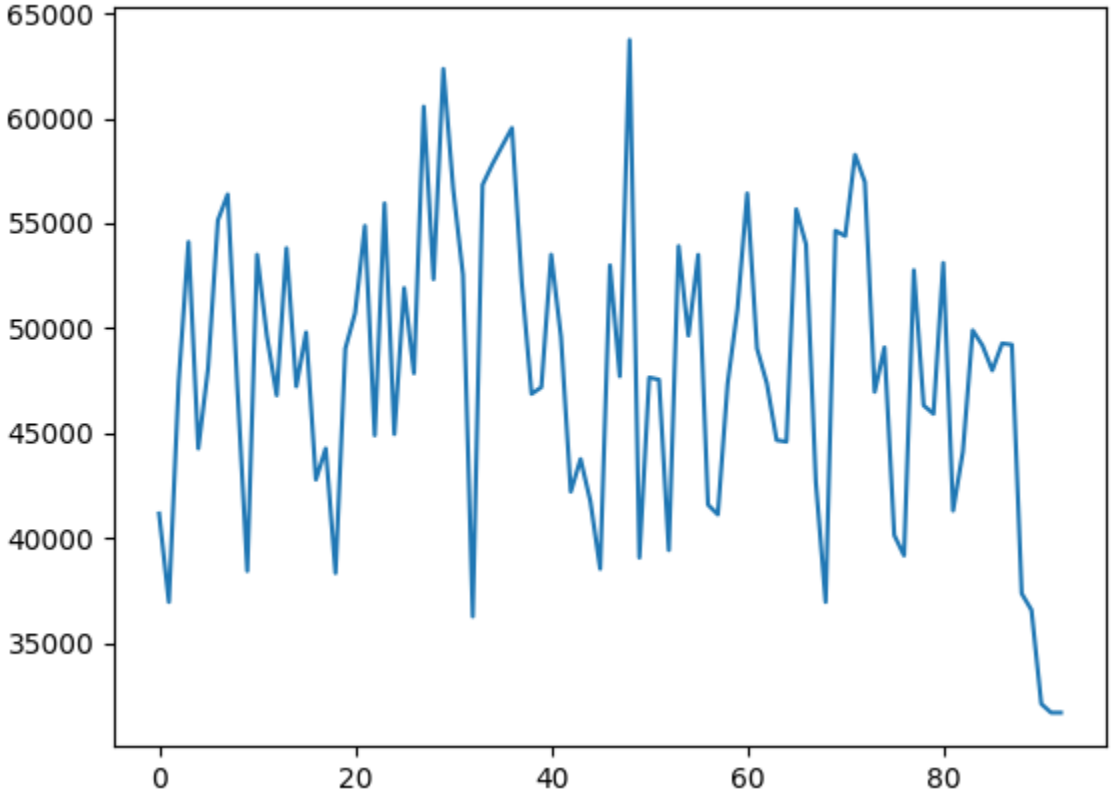
Traveling salesman problem using Hill climbing algorithm on 20 cities. This graph shows the hill climbing algorithm always goes up or down until it gets the local maximum or local minimum.



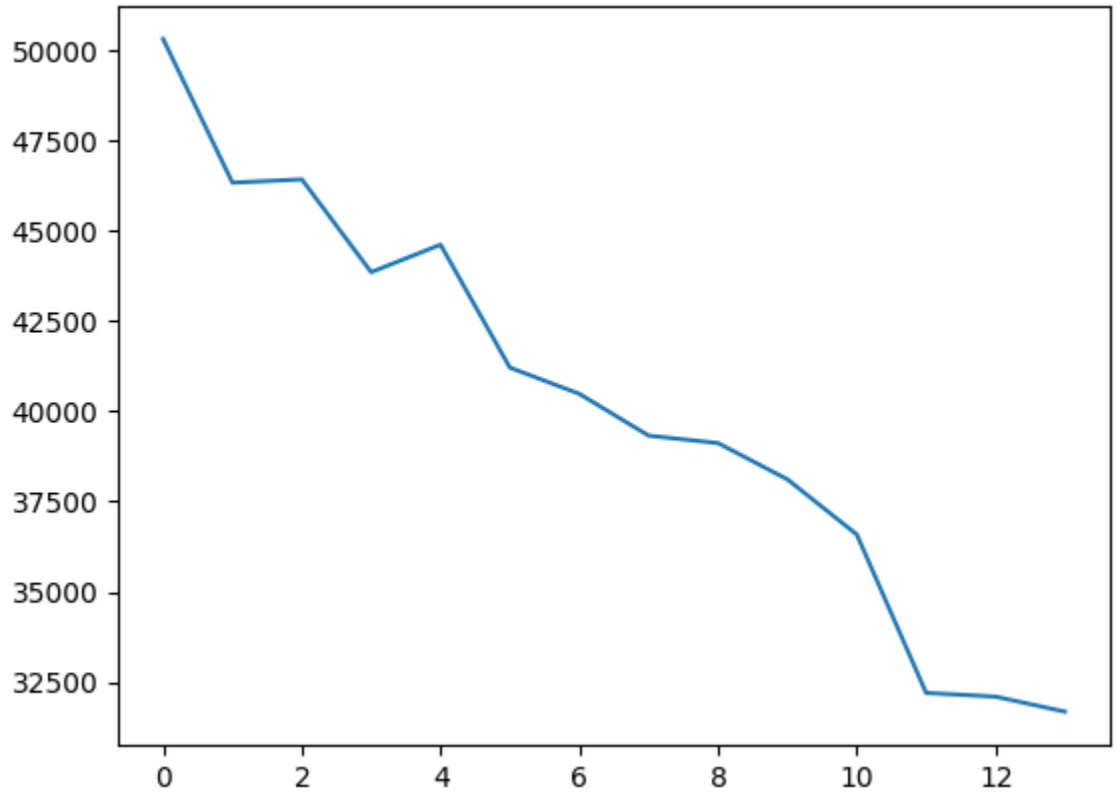
2. **Simulated Annealing Algorithm**

Traveling salesman problem using simulated annealing algorithm for 8 cities.

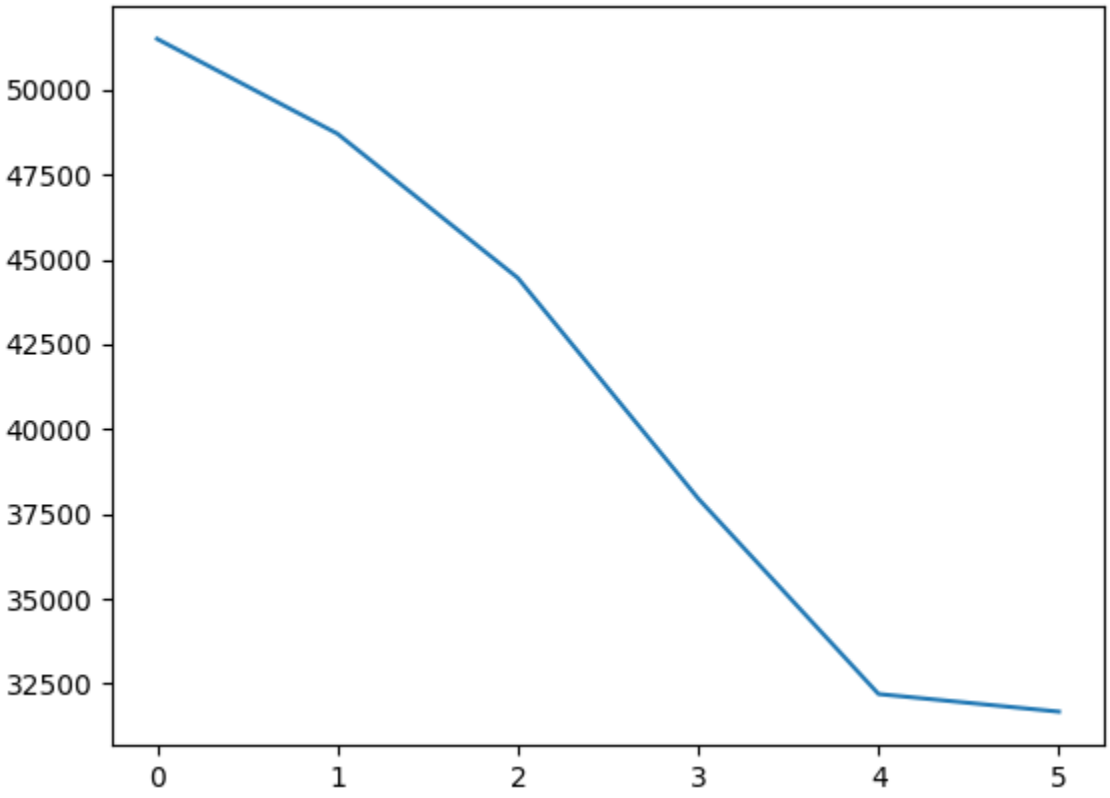
When T = 10000



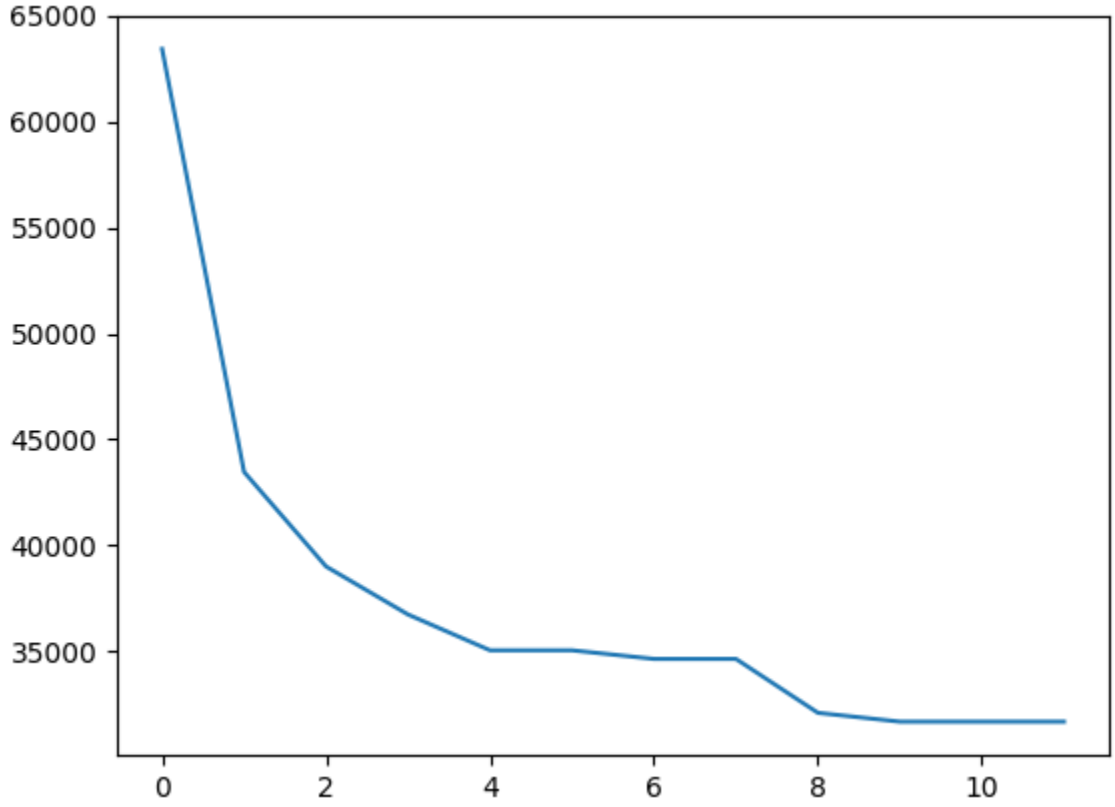
When T = 1000



When T = 100



When T = 10

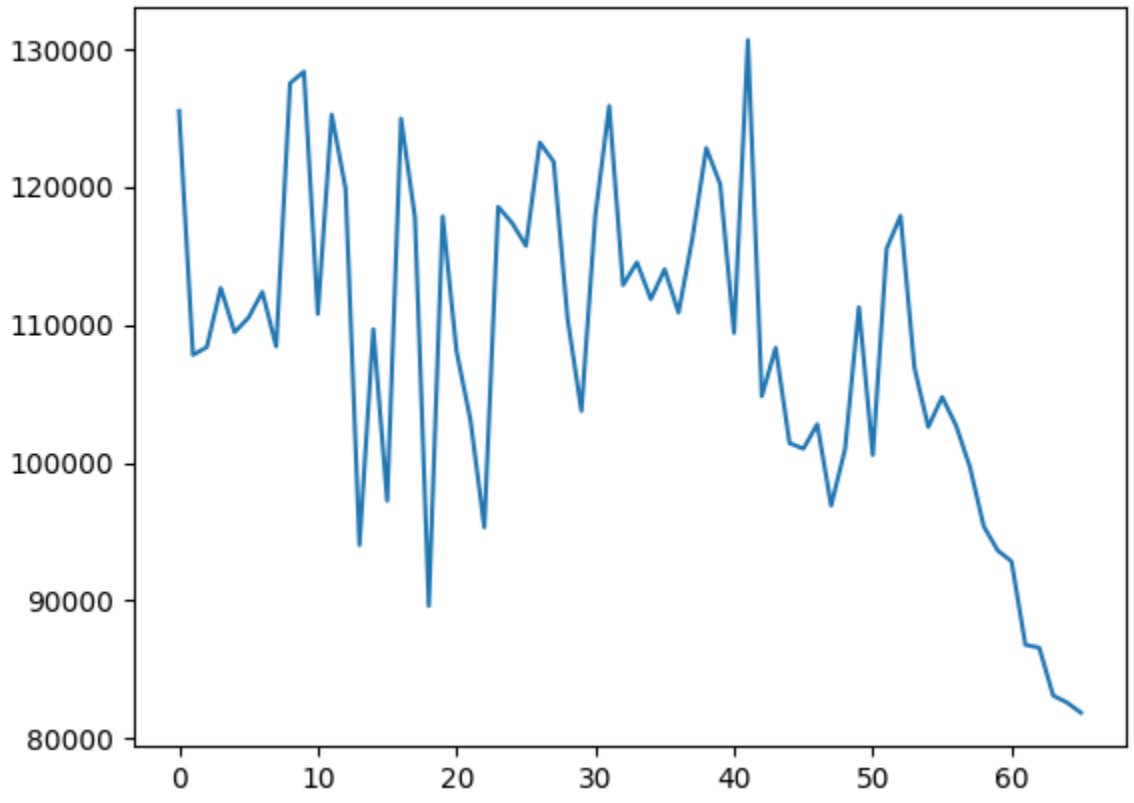


Summary

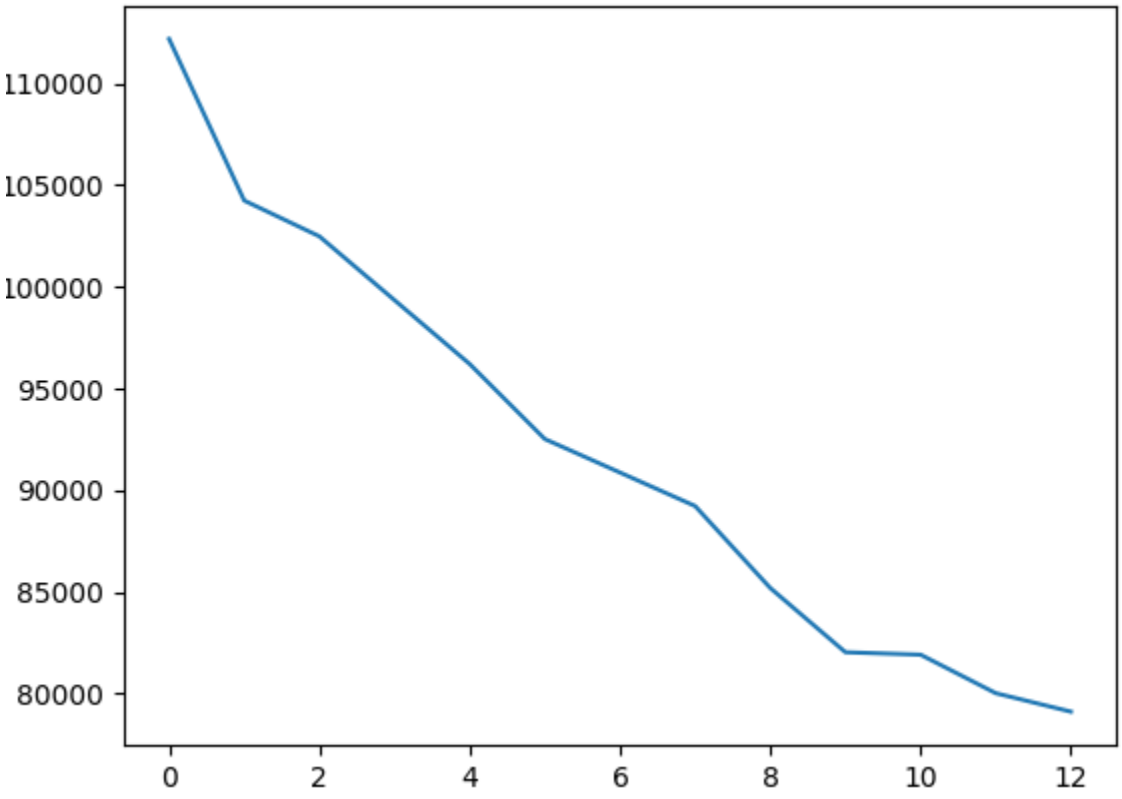
These graphs show us as we decrease T, The probability of accepting a worse solution will also decrease. That is why we got a decreasing graph.

Traveling salesman problem using simulated annealing algorithm for 16 cities.

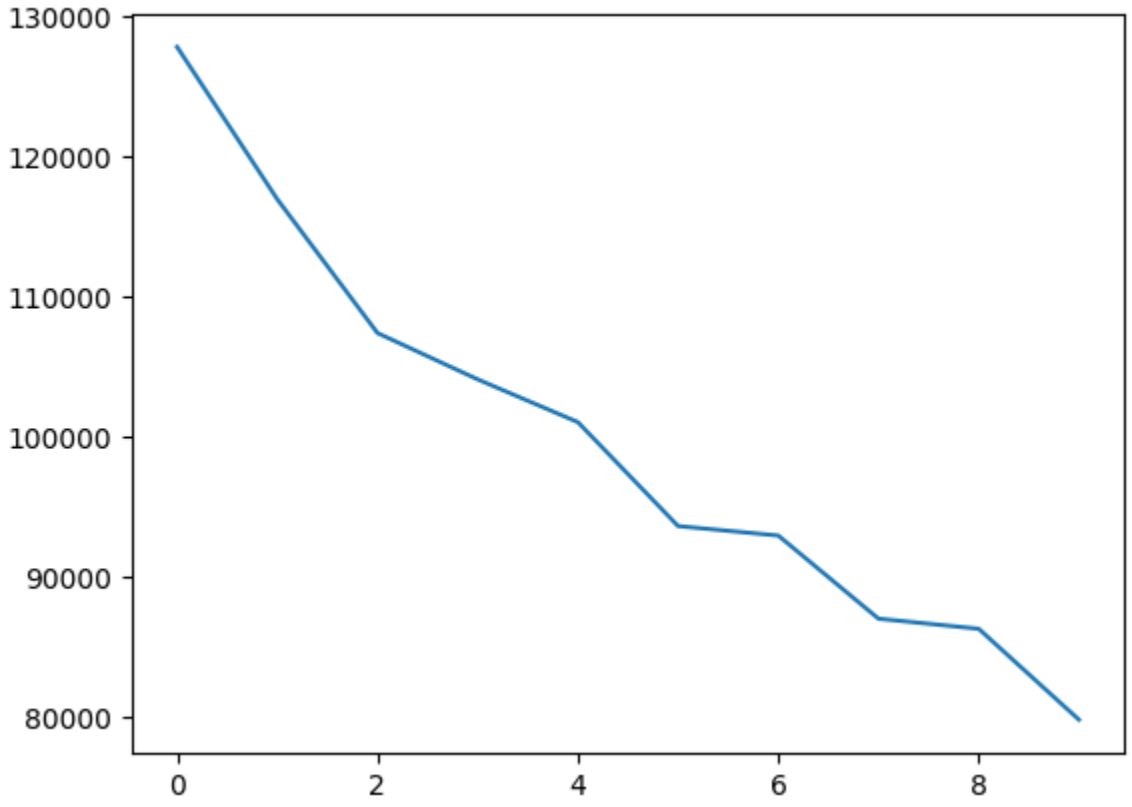
When T = 10000



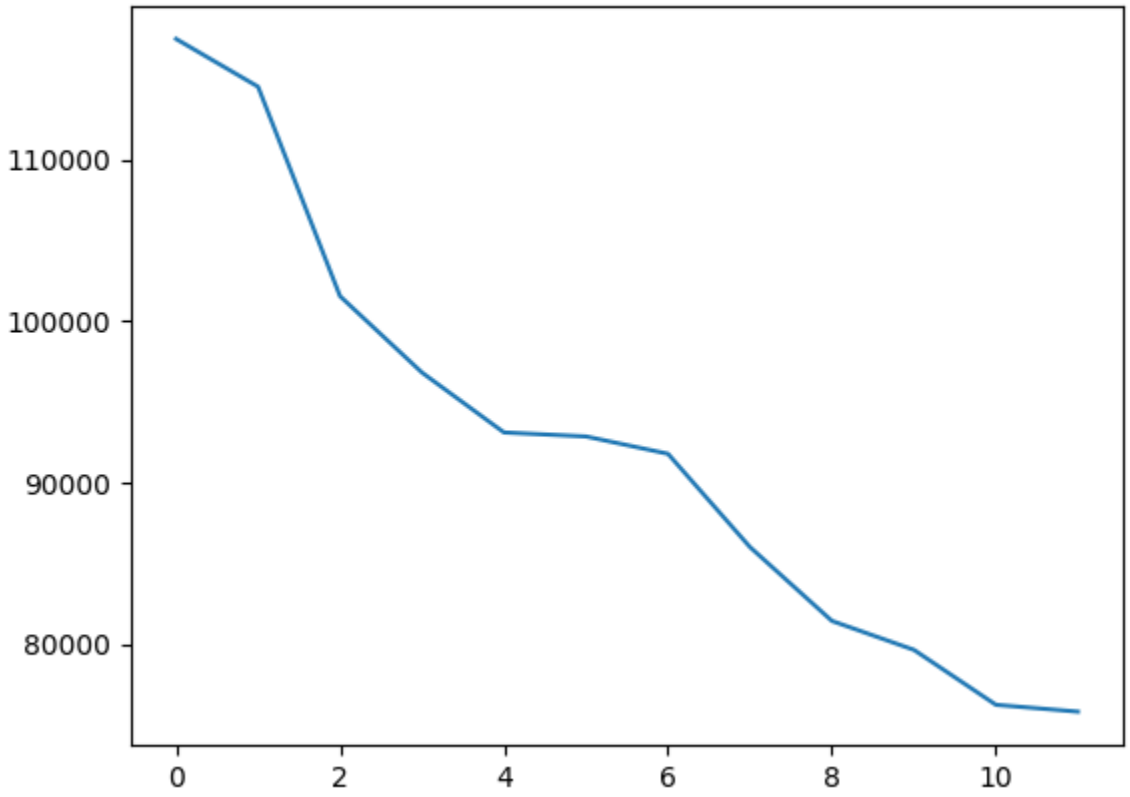
When T = 1000



When T = 100



When T = 10

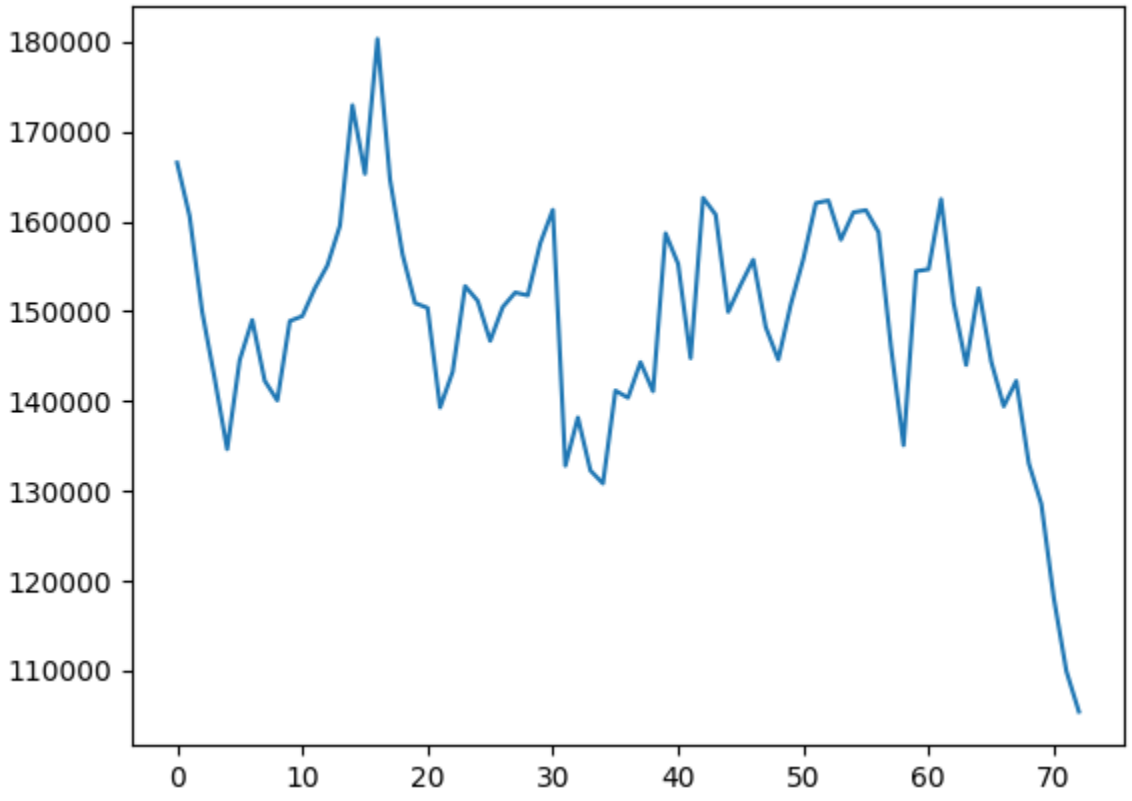


Summary

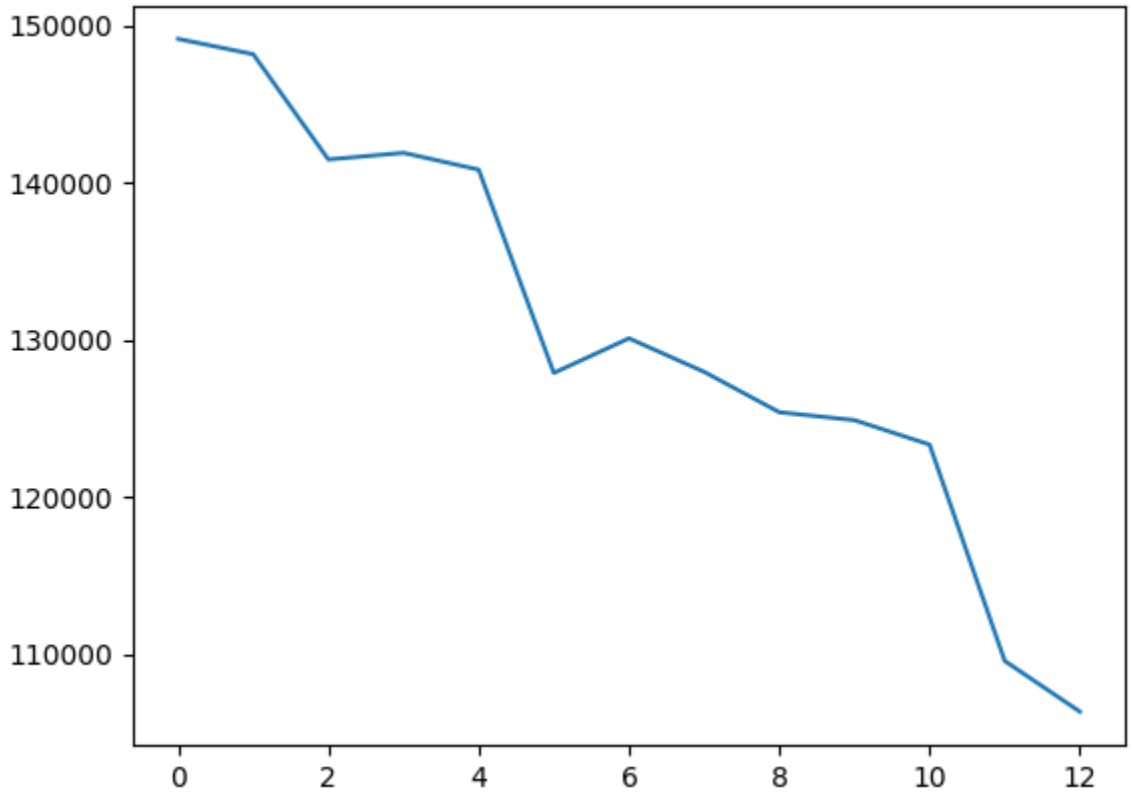
As we decrease the initial Temperature its probability to accept worse solutions will also decrease. Therefore the graph looks like a hill climbing algorithm graph.

Traveling salesman problem using simulated annealing algorithm for 20 cities.

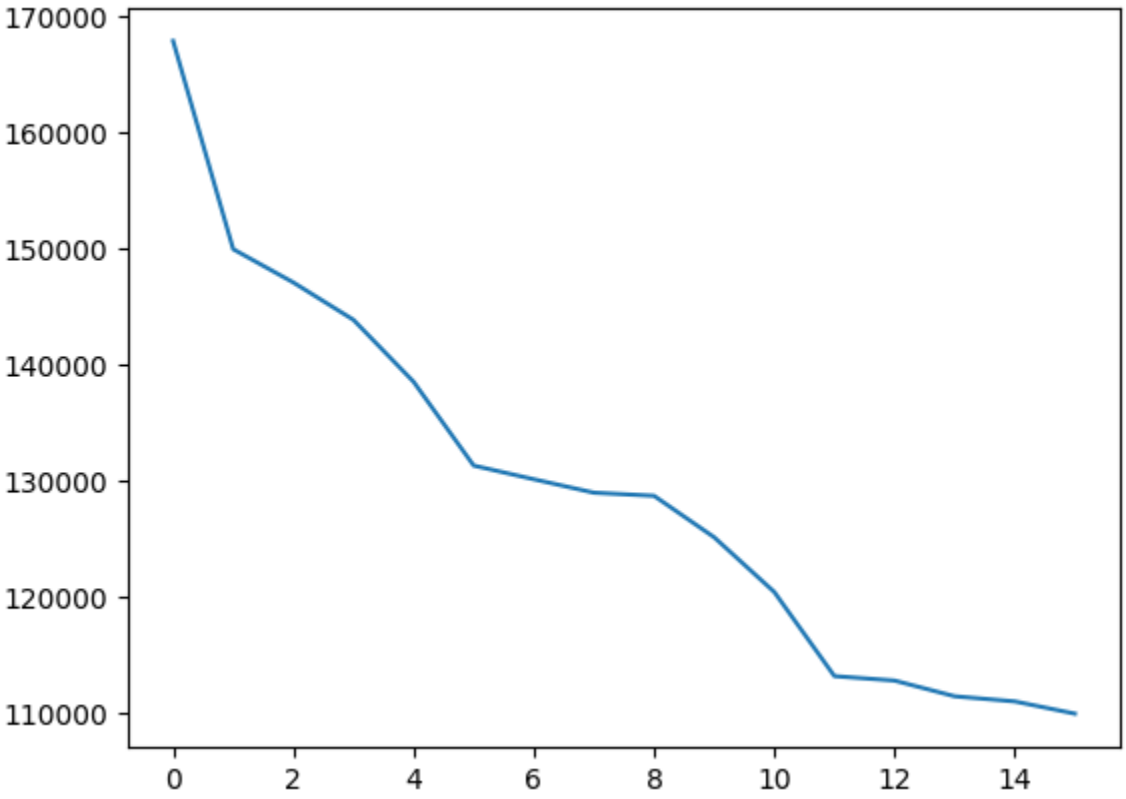
When T = 10000



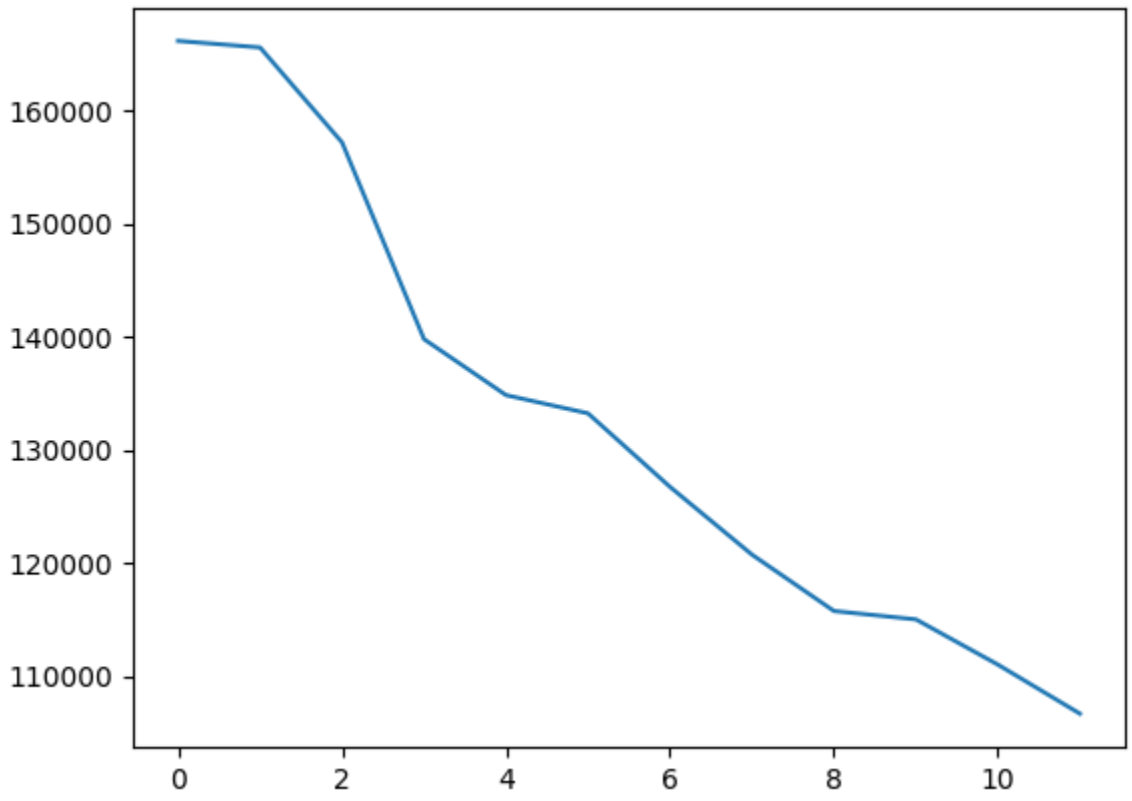
When T = 1000



When T = 100


170000
160000
150000
140000
130000
120000
110000
0
2
4
6
8
10
12
14

When T = 10



Summary

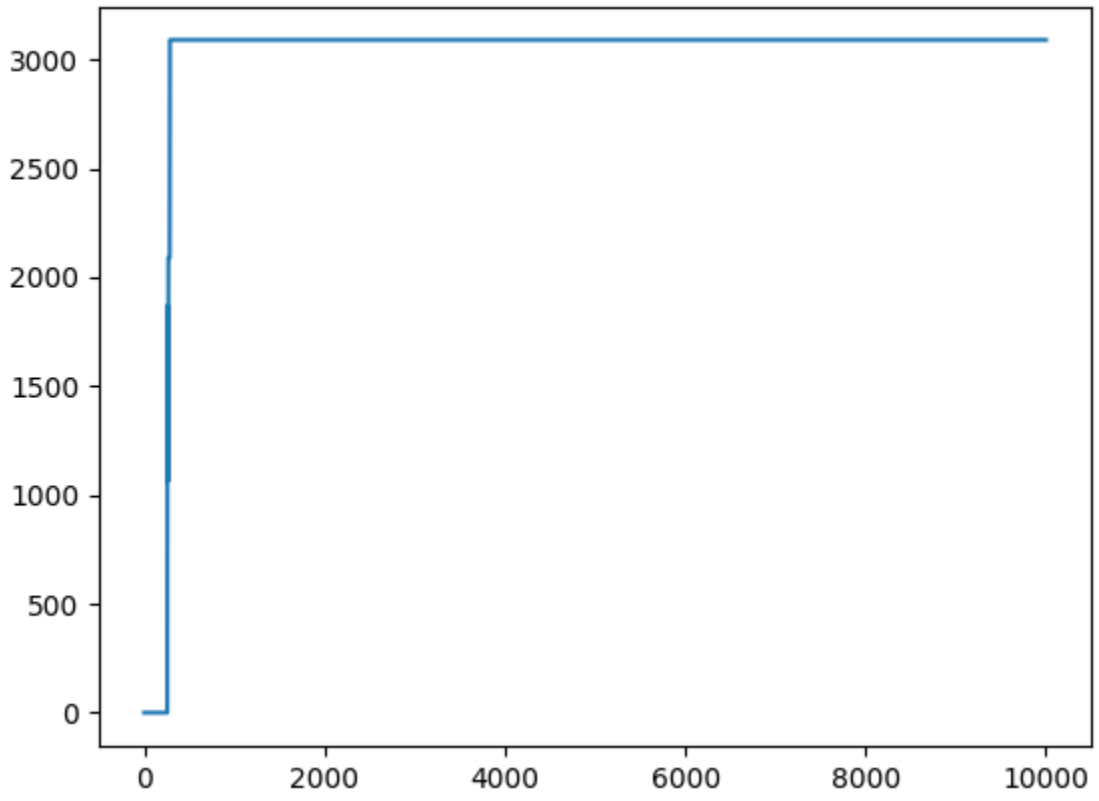
As we decrease the initial Temperature its probability to accept worse solutions will also decrease. Therefore the graph looks like a hill climbing algorithm graph.

The Knapsack problems speed and performance analysis with the three algorithms

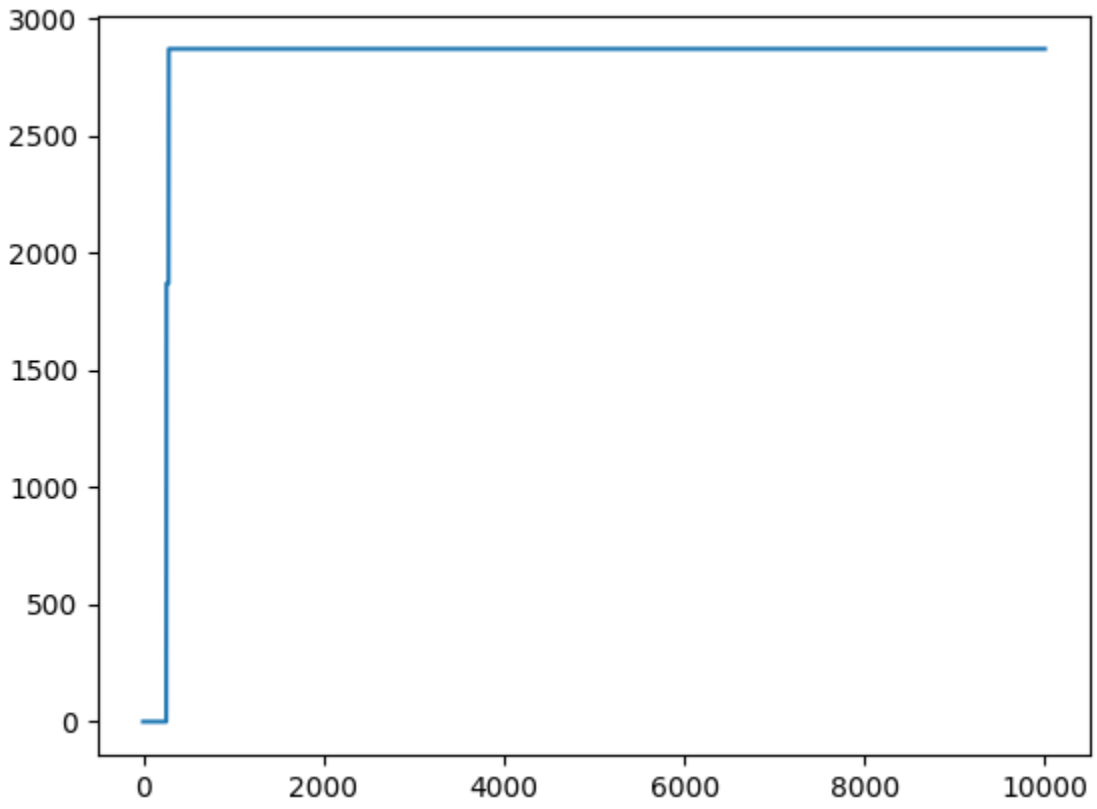
1. **Simulated Annealing Algorithm**

Simulated annealing algorithm for knapsack using for 10 Items and the maximum weight is 5kg

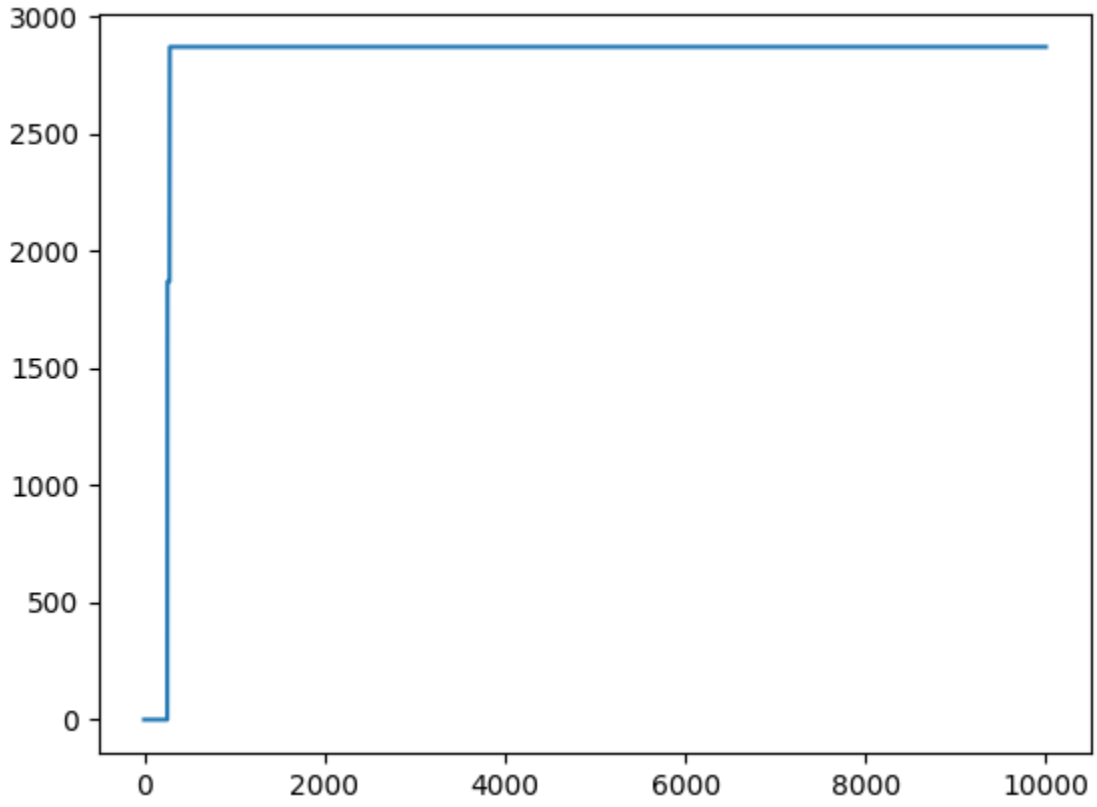
T = 10000



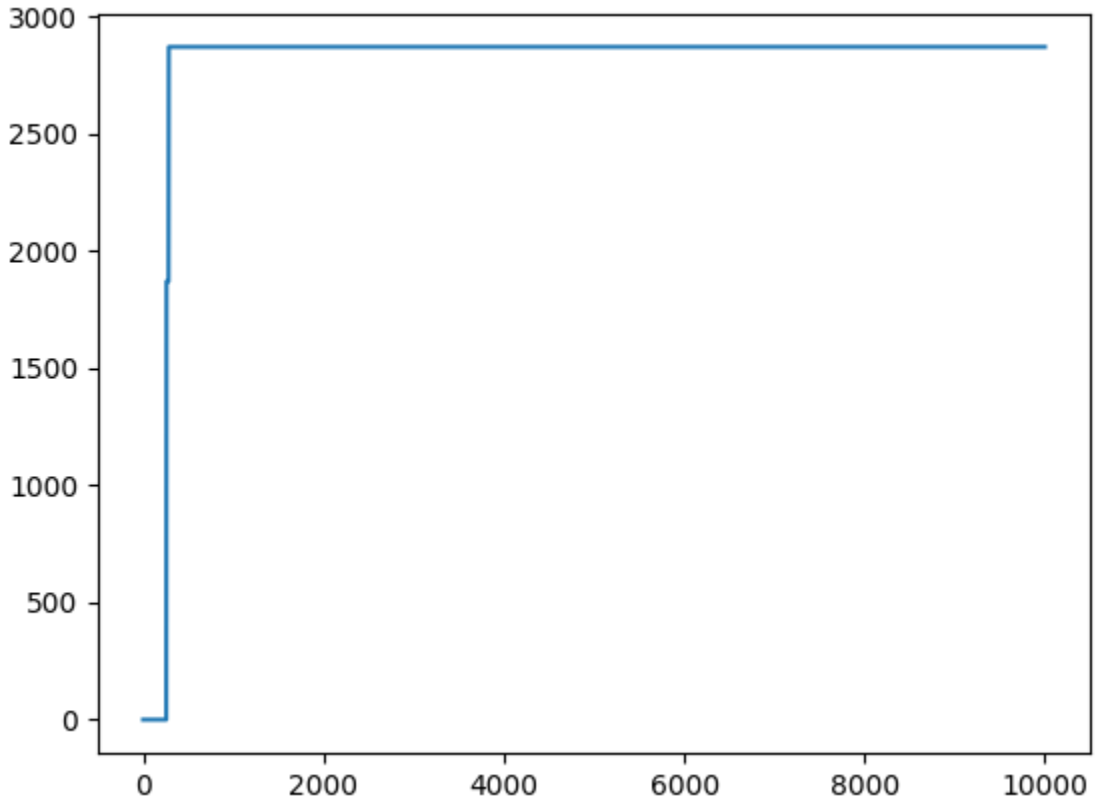
T = 1000



T = 100



T = 10

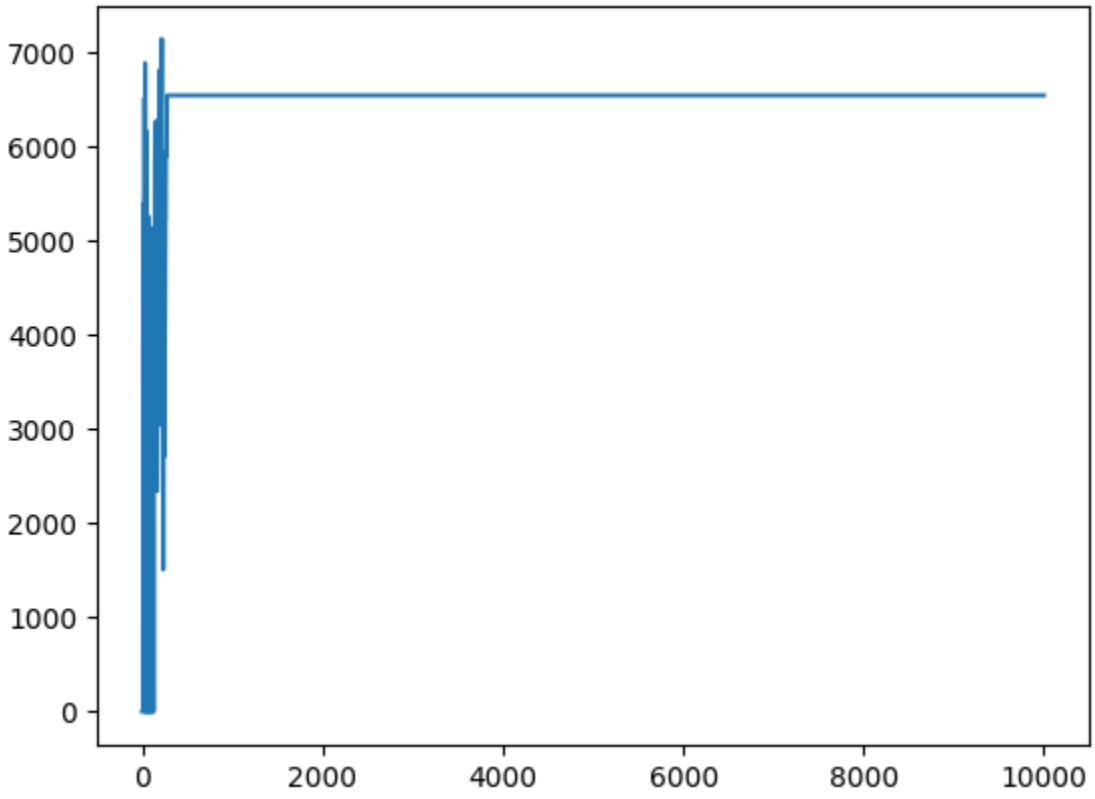


Summary

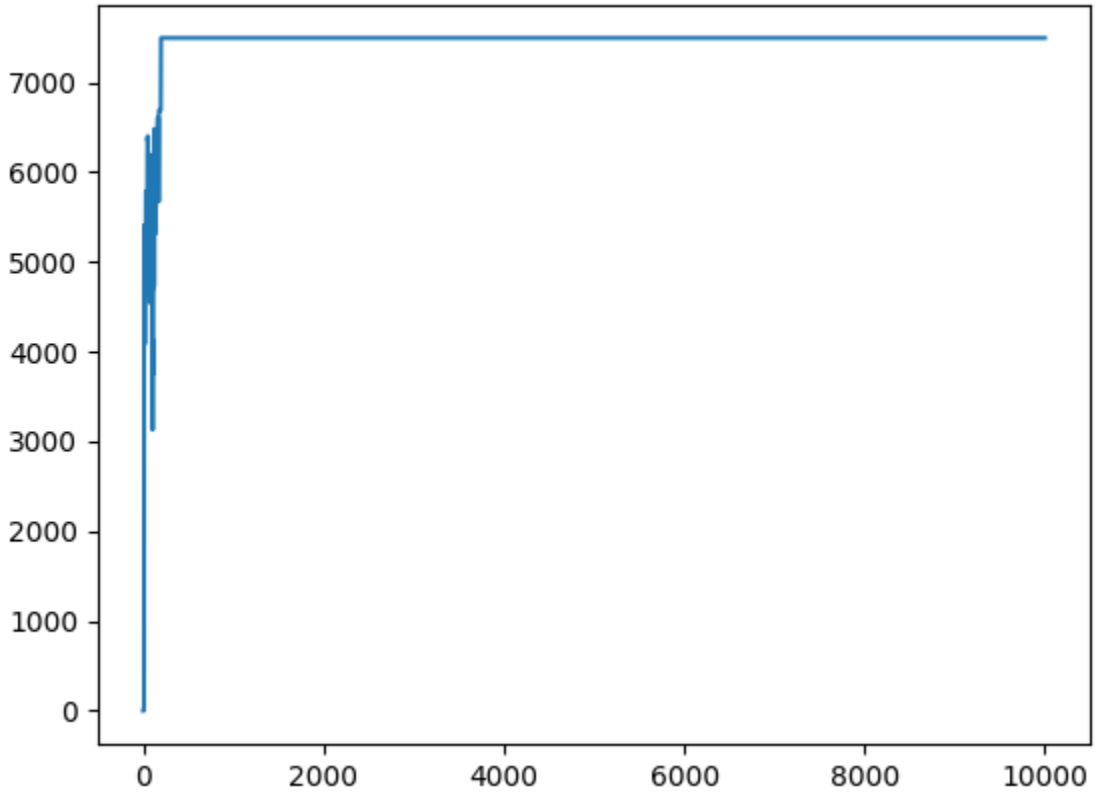
As we decrease the initial Temperature its probability to accept worse solutions will also decrease.

Simulated annealing algorithm for knapsack problem for 15 items and maximum weight is 50.

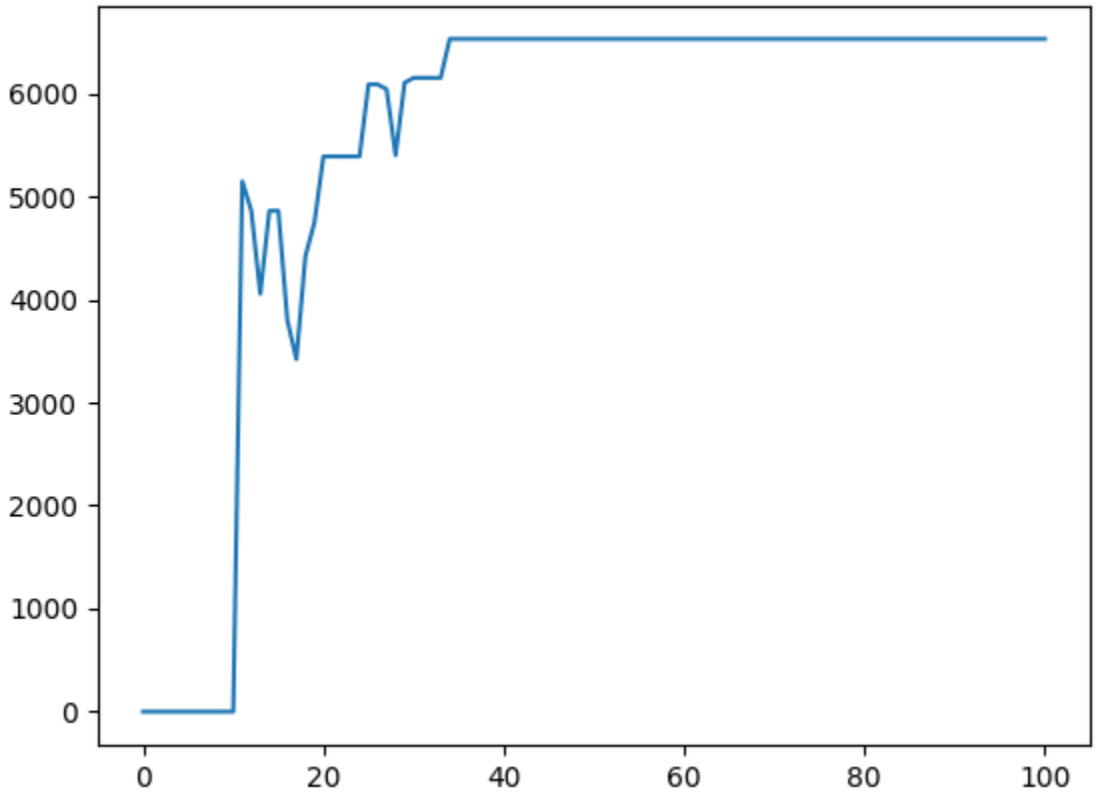
When T = 10000



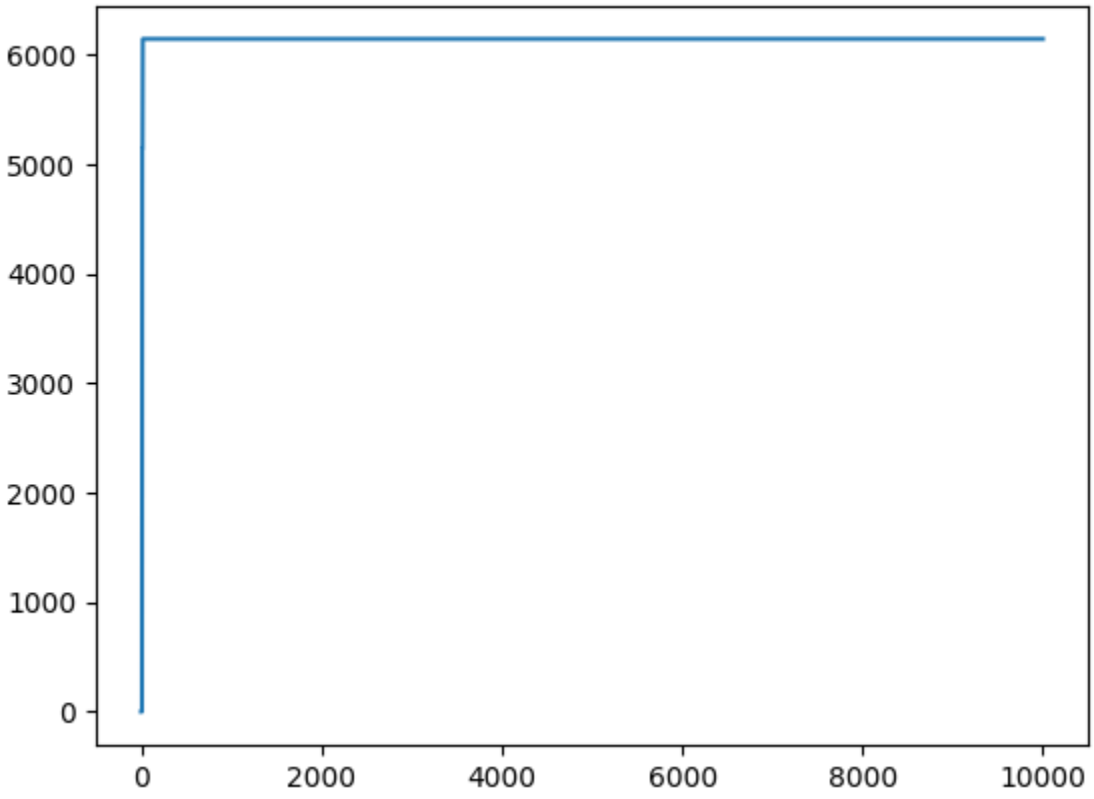
When T = 1000.


7000
6000
5000
4000
3000
2000
1000
0
0
2000
4000
6000
8000
10000

when T = 100



When T = 10

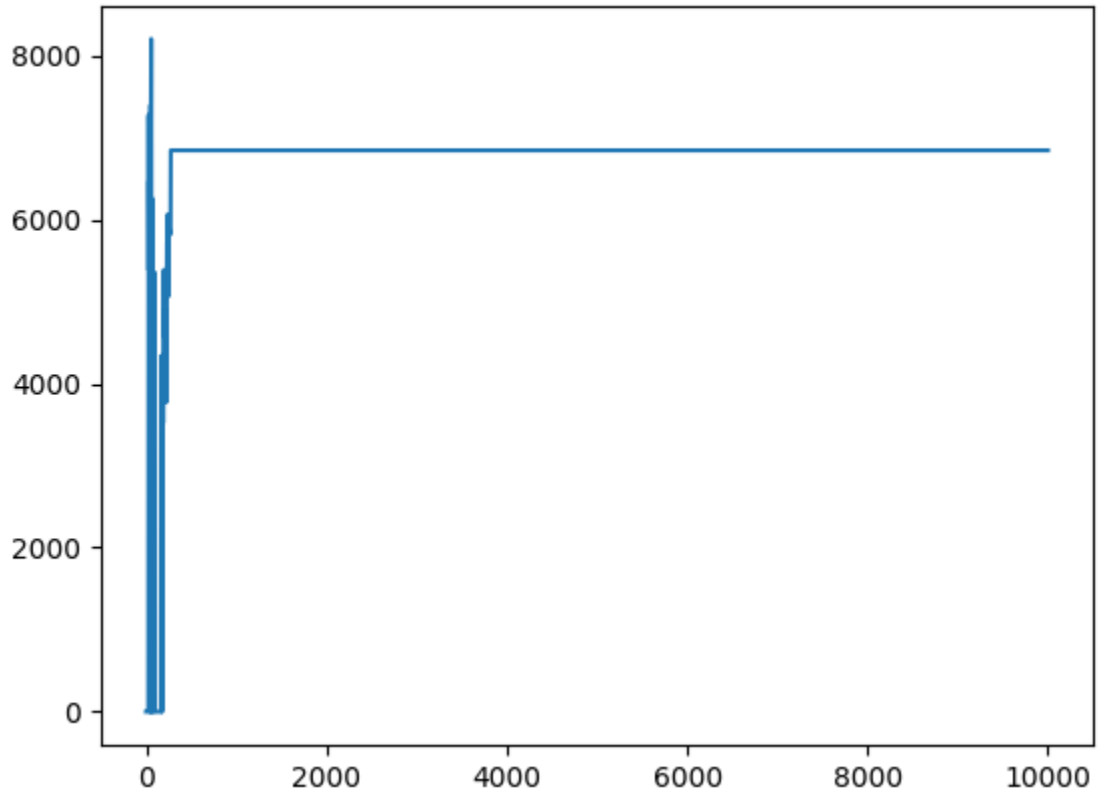


Summary

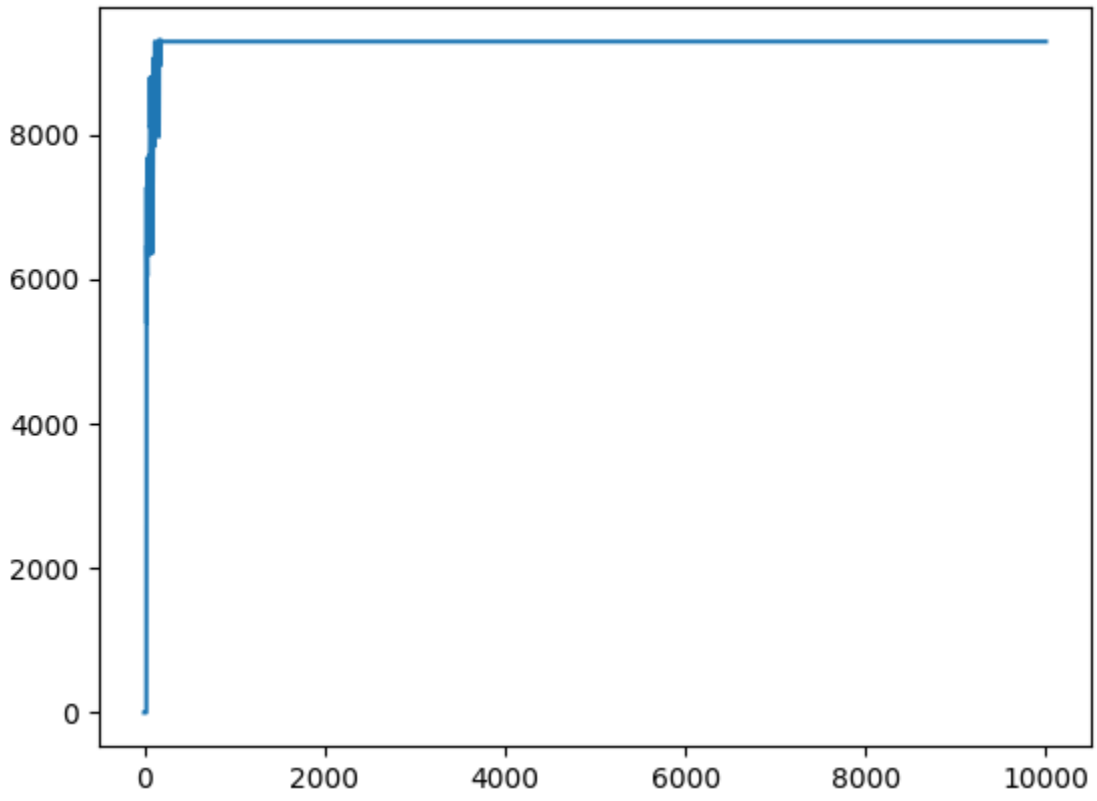
As we decrease the initial Temprature its probability to accept worse solutions will also decrease.

Simulated annealing algorithm for knapsack problem for 20 items and maximum weight is 60

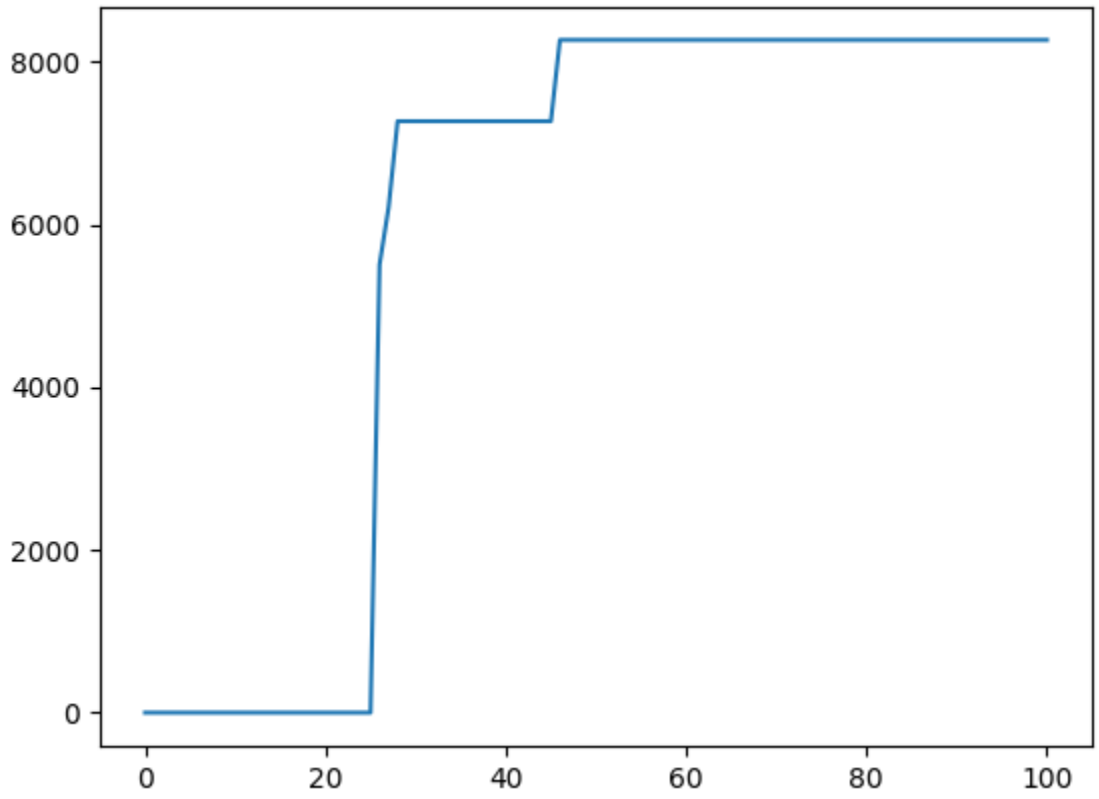
When T = 10000



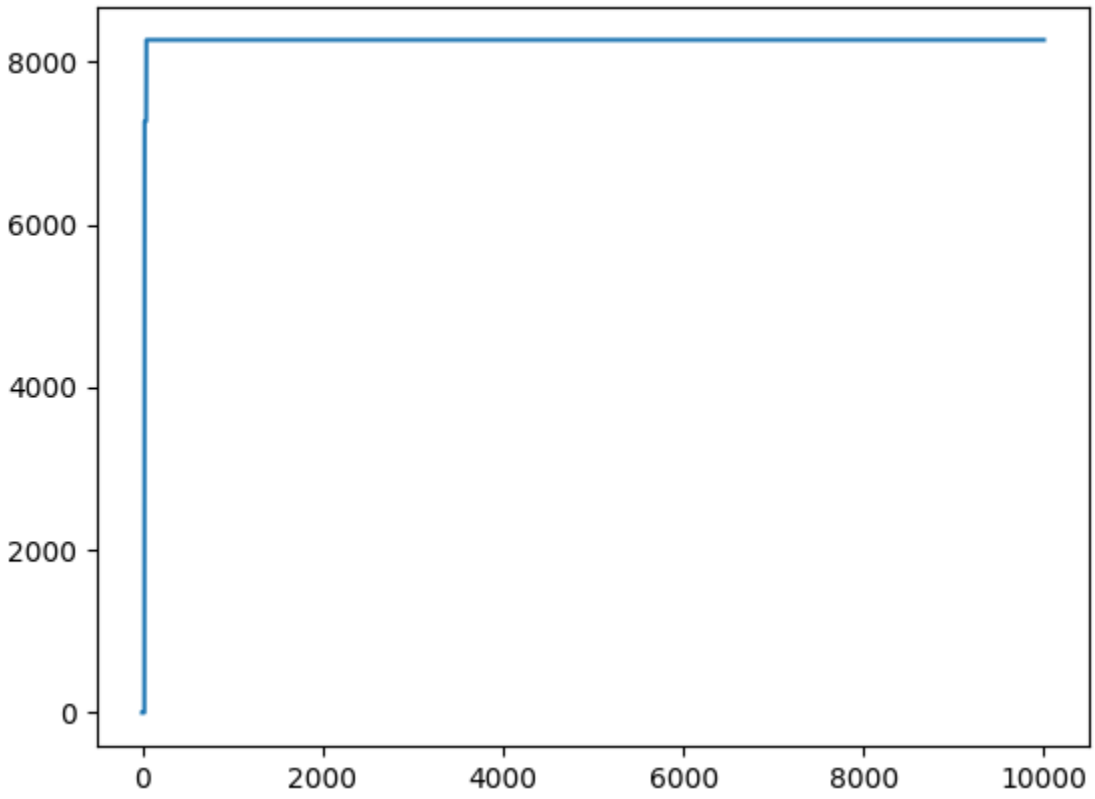
When T = 1000



When T = 100



When T = 10



Summary

As we decrease the initial Temperature its probability to accept worse solutions will also decrease.

REFERENCES

1. https://jamesmccaffrey.wordpress.com/2021/12/17/knapsack-problem-using-simulated-annealing-example/
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4. http://wikipedia.com