

Sample File for TSP_R00183770.py

System Requirement:

Not necessary but recommended: Windows 10 | i5 8th Gen | 8 GB Ram

The file can be executed from Command line

Steps to Run the file:

1. Download the zip file & extract it.
2. Go to cmd in folder where all files are extracted and run
 - a. python TSP_R00183770.py inst-4.TSP 1
 - b. python TSP_R00183770.py file_name config_number

```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.17763.805]
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E:\phalguni\MSc\Meta\Assignment 1\TSP_Project>python TSP_R00183770.py inst-4.TSP 1_
```

3. The expected output will be like this

```
C:\Windows\System32\cmd.exe
E:\phalguni\MSc\Meta\Assignment 1\TSP_Project>python TSP_R00183770.py inst-4.TSP 1
Times: 1
Best initial sol: 21924290.985046357
Iteration: 2 Best: 21808103.50707064
Iteration: 4 Best: 21768405.636761744
Iteration: 4 Best: 21338033.27250617
Iteration: 11 Best: 21218358.74459059
Iteration: 49 Best: 21191642.40160475
Iteration: 99 Best: 21024202.635013014
Iteration: 127 Best: 20835251.22981754
Population: 100
Mutation Rate: 0.1
Total iterations: 500
Best Solution: 20835251.22981754
Time Taken: 3.8221354166666667
Times: 2
Best initial sol: 21503891.491318874
Iteration: 10 Best: 21236955.31964088
Iteration: 20 Best: 21204974.499180857
Iteration: 159 Best: 20884574.365966644
Iteration: 331 Best: 20754820.01226398
Iteration: 336 Best: 20637985.562615782
Iteration: 567 Best: 20566836.455209322
Population: 100
Mutation Rate: 0.1
Total iterations: 600
Best Solution: 20566836.455209322
Time Taken: 4.765625
Times: 3
Best initial sol: 22471470.96420692
Iteration: 0 Best: 22430912.626384735
Iteration: 0 Best: 21738607.24451661
Iteration: 0 Best: 21565858.87253233
Iteration: 2 Best: 21562963.292045265
Iteration: 9 Best: 21561667.232284777
Iteration: 25 Best: 21501069.44708682
Iteration: 35 Best: 21350370.15082761
Iteration: 66 Best: 20981142.571116127
Population: 100
Mutation Rate: 0.1
Total iterations: 700
Best Solution: 20981142.571116127
Time Taken: 5.7885416666666666
Times: 4
Best initial sol: 22096109.929296587
Iteration: 2 Best: 21845318.43308222
Iteration: 8 Best: 21664985.970508706
Iteration: 11 Best: 21512217.170861136
Iteration: 15 Best: 21340361.472092703
```

```
C:\Windows\System32\cmd.exe
Iteration: 23 Best: 21214478.665923614
Iteration: 60 Best: 21139575.685156275
Iteration: 267 Best: 21053727.715909075
Population: 100
Mutation Rate: 0.1
Total iterations: 500
Best Solution: 21053727.715909075
Time Taken: 3.2721354166666665
Times: 5
Best initial sol: 22151991.540771075
Iteration: 0 Best: 22074534.177677248
Iteration: 1 Best: 22063626.744677268
Iteration: 1 Best: 21825126.307503253
Iteration: 9 Best: 21791516.938674107
Iteration: 11 Best: 21678965.395274296
Iteration: 19 Best: 21570878.839312002
Iteration: 30 Best: 21271373.297988795
Iteration: 94 Best: 21237349.226936795
Iteration: 204 Best: 21231114.623642486
Iteration: 279 Best: 20428427.473214477
Population: 100
Mutation Rate: 0.1
Total iterations: 600
Best Solution: 20428427.473214477
Time Taken: 4.9890625
Times: 6
Best initial sol: 22318886.95469726
Iteration: 0 Best: 22128238.024555456
Iteration: 1 Best: 22127317.374498017
Iteration: 1 Best: 21877975.859144464
Iteration: 1 Best: 21401836.860423766
Iteration: 31 Best: 21349013.449740898
Iteration: 45 Best: 21305182.482290372
Iteration: 62 Best: 21268515.146089725
Iteration: 69 Best: 21204108.450823437
Iteration: 79 Best: 21007836.994112417
Iteration: 87 Best: 20688950.840235054
Iteration: 415 Best: 20600709.118170924
Population: 100
Mutation Rate: 0.1
Total iterations: 700
Best Solution: 20600709.118170924
Time Taken: 5.84765625

E:\phalguni\MSc\Meta\Assignment 1\TSP_Project>
```

4. Along with this, an output file is also generated and is expected to be in the same folder where this program is.
 - a. Filename nomenclature: "inputFilename_Config_givenConfigNumber.txt"
5. File generated after running above config is also attached in zip file as sample, look for "inst-4.TSPConfig_1.txt"

Additions & Changes to Skeleton Code

1. Added 3 new class variables,
 - a. `_config/Self.config` : `_config` to take the configuration from user for executing it
 - b. `Self.choice` : It chooses between Random(1) or Heuristic(2) Initialization. It's updated according to config selected by user.
 - c. `self.fit_parents_list` : list to store the new pool of fittest parents among all via SUS
2. Added a if-elif conditions to choose the set of functions according to users config.
3. Added `self.minimization()`: To calculate minimized & normalized fitness. This is called in SUS function.
4. Default Values Given:
 - a. Iterations = 500
 - i. It is increased till 700 by incrementing +100 after in each iterations and resets at 4th Run(Times) to 500 again
 - ii. If config selected has "Heuristic function" then, incrementing & keeping 500 for all iterations
 - b. Pop = 100 for Config(1-6) and Pop = 50 for Config 7,8
 - i. It is set to pop = 200 at 4th Run for Config 1-6
 - ii. No changes for Config 7,8
 - c. MutRate = 0.1
 - i. It resets to mutRate = 0.5 at 4th Run for all configs
5. Added code to create a file to save output for future use
 - a. Filename nomenclature: "inputFilename_Config_givenConfigNumber.txt"
 - b. File is saved in the same folder as the TSP_R00183770.py file exists.

Issues

- The program is taking 5-10 hours for running the dataset of 823 cities for a single run of 500 iterations & 50 population
- The suspected reason for this is either the SUS Code or Heuristic Code.
- SUS Code when running with Random initialization is taking reasonable time (< 1 hour, in general)
- But SUS Code when running with Heuristic function is taking massive time (>5 hours)
- Also, tried running heuristic with Random Selection and it is still taking a lot of time (>3.5 -10+ hours)
- With above experience I estimate the reason is the Heuristic Code.

- Upon Investigation of the Heuristic code, it is found that it have multiple nested loops which could be the reason for the increased time complexity coupled with huge datasets, it is taking so long time.
- I have included results from both for Both SUS + Heuristic as well as Random + Heuristic.
- SUS+Random can be compared & checked with Config 1-6