ADVANCED ALGORITHMS 2021-2022

Assignment 2 - Traveling Salesman Problem

Data limite: lunedì, 16 maggio 2022, 23:59

General Description

In this assignment you are asked to solve an intractable problem and to compare the executi
that can be obtained with different approximation algorithms. The problem to be analyzed is
defined as follows: given the coordinates x, y of$N$ points in the plane (the vertices), and a we
of points (the arcs), find the simple loop of minimum weight that visits all the N points. The v
Euclidean or Geographic distance between the points u and v (you can find details on how to
description) . The weight function is symmetric and respects the triangular inequality.

Algorithms

The algorithms to implement are from two categories: (1) constructive heuristics; and (2) 2-ap

1. **Constructive heuristics:** choose *two* of the following constructive heuristics and imple
   Insertion, Farthest Insertion, Random Insertion, Cheapest Insertion.
2. **2-approximate algorithm:** Implement the 2-approximate algorithm based on the min

Dataset

The dataset contains 13 graphs, some from real test cases and some randomly generated. It
is in the file tsp_dataset.zip.

The first lines of each file contain some information about the instance, such as the number
the type of coordinates: Euclidean (EUC_2D) or Geographic (GEO). As an example the first line

```
NAME : eil51
```

```
COMMENT : 51-city problem (Christofides/Eilon)
TYPE : TSP
DIMENSION : 51
EDGE_WEIGHT_TYPE : EUC_2D
NODE_COORD_SECTION
1 37 52
2 49 49
3 52 64
4 20 26
...
```

The lines after NODE_COORD_SECTION contain the vertices of the graph: each line includes a
x and y coordinates which. The three values are separated by spaces.

The following table summarizes some statistics of the dataset:

File	Description	N	Optimal solution
burma14.tsp	Burma (Myanmar)	14	3323
ulysses16.tsp	Mediterranean Sea	16	6859
ulysses22.tsp	Mediterranean Sea	22	7013
eil51.tsp	Synthetic	51	426
berlin52.tsp	Germany	52	7542
kroD100.tsp	Random	100	21294
kroA100.tsp	Random	100	21282
ch150.tsp	Random	150	6528
gr202.tsp	Europe	202	40160
gr229.tsp	Asia/Australia	229	134602
pcb442.tsp	Drilling	442	50778
d493.tsp	Drilling	493	35002
dsj1000.tsp	Random	1000	18659688

Input handling and distance computation

- **GEO format:** the x coordinate is the latitude, the y coordinate is the longitude
  - convert x, y coordinates to radians using the code specified in the TSPLIB FAQ (Q: I get w
    The formula uses the integer part of x and y (DOES NOT ROUND TO THE NEAREST INTEG
  - compute the geographic distance between points i and j using the FAQ code for "dij". Th
    distances (does not round).
- **File in EUC_2D format:** No coordinate conversions are needed in this case. Calculate the E
  the nearest integer.

Question 1

Run the three algorithms (the two constructive heuristics and 2-approximate) on the 13 grap
table like the one below. The rows in the table correspond to the problem instances. The colu
of the approximate solution, the execution time and the relative error calculated as $\frac{Approxim}{}$

Instance	Constructive Heuristic 1			Constructive Heuristic 1			
	Solution	Time	Error	Solution	Time	Error	Solutio
burma14.tsp							
ulysses22.tsp							
eil51.tsp							
kroD100.tsp							
gr229.tsp							
d493.tsp							
dsj1000.tsp							

Question 2

Comment on the results you have obtained: how do the algorithms behave with respect to th
that always manages to do better than the others with respect to the approximation error? W
implemented is more efficient?

What to deliver

- A brief report on your project. The report must contain:
  - an introductory section with a description of the algorithms and implementation choices
  - the table with the results and the answers to the two questions;
  - any originality you introduced in the implementation;
  - a concluding section with your comments and your conclusions on results.
- The source code of the implementation in a single archive file (.zip, .tar.gz, etc.).

How to submit the assigment

- You can do the assigment either on your own or in a group of up to three people.
- You have to create a group even if you do the assigment on your own.
- The second assigment must be delivered by **Monday 16 May, 11:55 pm**. Late submissions

Final remarks

- You can implement the algorithms with any programming language you like. Basic data str
  dictionaries or maps, provided by the standard libraries of the language, can be used with
  libraries that directly provide data structures and algorithms to represent and manipulate
  similar.
- Comment the essential parts of the code so that the reader can grasp the ideas that led yo
  help to clarify whether a bug is a conceptual error or just a small mistake.

tsp_dataset.zip 5 maggio 2020, 09:24

◀ Lab 2 - TSP

Vai a...