Introduction to Applied Computer Science with Data Structures and Algorithms

CS525, Fall 2015

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WPI

Projects

- Teams of 3-4 students
- Homework
- Deadline: Tuesday December 10

Projects

- Some sessions will be devoted to the project, before the deadline
  - I will then review
    - Work status of each team
    - Distribution of tasks among team members

Topics

- Chose one of the following project
  1. TSP
  2. Sudoku
- Get started!

General customer requirements

- Must use Pyhton
- Must use greedy and/or local search
- Must provide users with the possibility of stating a limit on the number of moves in local search algorithms
  - Programs of different teams will be compared on the same instances
- Must comment each function/method
- Must use seeds for any random generation

Grading

- Correctness of result/code, all required features are done
- Clarity, simplicity of code
- Quality of solutions found by the program

Topics

- Chose one of the following project
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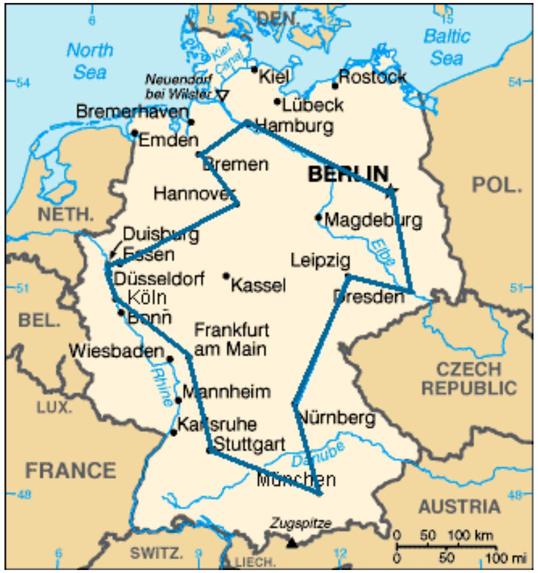
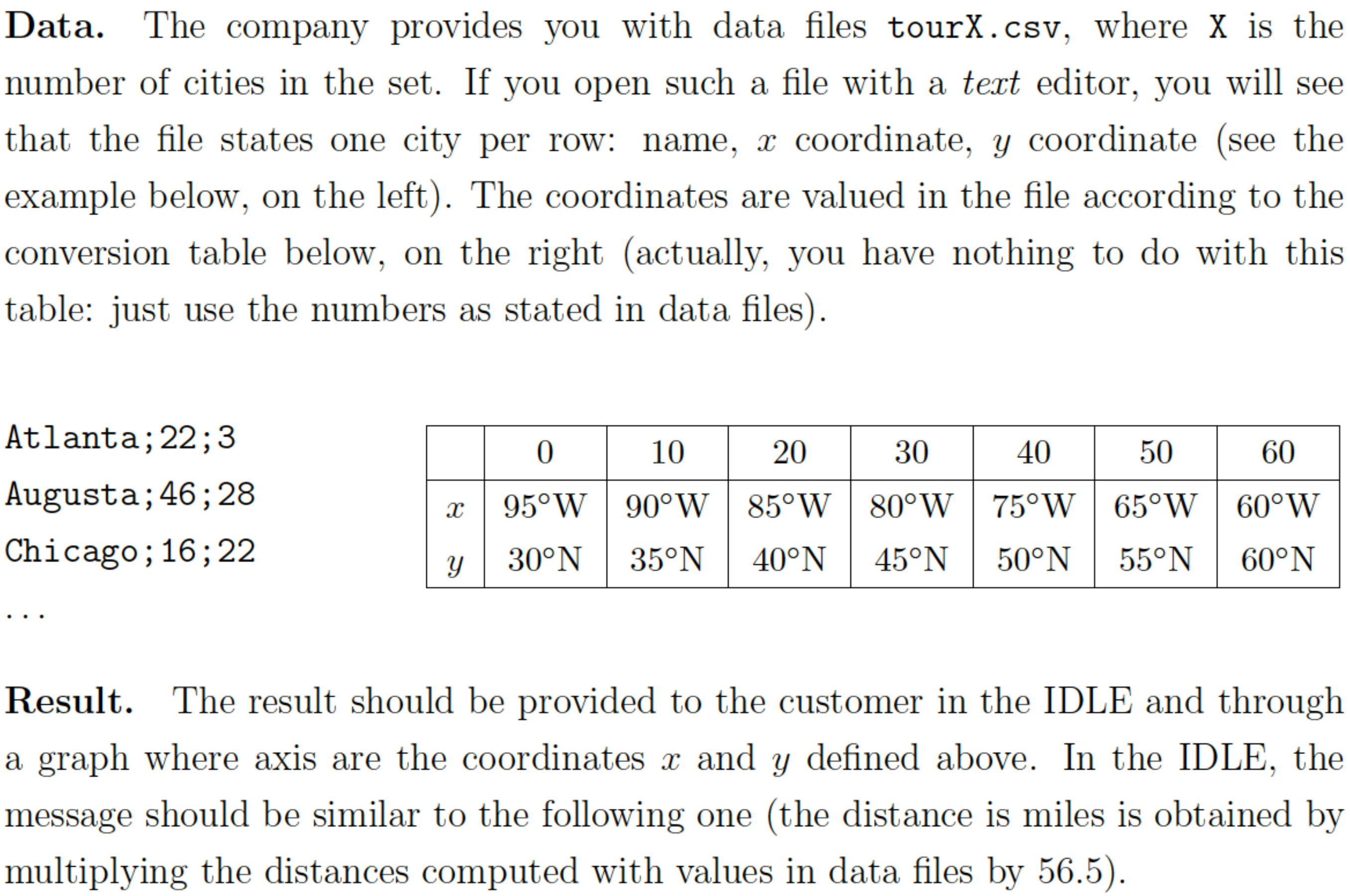
1. TSP



Traveling Salesman Problem (TSP):
A Salesman wishes to travel around a given set of cities, and return to the beginning, **covering the smallest** total distance

1. TSP

- Customer statements



Data. The company provides you with data files `tourX.csv`, where `X` is the number of cities in the set. If you open such a file with a *text* editor, you will see that the file states one city per row: name, x coordinate, y coordinate (see the example below, on the left). The coordinates are valued in the file according to the conversion table below, on the right (actually, you have nothing to do with this table: just use the numbers as stated in data files).

```
Atlanta;22;3
Augusta;46;28
Chicago;16;22
...
```

	0	10	20	30	40	50	60
x	95°W	90°W	85°W	80°W	75°W	65°W	60°W
y	30°N	35°N	40°N	45°N	50°N	55°N	60°N

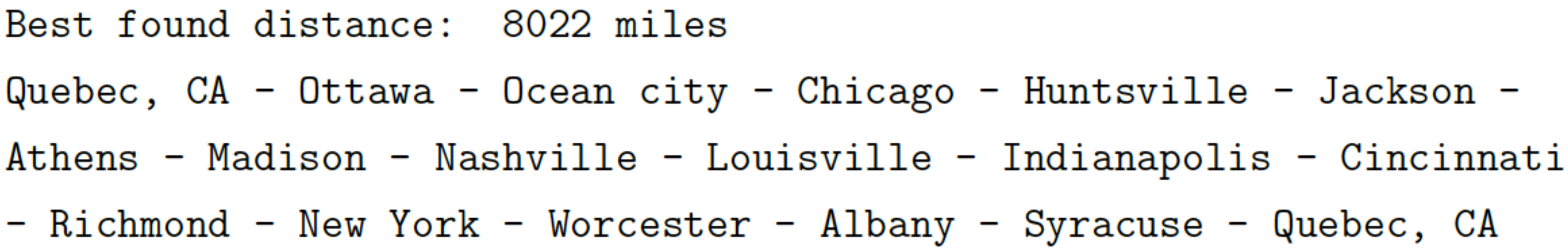
Result. The result should be provided to the customer in the IDLE and through a graph where axis are the coordinates x and y defined above. In the IDLE, the message should be similar to the following one (the distance is miles is obtained by multiplying the distances computed with values in data files by 56.5).

1. TSP

- Data
  - Files tourXXX.csv (similar to) the ones used in previous homework

1. TSP

- Expected results
  1. Print of best tour found by your program

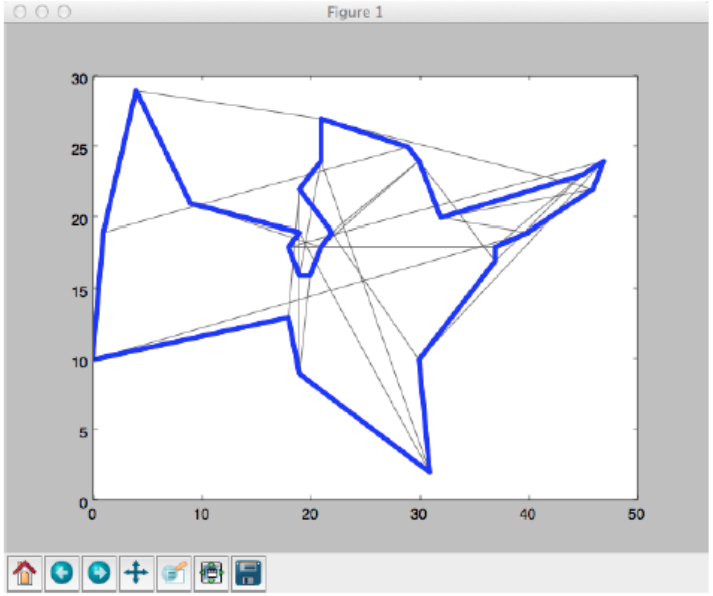


```
Best found distance:  8022 miles
Quebec, CA - Ottawa - Ocean city - Chicago - Huntsville - Jackson -
Athens - Madison - Nashville - Louisville - Indianapolis - Cincinnati
- Richmond - New York - Worcester - Albany - Syracuse - Quebec, CA
```

1. TSP

- Expected results
  2. Graph using Pyplot

The graph should simply look like the following picture. There is no need to consider a map or to write city names.



A line is a road taken by the tour, between two cities. The graph shows two solutions. Blue bold lines are the path followed in your solution (that minimizes as much as possible the total distance), while black lines correspond to a randomly generated solution (each city appears only once, but the distance is huge).

Extra credit (10 points bonus)

- Not mandatory
- Try to solve existing instances of TSP that can be found on the web, e.g., “TSPlib”
  - Search the related websites
  - Write a function/program to read the instances

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Sudoku

- Design a program for solving Sudoku grids

5	3	4	6	7	8	9	1	2
6	7	2	1	9	5	3	4	8
1	9	8	3	4	2	5	6	7
8	5	9	7	6	1	4	2	3
4	2	6	8	5	3	7	9	1
7	1	3	9	2	4	8	5	6
9	6	1	5	3	7	2	8	4
2	8	7	4	1	9	6	3	5
3	4	5	2	8	6	1	7	9

Sudoku

- Design a program for solving Sudoku grids
- If the program does not solves the Sudoku in a reasonable time, quality of the solution should be assessed (through a cost, cf. previous lecture)

Sudoku

- Data
  - Files SudokuXXX.csv on myWPI

Sudoku

- Expected result
  1. A program that, given a file SudokuXXX.csv, returns the filled grid that is as much as possible close to the solution (cost function)
  2. Method for exporting the result in a new csv file

Your program should find the solution for some Sudokus

Sudoku

- Reminder: MUST use local search
  - Some Python code exist on the web, using other techniques: copying them will lead to 0 points

Extra credit (10 points bonus)

- However, if all is done, you may enrich your program with propagation techniques
  - Ask me some information during the lab sessions devoted to the project
- Not mandatory

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- 5 minutes to select the project
- Roles of each team member
- Today, determine the program structure
  - Required features
  - Classes
  - Methods in each class
- Ask me questions

Next week

- Break: No lectures next week