Answer Sheet

Introduction à

l’optimisation

**Semester Project**

**Autumn 2014**

**Group Number:**

Name of the Students and their signatures:

|  |  |  |
| --- | --- | --- |
| Student name | Student number | Signature |
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**Questions:**

**Part 1: Mathematical Model**

1. Solve the travelling salesman problem using the mathematical model presented in the Project Description file (using MATLAB).
2. Plot the solution on a map (You will be given examples during the lab sessions).
3. Based on the plot, identify all sub-tours (if there is any). Specify the sub-tours by indicating the nodes (cities) that construct each of them.
4. To eliminate identified sub-tours in the previous step, apply constraint (5) **only once** (in the Project Description file). Write all of these constraints and add it to the model. Resolve the linear programming. Is the solution integer or fractional?
5. Plot the solution if possible. Does the solution represent the upper bound or the lower bound to the model?

**Part 2: Heuristics**

1. Apply the greedy algorithm to find an initial solution. Is the initial solution an upper bound or a lower bound to the original model?
2. Use 2-opt heuristic method to improve the initial solution obtained by the greedy algorithm. (You should check all pairwise comparisons for the 2-opt approach. The process goes on as long as there is still improvement in the objective function)
3. How much the solution is improved? Plot the solution.
4. Fill the following table

|  |  |  |
| --- | --- | --- |
| Model | Objective value | Gap = (Sol./LP Sol.) |
| Original model (constraints 1-4)  |  | N/A |
| Greedy algorithm (initial solution) |  |  |
| 2-opt algorithm  |  |  |

**Bonus question:**

Adapt 2-opt heuristic into simulated annealing framework. Start from the greedy initial solution and use the new algorithm to improve the solution. Based on your experience, which algorithm would be a suitable option? Justify your answer.