

INEN471/571: Linear and Integer Programming Computer Group Project (Option 2)

Objective: Your objective is to implement a branch-and-cut computer code using Gurobi to solve the Traveling Salesman Problem (TSP).

Due Date: April 17th! The research report and a 10-15 minute presentation should be given in class and the source files should be submitted to canvas or emailed to me at ivhicks@rice.edu.

Minimum Requirements (100 points): Lower bounds will be calculated by Gurobi; Gurobi can only be used to solve LPs. Also, use the referenced article to derive an algorithm to generate subtour elimination constraints on your own. **Do not** use any code found online (like Wikipedia)! Also, the code has to be written in C++, C, Python, R, or Java. Number indexes start counting at 0 instead of 1. Please provide a readme file to give instructions on how to run your code.

I/O Requirements: The code must read in a file through standard input. The input file will look like the following:

```
n    m  //# of nodes and # of edges
end1 end2 weight //for edge(0)
...
end1 end2 weight //for edge(m-1)
```

Standard output must be the ends of the edges chosen with their cost and the cost of the best tour found like the following:

```
end1 end2 weight //for edge(0) of tour
...
end1 end2 weight //for edge(n-1) of tour
```

The cost of the best tour is: (the cost the best tour)

Test Instances: The test instance files will be sent by email to you. Below are the names and the optimal costs of the tours:

att48: 10628 berlin52: 7542 gr21: 2707 hk48: 11461 ulysses22: 7013

The Research Report: The group must also turn in a detailed report entailing an intro, a description of the problem, the steps of your algorithm, computational results (i.e. running times) of your code on the five problems and concluding remarks. In terms of computational results, the report should have a table which includes runtimes for your code on the different test instances and the number of each type of constraint that was added during each run. References would be welcomed. Also email me a critique of your group member and their participation in the project.

Extra Points: Extra points will be given to groups who enhance the code by adding an upper bound algorithm or some other algorithm to the code.

Technical Support: The codes should be written to run on a Unix machine (no Microsoft templates). Feel free to contact me if you have any technical questions. Good luck!

Subtour Elimination Reference:

M. Stoer and F. Wagner. A Simple Min-Cut Algorithm, J of ACM, 1997