Due: 20.05.12, Sunday, 23:00

BLG 372E - Analysis of Algorithms, Spring 2012

Project 3 - Transportation

Scenario:

You are hired to a consulting company in order to optimize the transportation of products between transportation agencies. Consider there are several transportation agencies which carry products from their agencies to the other agency in order to transfer products from source agency to the target agency. Each agency owns trucks with limited capacity and able to send their trucks according to road condition since some roads are rough and crooked. So, if an agency sends products whose total weight is greater than the carrying capacity of the intermediary agency, the remaining product is wasted. Please optimize transportation system in order to carry maximum possible weighted products without waste.

You are going to be given transportation agencies which are symbolized by numbers, their relations and the carrying capacity of agencies from one to another. Please see the sample file which is listed as agency 1, agency 2, and the capacity. The carriage direction will be from agency 1 to agency 2. Source agency is the first agency; target agency is the last agency.

Sample input (capacity.txt):

1	2	10
1	3	8
1	5	5
2	4	3
2	6	5
3	2	3
3	4	10
3	5	3
4	6	8
5	4	3
5	6	10

Mission 1:

Print the maximum flow of products from first agency to the last agency. Please trace the paths and their capacities in order to inform agencies which agency will send how much product to which agency. Please see the sample output below. (Traces may differ according to the algorithm you use.)

Sample output:

```
Maximum flow: 21

Traces and capacities:

1-2-6       5
1-2-4-6     3
1-3-4-6     5
1-3-5-6     3
1-5-6       5
```

Mission 2:

The employee who is fired before you are hired used just a greedy approach in order to transfer products from one agency to other. The transportation scheme which is prepared by fired employee is going to be given to you. Please report that with this scheme is it possible to transfer maximum product from source agency to the target agency. If it is not the maximum flow, please trace the possible roads in order to carry more products.

Sample input (scheme.txt):

```
1    2    5
1    3    8
1    5    5
2    6    5
3    4    8
4    6    8
5    6    5
```

(capacity.txt is already given to you)

Sample output:

```
Is maximum flow? : No

Maximum flow is: 21

Possible trace:

1-2-4-3-5-6    3
```

Implementation notes:

Use one of the algorithms that you have learned in the Analysis of Algorithms class. All your code must be written in C++, and compiled and run on linux/unix using g++. You have to use standard libraries. Do not forget to add necessary **headers** for functions and variables. When you write your code, try to follow an object-oriented methodology with well-chosen variable, method, and class names and comments where necessary. Your code must be compiled without any errors; otherwise, you may get a grade of zero on the assignment. The compilation and the running command are **strict** and they are like below.

Your compilation code will be: g++ *.cpp -o main

Running command will be: ./main file_name1 file_name2

Example run:

g++ *.cpp -o main

./main capacity.txt scheme.txt

Format of program:

The program shows a menu like below:

```
1. Mission-1
2. Mission-2
3. Exit
Your choice:
```

Example run for the sample (./main capacity.txt scheme.txt):

```
1. Mission-1
2. Mission-2
3. Exit
Your choice: 1
--------------------------------------------------------------------------------
Maximum flow: 21
Traces and capacities:
1-2-6          5
1-2-4-6        3
1-3-4-6        5
```

```
1-3-5-6          3
1-5-6            5
-------------------------------------------------------------------------------
1. Mission-1
2. Mission-2
3. Exit
Your choice: 2
-------------------------------------------------------------------------------
Is maximum flow? : No
Maximum flow is: 21
Possible trace:
1-2-4-3-5-6      3
-------------------------------------------------------------------------------
1. Mission-1
2. Mission-2
3. Exit
Your choice: 3
```

In your reports:

In your reports, please **explain** your approaches and algorithms you used. Give the data structures you have built and explain them.

Scoring:

70 points for your program:

Data structures and algorithms: 30 points,

Correct run for several tests: 15 points, 15 points

Presenting as explained: 10 points,

30 points for your reports.

Be sure that your program can be compiled and run with the command given above. Otherwise, you may get a grade of zero for your program. Do not forget that your code will be tested with several different input files. The total point will constitute %10 of your overall grade.

Policy:

You may discuss the problem addressed by the project at an abstract level with your classmates, but you should not share or copy code from your classmates or from the Internet. You should submit your own, individual project. Plagiarism and any other forms of cheating will have serious consequences, including failing the course.

Submission Instructions:

Please submit your assignment through Ninova. Please zip and upload all your files. In the zipped file, you must include your report and your entire program.

If a question is not clear, please let the teaching assistant Meryem Uzun-Per know by e-mail (uzunper@itu.edu.tr).