Algorithm Design and Complexity
Third Assignment

January 14, 2013

1 Problem 1 - Rock the Squirrel

Rock is a very greedy squirrel and he loves maize kernels (corn) a lot. He lives in a tree with very sensitive branches: they can only hold a specific weight or they break. Evey day Rock has to bring food to its home so he gathers maize kernels in its cheeks. He has a map of all the branches of its tree. This map is similar to an undirected weighted graph (some branches are connected so it is possible to find cycles), where each branch's weight is in fact its resistance. This graph has N vertices: 1 is the starting point and N is the destination. Help Rock return home with as much weight as possible, by modifying a known algorithm for computing the shortest path or finding the minimum spanning tree.

1.1 Input data

The input file (rock.in) contains on the first row N, M ans W, the number of vertices, edges and Rock's weight. Each of the next M rows represent edges and tey contain 3 integers : the two vertices and the maximum weight allowed. An example is below.
5 6 5
1 2 15
1 4 13
2 5 6
3 4 10
3 5 13
4 5 8

1.2 Output data

The output file (rock.out) contains, on the first row, separated by " ", the vertices representing the path followed by Rock, and on the second row the weight of maize kernels brought home. For the given input, the output is the following:
1 4 3 5
5

1.3 Restrictions

$1 < N \leq 1000$
$1 < M \leq 100000$
$1 < W \leq 50$
$W < w_i \leq 1000$ where w_i is the weight of edge i

2 Problem 2 - Solar Power

A robot is in charge of refueling a research center's generator with energy. The research center is situated in the desert but it cannot convert solar power to energy. Therefore the robot has to go outside (in sun light) and return to the research center constantly. Moreover, it also consumes some of the converted energy. The delivery point is situated somewhere inside the building and there are more possible paths to it. The map is similar to a N vertices directed weighted graph, where vertex 1 is the starting point and N is the destination. The weight of an edge is the amount of energy consumed by the robot when walking on that specific.Moreover, it is also possible that the robot's energy increases on a particular edge if that edge is enlightened (in this case, its weight will be). Find the best path for the robot to charge as much as possible of the generator, knowing that it cannot form cycles.

2.1 Input data

The input file (robot.in) contains on the first row N, M and E, the number of vertices, the number of edges and the capacity of the robot (amount of energy at the entrance). Each of the next M rows contains 3 values representing the vertices of the edge and its weight. An example is below.
6 8 1 000
1 2 200
1 3 100
2 3 -300
3 5 300
4 2 300
4 6 200
5 4 -200
5 6 500

2.2 Output data

The output file (potters.out) contains the amount of energy delivered, on a single row. Example:
800
The value is obtained for the path: 1-2-3-5-4-6

2.3 Restrictions

$1 < N \leq 1\ 000$
$1 < M \leq 10\ 000$
$1 \leq E \leq 10\ 000$
$-10\ 000 < w_i \leq 10\ 000$ where w_i is the weight of edge i