CENG 315

Fall 2012 - Homework 4
Due: 23:55, 24th of December, 2012

*"**Super Mario Bros.** is a 1985 platform video game developed by Nintendo, published for the Nintendo Entertainment System as a pseudo-sequel to the 1983 game Mario Bros. It is the first of the Super Mario series of games. In Super Mario Bros., the player controls as he travels through the Mushroom Kingdom in order to rescue Princess Peach from the antagonist Bowser."*   *-- Wikipedia*

There are also various hacked versions of this successful video game. Some of them we know as "Flying Mario", "Unlimited Lives Mario", "Fancy Mario" etc.

In this homework, a new hack for Super Mario Bros. is introduced: "Mario Warprun". In this version, every single life (clone) of Mario plays the game separately. Moreover, the only way through the levels is going through the warp gates at the pipes. However, the warps have certain limits for how many lives of Mario can pass through. The score of the game is determined by the count of the lives finishing the game (by reaching the final level). Your task is to find the path that the lives of Mario should follow to obtain the best score and, of course, the possible best score.

Specifications

- The name of the first level is always "MarioLand", and the final level "BowserLand".

- There are green "1 up" mushrooms on some levels generating bonus Mario lives. Even if there is not any life of Mario coming from a warp gate to this level, this rule still holds.

- Since this is an amateur hack, warp gates might have been arranged so that there is no path from "MarioLand" to the final level "BowserLand".

- If none of the lives of Mario finishes the game, it means "GAME OVER".

As shown in the figure below, you will be given the levels, the warp gates, the locations of green mushrooms.

Input Specification

- The input will be given in a file named "warprun.inp".

- The first line of the input will be of the form "M L W", where:

  - **M** represents the starting lives of Mario,

  - **L** shows the number of levels, which is between 2 and 1000, and

  - **W** is the number of warp gates.

- Then, **L** number of lines will follow. They will be of the form "**N b**", where **N** is the string (maximum 10 chars from the English alphabet) representing the name of the level and **b** shows the number of green mushrooms at this level.

- After those **L** lines, there will be **W** number of lines representing the warp gates. Their form will be "**u v x**" meaning that there is a warp gate from **u** to **v** that lets Mario to pass **x** of its lives.

Output Specification

- The output should be printed in a file named "warprun.out".

- If it is not possible for any life of Mario to finish that game, print only "GAME OVER"

- Otherwise,
    - The first line should be the maximum score, and
    - The following lines should be of the form "**u v m**", which means **m** number of Mario lives should pass from **u** to **v** to obtain the maximum score.
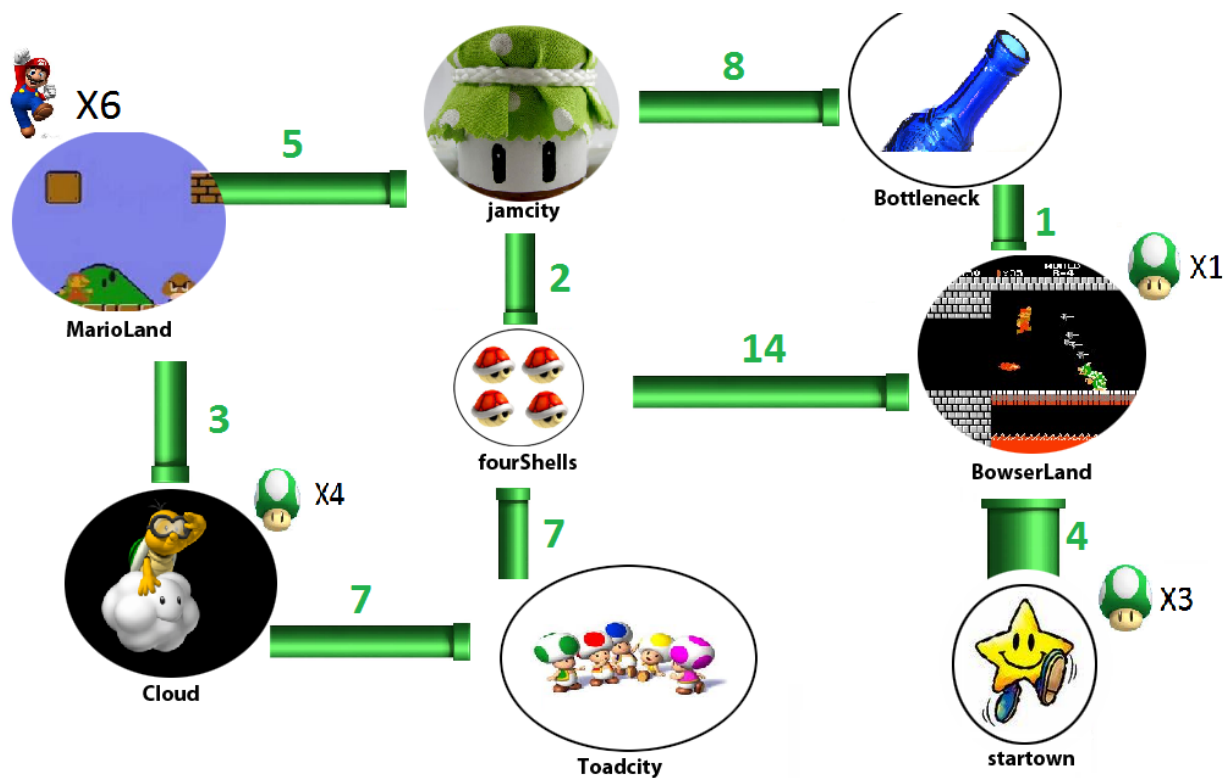

Figure: "Mario warprun" world created with respect to the sample input

Sample Input:

6 8 9

MarioLand 0

Cloud 4

jamcity 0

Toadcity 0

fourShells 0

Bottleneck 0

startown 3

BowserLand 1

MarioLand jamcity 5

MarioLand Cloud 3

jamcity bottleneck 8

jamcity fourShells 2

Cloud Toadcity 7

Toadcity fourShells 7

4shell BowserLand 14

bottleneck BowserLand 1

startown BowserLand 4

Sample Output:

14

MarioLand jamcity 3

fourShells BowserLand 9

MarioLand Cloud 3

Cloud Toadcity 7

jamcity fourShells 2

jamcity bottleneck 1

Toadcity fourShells 7

bottleneck BowserLand 1

startown BowserLand 3

Submission Specifications

- Do not use the "algorithms" library or any external library for graph algorithms
- Your work will not be tested on graphs with cycles.
- All of the work should be done individually. We will check your homeworks for cheating.
- Submit a single file called "warprun.cpp" through the COW.