{EPITECH}

GAME OF STONES

A SONG OF GRAPHS AND STONES

GAME OF STONES

✓ The totality of your source files, except all useless files (binary, temp files, obj files,…), must be included in your delivery.
✓ All the bonus files (including a potential specific Makefile) should be in a directory named bonus.
✓ Error messages have to be written on the error output, and the program should then exit with the 84 error code (0 if there is no error).
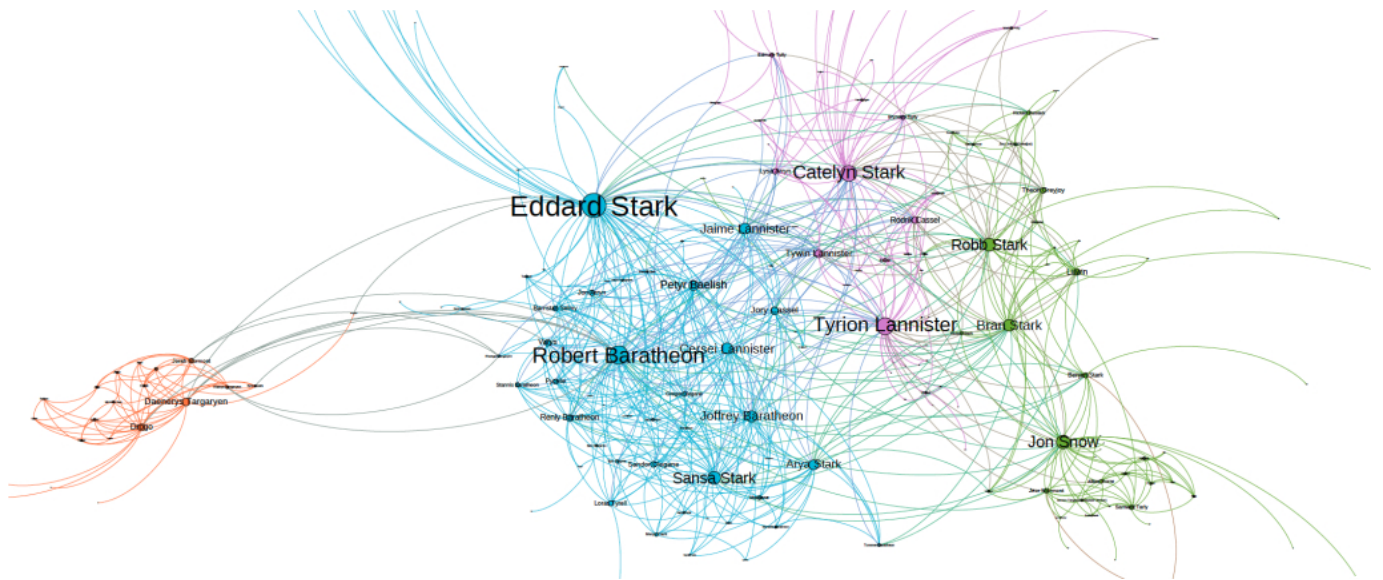
You are the Grand Maester of the Jewel Throne and the Red Keep, currently occupied by Cersei Lannister, Queen of the Gamut and the First Stones, and Protector of the Three Kingdoms. However, her throne is threatened by numerous enemies that conspire against her, like the terrible Kallydis brotherhood or the Sycarios cartel.

Fortunately, you have access to the best spies in all of Tekeros. They made a report with two parchments stating their observations about the state of the relationships between the major political figures of the three Kingdoms.

Your best weapon being cunning instead of strength, you need to decide either to conspire with some other political figures so that they eliminate threats to the Crown, therefore protecting it, or to betray the Crown if you see that you cannot protect it (life is harsh in Tekeros).

As Grand Maester, you have access to the latest technological advances, such as the very secret "computer", a machine created by the mysterious *Garin Talun* that can make a lot of computations very quickly, if provided the right sets of instructions.
Thanks to the latest work of *Countess Lava de Locae* on how to give instructions to this "computer", you decide to use this technology to your advantage to analyze all these reports using graph theory, which was developped by the great *Leonard Ruler*.

The project

After summoning the Master of Spies, he hands you the two parchments that reports the state of alliances and conspiracies among Tekeros: the **F**riendships **R**eport and the **C**onspiracy **R**eport. You decide together that the spies should format these reports such that you can work on it more easily.

You must now write a program that will read these reports. As you may wish to extract different informations from it, you decide to have two modes on your program:

- ✓ *Links mode*: it will read the **FR** and take two people as input, and will display the degree of separation of these people (or -1 if they are not connected).

- ✓ *Plots mode*: it will take the two reports (**FR** and **CR**) and a number n as input, and displays:
  - the list of people from the **FR** in alphabetical order (the order that will be used to build the matrices),
  - the matrix of shortest separation between them, with lengths less than or equal to n.
  - a report of your actions (refer to the *Conspiracies* section).

> ℹ️ If a person is in the **CR** but not in the **FR**, this is an error.

Be careful! Friendships are reciprocal: if A is friends with B, then B is also friends with A.
This is not the case for conspiracies (one may plot against someone that is not plotting against them).

> ℹ️ Two "friends" can plot against each other.

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Conspiracies

Now, you need to think about a plan on how to eliminate every threat to the Crown. From the conspiracy report, you need to extract every people directly plotting against the Queen. These will be your *direct enemies*. Because feeding an army is expansive and you already have so much trouble fighting the North rebellion, you need to find a better way to eliminate these *direct enemies.*
And what better way than by conspiring with their own enemies against them!

Now that everything is setup for what you need to do, you decide to take a look at the work of *Leonard Ruler*. His theory about graphs resonates with you, and you think it's a good idea to use it to your advantage. You decide to program your computer to build a graph representing the known conspiracies between each political figures (who plots against whom). Using this graph, you will try to eliminate every direct to the Crown.

To do so, you need to check every *close friend* to the Crown that is also plotting against these *direct enemies*, and join forces together. If a *direct enemy* doesn't have any of your *close friends* plotting against them, but has some other people plotting against them, you can still try to make an alliance with these people by plotting against one of their own enemies (we will call these people *far friends*).

Someone plotting against a *far friend* will be called an *indirect enemy*, and just like your *direct enemies*, you can plot with their enemies if the latters are *close friends* to you, or try to make an alliance with a 2nd degree *far friend*. If you can plot against at least one of a *far friend*'s enemy, then they will help you, just like a *close friend*.

You must keep trying recursively until finding a way to plot (directly or indirectly) against all your *direct enemies*. In one chain of conspiracy, you cannot plot with or against the same person twice.

Anyone with a friendship level relative to the Queen less than or equal to n is considered a *close friend*.

- ✓ You must display the chain of conspiration that results on saving the Queen, sorted from the shortest to the longest chains. For each chain of same length, you must display them in alphabetical order.
- ✓ If you can conspire with multiple allies against a common ennemy, choose in priority the ones that are not directly plotting against the Queen, then those who are the closest to the Queen, and finally take the first one in alphabetical order.

If you can successfully plot against all your direct enemies, you must print "The stone is

safe!", otherwise you need to betray the Crown and must display "There is only one way out: treason!".

Don't take assumption about alliances! You can plot with someone against a common enemy, even though this person is also directly plotting against you.

External functions and libraries handling graphs and matrices don't exist in Tekeros, and would be considered as Dark Magic, thus banishing you from the Realm (with a nice 0)

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Usage

```
~/G-CNA-400> ./game_of_stones --help
USAGE
    ./game_of_stones [--links FR P1 P2 | --plots FR CR n]

DESCRIPTION
    FR    file containing friendship relations between people
    Pi    name of someone in the friendships file
    CR    file containing conspiracies intentions
    n      maximum length of friendship paths
```

Suggested Bonuses

✓ Graphical visualization of the connections between people.

Examples

```
~/G-CNA-400> cat friends.txt
Jon Snow is friends with Sansa Stark
Missandei is friends with Daenerys Targaryen
Tywin Lannister is friends with Cersei Lannister
Sansa Stark is friends with Cersei Lannister
Lynce Hightower is friends with Jorah Mormont
Daenerys Targaryen is friends with Jorah Mormont
Jeor Mormont is friends with Jorah Mormont
Samwell Tarly is friends with Maester Aemon
Samwell Tarly is friends with Sansa Stark
Maester Aemon is friends with Tywin Lannister
Vere is friends with Samwell Tarly
Theon Greyjoy is friends with Jon Snow
Tyrion Lannister is friends with Cersei Lannister
Samwell Tarly is friends with Jon Snow
The Mountain is friends with Cersei Lannister
Jorah Mormont is friends with Cersei Lannister
```

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```
~/G-CNA-400> cat plots.txt
Daenerys Targaryen is plotting against Cersei Lannister
Tywin Lannister is plotting against Cersei Lannister
Sansa Stark is plotting against Theon Greyjoy
The Mountain is plotting against Jon Snow
Jon Snow is plotting against Tywin Lannister
Theon Greyjoy is plotting against Sansa Stark
Jon Snow is plotting against Theon Greyjoy
Tywin Lannister is plotting against Daenerys Targaryen
Sansa Stark is plotting against Cersei Lannister
```

```
~/G-CNA-400> ./game_of_stones --links friends.txt ''Vere'' ''Cersei Lannister''
Degree of separation between Vere and Cersei Lannister: 3
```

```
~/G-CNA-400> ./game_of_stones --links friends.txt ''Jon Snow'' ''Jon Snow''
Degree of separation between Jon Snow and Jon Snow: 0
```

```
~/G-CNA-400> ./game_of_stones --links friends.txt ''Jon Snow'' ''Harry Potter''
Degree of separation between Jon Snow and Harry Potter: -1
```

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```
~/G-CNA-400> ./game_of_stones --plots friends.txt plots.txt 3
Names:
Cersei Lannister
Daenerys Targaryen
Jeor Mormont
Jon Snow
Jorah Mormont
Lynce Hightower
Maester Aemon
Missandei
Samwell Tarly
Sansa Stark
The Mountain
Theon Greyjoy
Tyrion Lannister
Tywin Lannister
Vere

Relationships:
0 2 2 2 1 2 2 3 2 1 1 3 1 1 3
2 0 2 0 1 2 0 1 0 3 3 0 3 3 0
2 2 0 0 1 2 0 3 0 3 3 0 3 3 0
2 0 0 0 3 0 2 0 1 1 3 1 3 3 2
1 1 1 3 0 1 3 2 3 2 2 0 2 2 0
2 2 2 0 1 0 0 3 0 3 3 0 3 3 0
2 0 0 2 3 0 0 0 1 2 3 3 3 1 2
3 1 3 0 2 3 0 0 0 0 0 0 0 0 0
2 0 0 1 3 0 1 0 0 1 3 2 3 2 1
1 3 3 1 2 3 2 0 1 0 2 2 2 2 2
1 3 3 3 2 3 3 0 3 2 0 0 2 2 0
3 0 0 1 0 0 3 0 2 2 0 0 0 0 3
1 3 3 3 2 3 3 0 3 2 2 0 0 2 0
1 3 3 3 2 3 1 0 2 2 2 0 2 0 3
3 0 0 2 0 0 2 0 1 2 0 3 0 3 0

Conspiracies:
Jon Snow -> Tywin Lannister
Theon Greyjoy -> Sansa Stark
Tywin Lannister -> Daenerys Targaryen

Result:
The stone is safe!
```

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```
~/G-CNA-400> ./game_of_stones --plots friends.txt plots.txt 2
Names:
Cersei Lannister
Daenerys Targaryen
Jeor Mormont
Jon Snow
Jorah Mormont
Lynce Hightower
Maester Aemon
Missandei
Samwell Tarly
Sansa Stark
The Mountain
Theon Greyjoy
Tyrion Lannister
Tywin Lannister
Vere

Relationships:
0 2 2 2 1 2 2 0 2 1 1 0 1 1 0
2 0 2 0 1 2 0 1 0 0 0 0 0 0 0
2 2 0 0 1 2 0 0 0 0 0 0 0 0 0
2 0 0 0 0 0 2 0 1 1 0 1 0 0 2
1 1 1 0 0 1 0 2 0 2 2 0 2 2 0
2 2 2 0 1 0 0 0 0 0 0 0 0 0 0
2 0 0 2 0 0 0 0 1 2 0 0 0 1 2
0 1 0 0 2 0 0 0 0 0 0 0 0 0 0
2 0 0 1 0 0 1 0 0 1 0 2 0 2 1
1 0 0 1 2 0 2 0 1 0 2 2 2 2 2
1 0 0 0 2 0 0 0 0 2 0 0 2 2 0
0 0 0 1 0 0 0 0 2 2 0 0 0 0 0
1 0 0 0 2 0 0 0 0 2 2 0 0 2 0
1 0 0 0 2 0 1 0 2 2 2 0 2 0 0
0 0 0 2 0 0 2 0 1 2 0 0 0 0 0

Conspiracies:
Jon Snow -> Tywin Lannister
Tywin Lannister -> Daenerys Targaryen
The Mountain -> Jon Snow -> Theon Greyjoy -> Sansa Stark

Result:
The stone is safe!
```

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```
~/G-CNA-400> ./game_of_stones --plots friends.txt plots.txt 1
Names:
Cersei Lannister
Daenerys Targaryen
Jeor Mormont
Jon Snow
Jorah Mormont
Lynce Hightower
Maester Aemon
Missandei
Samwell Tarly
Sansa Stark
The Mountain
Theon Greyjoy
Tyrion Lannister
Tywin Lannister
Vere

Relationships:
0 0 0 0 1 0 0 0 0 1 1 0 1 1 0
0 0 0 0 1 0 0 1 0 0 0 0 0 0 0
0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 1 0 1 0 0 0
1 1 1 0 0 1 0 0 0 0 0 0 0 0 0
0 0 0 0 1 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 0 0 0 0 1 0
0 1 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 1 0 0 1 0 0 1 0 0 0 0 1
1 0 0 1 0 0 0 0 1 0 0 0 0 0 0
1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 1 0 0 0 0 0 0 0 0 0 0 0
1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
1 0 0 0 0 0 1 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 1 0 0 0 0 0 0

Conspiracies:
Tywin Lannister -> Daenerys Targaryen
The Mountain -> Jon Snow -> Theon Greyjoy -> Sansa Stark
No conspiracy possible against Tywin Lannister

Result:
There is only one way out: treason!
```

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