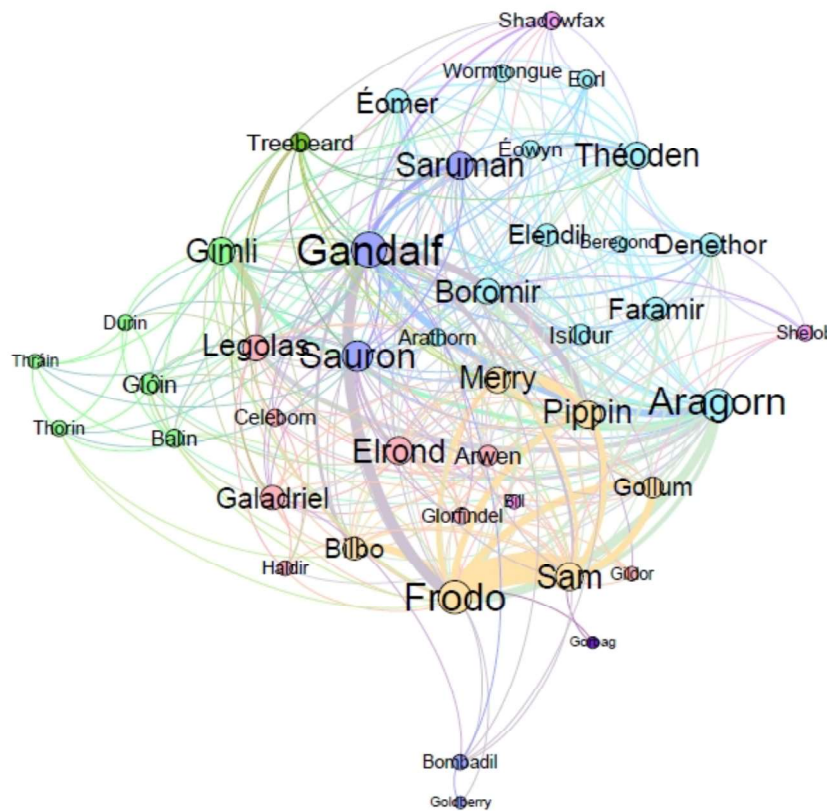## Lab task 4 - Graphs

Lord of the Rings

Problem description[1]

We have at our disposal two CSV files with information that represent a network of relationships between characters from The Lord of the Rings, corresponding to the interactions they have had throughout the 3 books that make up the original saga: The Fellowship of the Ring, The Two Towers and The Return of the King. The file lotr-pers.csv contains the data of each character (identifier, type, subtype/race, name, gender and an integer indicating the total number of references to the character in the saga), and the file networks-id-3books.csv contains, for each pair of characters, the number of interactions between them. This network can be visualized through the following graph:

To do

The objective of this practical work is to implement a Java program that processes the indicated files and meets the following requirements:

1. Build the corresponding graph and show the number of characters, the total number of relationships between characters, the character that has a relationship with more characters, and the pair of characters that have the highest level of interaction with each other.
2. The war of the ring is at its peak, and the Council of Elrond has decided to form a special command to put an end to the great threat posed by the Witch King, feared lord of the Nazgul. It is well known that there is a prophecy that no man can kill the Witch King. To do this, given two characters read by

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[1] Graph problem inspired by the work Lord of the Rings Networks
(https://github.com/morethanbooks/projects/tree/master/LotR)

keyboard (leaders of the special command), look for any sequence of character[2] that connects both leaders, taking into account that their race must be different from "men" or their gender must be different from "male". To ensure that all members of the command have the necessary power, they must have at least a value of 80 in the "FreqSum" field. Note: Leaders do not have to meet these conditions, they are always supposed to be part of the team.

3. The Council also wants to establish a secure communication network to be able to send secret messages between the different towns involved in the war without being intercepted by Sauron's forces. In this way, given two characters read by the keyboard (sender and recipient), indicate the shortest sequence of trusted persons[23] that allows reaching the recipient to transfer the necessary orders.

Technical requirements

- In part b) it is mandatory to use a DFS algorithm.
- It will be appreciated that the search for paths is repeated at the user's indication.
- The implementation of Graphs provided in the course will be used.
- The Decorated Element pattern seen in class will be used to decorate or collect the set of technical attributes related to the manipulation and traversal of graphs, which must be based on generic data types.
- Every class that will be generated should be in a different file, including the possible classes that define exceptions. Try to modularize the code properly.
- Each class/method in the program should include appropriate internal documentation to make it fully understandable. In "Campus Virtual" you can find information to write internal doc (see Lab section).
- In order to use anti-plagiarism and semantic similarity detection systems, source code files may not contain personal data about students such as name, email... Instead, the authors and the group will be identified in the comments of the code with the initials of the students and the assigned group code.

Additional improvements

- Generation of a .jar file with all classes of the program
- Generation of a batch process file .bat that executes the program using the mentioned library as .jar file.

Running and delivery rules

- The project must be carried out by each of the work groups that have been previously formed in practical classes. It cannot be done individually.
- The delivery and evaluation will be made on the day previously indicated in the Campus Virtual. One of the members of the group will send a compressed file with all the classes that compose the program. Individually, you must also submit the participation template, which will be available in "Campus Virtual".
- For the practice to be evaluated, the program must compile and run correctly.
- Remember that this activity is mandatory to pass the subject.

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[2] The nodes that identify inanimate beings will be discarded, that is, those that are not of type "per"
[3] Since double spies and betrayals abound in The Lord of the Rings, it will be understood that a trusted person is a character with whom one has a good relationship, understanding a good relationship as a number of interactions equal to or greater than 10.