CSE331 : data structure and algorithms

Project Description

Guidelines

- Please form teams of 3 to 5 members.
- You need to fill this form [redacted] (https://forms.gle/u5fLukwvcyo3imS7A) - only one submission per team
  You will lose marks in case of failure to fill in the form on time!
- For the project, you can use implementations of the following data structures: arrays, dynamic arrays (vectors), linked lists, stacks, queues, priority queues (heap).
- You **MUST** implement any other data structure **from scratch**.
- You should use GitHub/Gitlab to manage your projects (Your project should be private so if you can't create private repos on Github then you should use Gitlab).
  It's really important to learn how to use Git and Github now.
  Those courses are nice ones
  (Git: https://www.udacity.com/course/version-control-with-git--ud123)
  (READMEs and markdown: https://www.udacity.com/course/writing-readmes--ud777)

Submission

- You will need to submit **a short video** to demonstrate the different features of the program.
- You will need to write a **report to describe the project**. Imagine that you are describing the project/ data structures used to someone who has a coding background but who doesn't know much about the project.
    - The document should contain a number of words in the range of 1000 to 2000 words and should contain diagrams/ screenshots that demonstrate the project's background and implementation details.
    - The report should be divided into sections such as background, implementation details and complexity of operations.
    - The report should contain a references section where the resources that you have used during the project are listed.

Idea

XML (Extensible Markup Language) is one of the most famous formats for storing and sharing information among different devices. Some text editors such as Sublime Text are able to parse such files and do some basic operations. In this project, you will work on developing a GUI (Graphical User Interface) based program to parse and visualize an XML file.

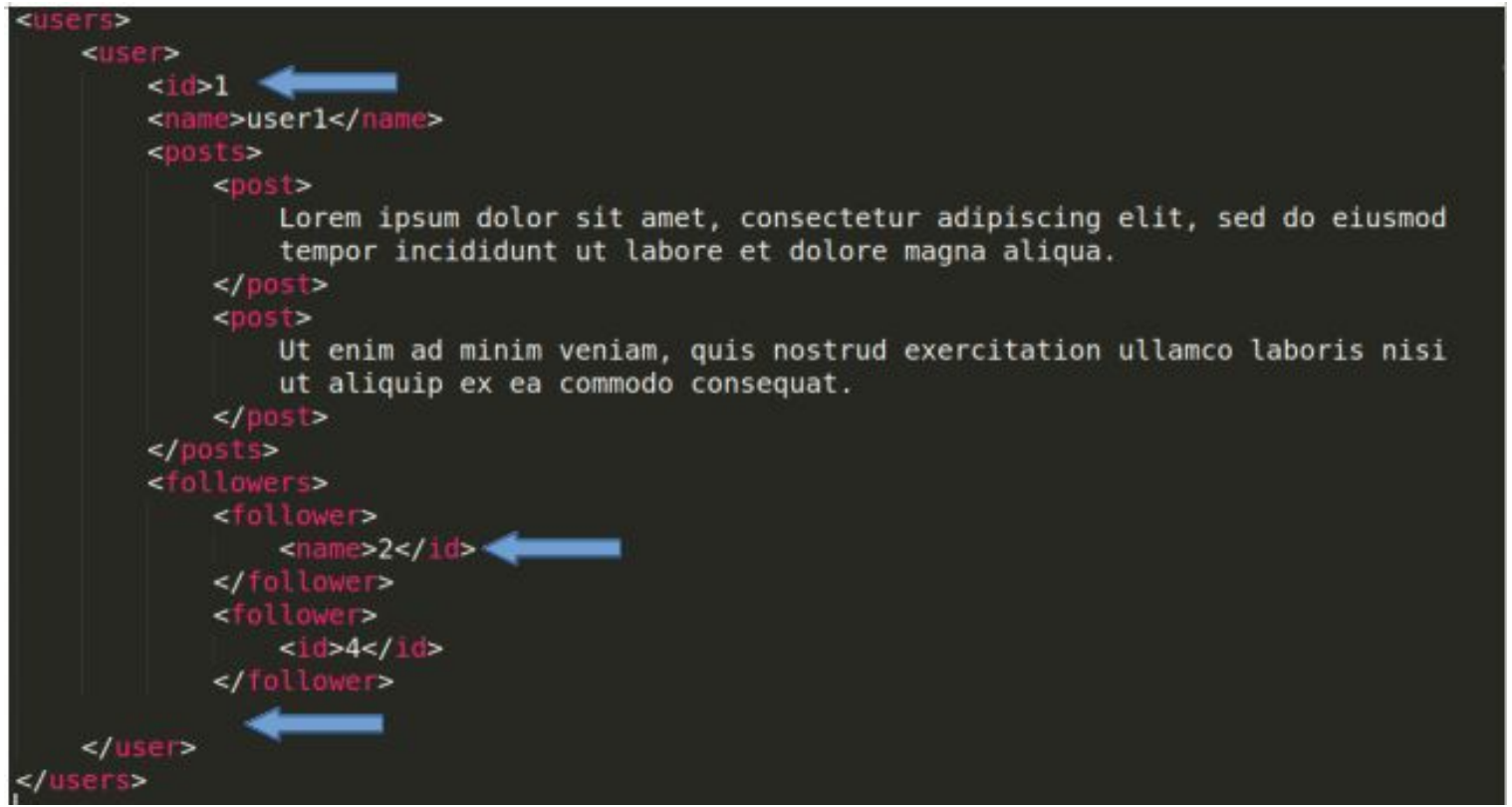
In our system the XML file will represent users in a social network
Each user has id (unique), name, list of posts, list of followers.
Each post has text and list of topics.

- Sample of input file: https://drive.google.com/file/d/1_GeHIjYQZEAZNu6ZxdXEotPnHhiKnaWn/view?usp=sharing

Requirements

- Building a GUI in which the user can specify the location of an input XML file.
- Checking the XML consistency: The input XML may have inconsistencies like missing any of the closing and opening tags or not matching tags.The program should be able to detect and visually show any errors in consistency. Optimally, the program will also be able to automatically solve the errors.

Requirements



Requirements

- Formatting (Prettifying) the XML: the XML file should be well formatted by keeping the indentation for each level.

```
<users>
<user>
<id>1</id>
<name>user1</name>
<posts>
<post>
Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do
    eiusmod tempor incididunt ut labore et dolore magna aliqua.
</post>
<post>
Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris
    nisi ut aliquip ex ea commodo consequat.
</post>
</posts>
<followers>
<follower>
<id>2</id>
</follower>
<follower>
<id>4</id>
</follower>
</followers>
</user>
</users>
```

```
<users>
    <user>
        <id>1</id>
        <name>user1</name>
        <posts>
            <post>
            Lorem ipsum dolor sit amet, consectetur adipiscing elit,
                sed do eiusmod tempor incididunt ut labore et dolore
                magna aliqua.
            </post>
            <post>
            Ut enim ad minim veniam, quis nostrud exercitation ullamco
                laboris nisi ut aliquip ex ea commodo consequat.
            </post>
        </posts>
        <followers>
            <follower>
                <id>2</id>
            </follower>
            <follower>
                <id>4</id>
            </follower>
        </followers>
    </user>
</users>
```

Requirements

- Converting XML to JSON: JSON (Javascript Object Notation) is another format that is used to represent data. It's helpful to convert the XML into JSON, especially when using javascript as there's tons of libraries and tools that use json notation.

```
{
    "users": [
        "user": {
            "id": "1",
            "name": "user1",
            "posts": [
                    "Lorem ipsum dolor sit amet, consectetur
                        adipiscing elit, sed do eiusmod tempor
                        incididunt ut labore et dolore magna aliqua.",
                    "Ut enim ad minim veniam, quis nostrud
                        exercitation ullamco laboris nisi ut aliquip
                        ex ea commodo consequat."
                ],
            "followers": [
                    {
                        "id": "2"
                    },
                    {
                        "id": "4"
                    }
                ]
            }
        ]
}
```

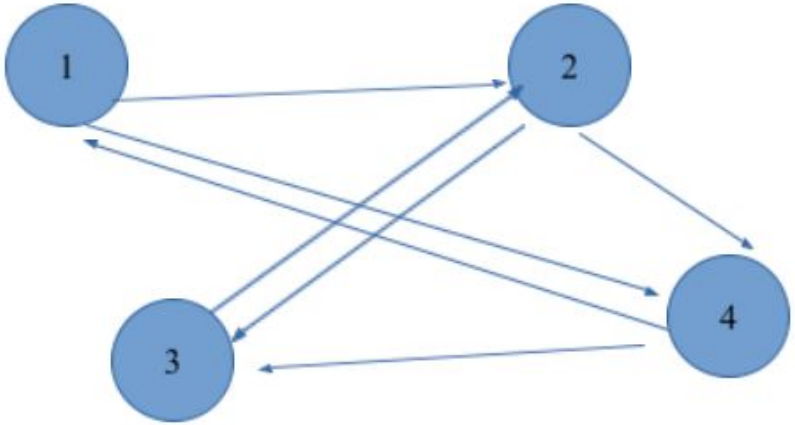
Requirements

- Minifying the XML file: Since spaces and newlines (**\n**) are actually characters that can increase the size of an XML document. This feature should aim at decreasing the size of an XML file (compressing it) by deleting the whitespaces and indentations.
- Compressing the data in the XML/JSON file: You should come-up with a way to reduce the size of the file using a data compression technique. You can invent your own ad-hoc method for such compression. On the other hand, you can check how JSONH works and try to distill ideas from it. Finally, you can use a data compression technique such as byte pair encoding (https://en.wikipedia.org/wiki/Byte_pair_encoding).
  The smaller the output file is, the more efficient your algorithm is.

Requirements

- representing the users data using the graph data structure: the XML file will represent the users data in a social network (their posts, followers, ...etc).
  The user data is his id (unique across the network), name, list of his posts and followers.
  So you should represent the relation between the followers using the graph data structure as it will be very helpful for the network analysis.
  If the input file was like this (the dots mean that there are additional tags inside the user tag) :
  Then you should build a graph relation between the user that looks like the graph beneath.

Requirements




```
<users>
    <user>
        <id>1</id>
        ...
        <followers>
            <follower>
                <id>2</id>
            </follower>
            <follower>
                <id>4</id>
            </follower>
        </followers>
    </user>
    <user>
        <id>2</id>
        ...
        <followers>
            <follower>
                <id>3</id>
            </follower>
            <follower>
                <id>4</id>
            </follower>
        </followers>
    </user>
    <user>
        <id>3</id>
        ...
        <followers>
            <follower>
                <id>2</id>
            </follower>
        </followers>
    </user>
    <user>
        <id>4</id>
        ...
        <followers>
            <follower>
                <id>1</id>
            </follower>
            <follower>
                <id>3</id>
            </follower>
        </followers>
    </user>
</users>
```

Requirements

- Network analysis: by representing the network using the graph data structure, we can extract some important data:
  - who is the most influencer user (has the most followers)
  - who is the most active user (connected to lots of users)
  - the mutual followers between 2 users
  - for each user, suggest a list of users to follow (the followers of his followers)
- Post search: given a specific word or topic, get the posts where this word or topic was mentioned.

Bonus requirements

- Graph visualization: you're free to use any tool or 3rd party library to help you visualize the graph of the network showing how the user is connected to each other.
- Additional operations: you're free to implement additional operations to help you analyze the network better.

- NOTE:
  You have to finish all the basic requirements first to get the bonus for the bonus requirements.

Submission Requirement

- The program should be working properly.
- The program should have a simple GUI window containing a set of buttons that are used to choose the operation that needs to be done on the XML file.
- The GUI should allow the user to choose the XML file that will be used.
- The GUI should allow viewing the input XML and the output of each operation as much as possible (If you face problems with large files then you can view only the first lines of the file).
- The GUI should allow the user to save the results of the operations to a new file.

Submission milestones

Phase	Deadline
- XML consistency - Formatting XML - XML to JSON - Compressing the file	During the 3rd week after the midterm exams.
- Graph data representation - Network analysis - Post search - Any extra operations	After one week from the final exams

Why this project

In this project, you will learn how to understand and parse XML and json files. Additionally, you will work on designing a GUI (Graphical User Interface) to visualize XML and json files. You should also work on designing the program such that it makes use of optimal data structures for the implemented features.