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CSC2001F

Assignment 1 - Report
15/03/2025

CSC2001F 2025 Data Structures Assignment 1

My Object Oriented design:

I created several different classes that interact with each other, making my programmes object-oriented. Object-oriented design promotes the modularity of my code and feeds well into the workflow of Java programmes, the language I used to code my work. This coding approach was beneficial when considering the expanse of this project compared to those of my previous CSC1015/16 assignments.

Classes Created:

The **GenericsKbArrayApp** class manages the knowledge base using an array. It handles populating the base from a file, updating entries, searching for terms, and displaying results. The class uses a two-dimensional array to store the term, sentence, and confidence score, encapsulating all operations related to array-based knowledge base management. It marks one of my two GenericsApp implementations.

The **GenericsKbBSTApp** class implements the knowledge base using a binary search tree (BST). It provides the same functionality as the **GenericsKbArrayApp** but with improved efficiency in search, insert, and delete operations due to the use of a binary tree. Each node in the BST stores a term, sentence, and confidence score. This class supports dynamic insertion and efficient searching, offering better performance for the large dataset.

The **Parsefile** class reads and parses the input text file, storing the terms, sentences, and confidence scores in a list of String arrays for use by the **GenericsKbArrayApp** and **GenericsKbBSTApp** classes.

The **BinarySearchTree** class manages the knowledge base used in **GenericsKbBSTApp** using a binary tree. It supports efficient insertions, traversal, and searches. Each node stores a term, sentence, and associated confidence score.

The **Node** class represents an entry in the binary search tree, storing a term, sentence, confidence score, and references to its left and right child nodes. It supports tree operations like traversal, insertion, and searching.

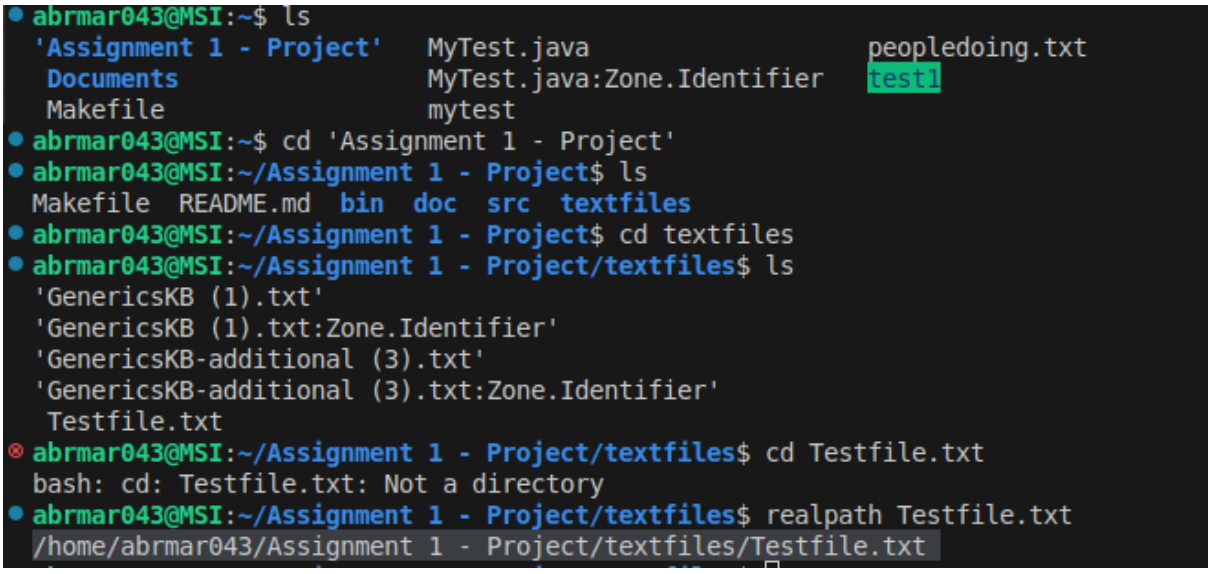
The **Tree** interface provides a blueprint for implementing tree-based knowledge base management in **GenericsKbBSTApp** and defines operations for BinaryTreeSearch.

How they interact:

The **GenericsKbArrayApp** and **GenericsKbBSTApp** classes load the knowledge base via the **Parsefile** class, storing the data in either an array or binary search tree. The **BinarySearchTree** class only manages the database of **GenericsKBBSTApp**, and the **Node** class and **Tree** interface are used in **BinarySearchTree** to represent entries and define operations, respectively.

Testing Process:

(NB: when entering the filepath/ directory of my textfile/database, eg: */home/abrmar043/Assignment 1 - Project/textfiles/Testfile.txt*, I didn't directly copy the file as a path since I was using Ubuntu)



Testing GenericsKbArrayApp:

```
abrmar043@MSI:~/Assignment 1 - Project$  cd /home/abrmar043/Assignment\ 1\ -\ Project ; /usr/bin/env /usr/lib/jvm/java-21-openjdk-amd64/bin/java -agentlib:jdwp=transport=dt_socket,server=n,susp
end=y,address=localhost:45065 -XX:+ShowCodeDetailsInExceptionMessages -cp /home/abrmar043/.config/Code/User/workspaceStorage/625495b6905a0cf58c7c0798414660f0/redhat.java/jdt_ws/Assignment\ 1\ -
\ Project_832ac0f2/bin src.GenericsKbArrayApp
Welcome to GenericsKb :)

Choose an action from the menu:
1. Load a knowledge base from a file
2. Update a statement in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:

1
Enter file directory:
/home/abrmar043/Assignment 1 - Project/textfiles/Testfile.txt
Knowledge base loaded successfully.


Choose an action from the menu:
1. Load a knowledge base from a file
2. Update a statement in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:

3
Enter the term to search:
motility
Statement found: Motility is an action
Confidence Score: 1.0

Choose an action from the menu:
1. Load a knowledge base from a file
2. Update a statement in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:
```

```
2
Please enter the term you want to update:
motility
Please enter the new information you want associated with the term:
Motility is not an action.
Please enter the Confidence Score of your information on a scale from 0.0(impossible) to 1.0(certain):
0.0
Failed to update: The new confidence score (0.0) is lower than the existing score (1.0). :(


Choose an action from the menu:
1. Load a knowledge base from a file
2. Update a statement in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:

3
Enter the term to search:
motility
Statement found: Motility is an action
Confidence Score: 1.0

Choose an action from the menu:
1. Load a knowledge base from a file
2. Update a statement in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:

4
Enter the term to search:
motility
Enter the statement to search for:
Motility is an action
Statement was found and has a Confidence Score of: 1.0

Choose an action from the menu:
1. Load a knowledge base from a file
2. Update a statement in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:
```

```
2
Please enter the term you want to update:
motility
Please enter the new information you want associated with the term:
motility is an action involving the motion of an item or thing.
Please enter the Confidence Score of your information on a scale from 0.0(impossible) to 1.0(certain):
1.0
Statement successfully updated :D !!!

Choose an action from the menu:
1. Load a knowledge base from a file
2. Update a statement in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:

3
Enter the term to search:
motility
Statement found: motility is an action involving the motion of an item or thing.
Confidence Score: 1.0

Choose an action from the menu:
1. Load a knowledge base from a file
2. Update a statement in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:

5
abrmar043@MSI:~/Assignment 1 - Project$
```

TestingGenericKbBSTApp:

```
Choose an action from the menu:
1. Load a knowledge base from a file
2. Add or update a statement to\in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:

2
Please enter the term you want to add to the knowledge base:
jellybeans
Please enter the new information you want associated with the term:
Jellybeans are colorful and sweet.
Please enter the Confidence Score of your information on a scale from 0.0(impossible) to 1.0(certain):
0.8
Node found: null
The term was not found within the database.
Would you like to add the new information to the knowledge base? [y or \n]:
y


Tree Contents (In-order traversal):
Key: jellybeans, Sentence: Jellybeans are colorful and sweet., Confidence Score: 0.8

Choose an action from the menu:
1. Load a knowledge base from a file
2. Add or update a statement to\in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:

2
Please enter the term you want to add to the knowledge base:
chocolate
Please enter the new information you want associated with the term:
Chocolate is made from cocoa beans.
Please enter the Confidence Score of your information on a scale from 0.0(impossible) to 1.0(certain):
0.9
Current node key: jellybeans
Node found: null
The term was not found within the database.
Would you like to add the new information to the knowledge base? [y or \n]:
y


Tree Contents (In-order traversal):
Key: chocolate, Sentence: Chocolate is made from cocoa beans., Confidence Score: 0.9
Key: jellybeans, Sentence: Jellybeans are colorful and sweet., Confidence Score: 0.8
```

```
1. Load a knowledge base from a file
2. Add or update a statement to\in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:

3
Enter the term to search:
chocolate
The root of your tree is null.
Current node key: jellybeans
Node found: chocolate
Term found: chocolate
Confidence Score: 0.9
Choose an action from the menu:
1. Load a knowledge base from a file
2. Add or update a statement to\in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:

4
Enter the term to search:
jellybeans
Enter the statement to search for:
Jellybeans are colorful and sweet.
The root of your tree is null.
The statement was found with a Confidence Score of: 0.8
Choose an action from the menu:
1. Load a knowledge base from a file
2. Add or update a statement to\in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:

abrmar043@MSI:~/Assignment 1 - Project$  cd /home/abrmar043/Assignment\ 1\ -\ Project ; /usr/bin/env /usr/lib/jvm/java-21-openjdk-amd64/bin/java -agentlib:jdwp=transport=dt_socket,server=n,suspend=y,address=localhost:42887 -XX:+ShowCodeDetailsInExceptionMessages -cp /home/abrmar043/.config/Code/User/workspaceStorage/625495b6905a0cf58c7c0798414660f0/redhat.java/jdt_ws/Assignment\ 1\ -\ Project_832ac0f2/bin src.GenericsKbBSTApp
Choose an action from the menu:
1. Load a knowledge base from a file
2. Add or update a statement to\in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:

2
```

Preliminary Tests:

Pre-finish trace statements:

(I mainly had issues within my BinarySearchTree and GenericsKbBSTApp classes)

BinarySearchTree:

```
48  +            if (node == null || key.equals(node.key)) {
49  +
50  +                System.out.println("Node found: " + (node != null ? node.key : "null")); // Debug statement check node empty
51  +
52  +                return node; }
53  +
54  +                System.out.println("Current node key: " + node.key); // Debug statement check node
```

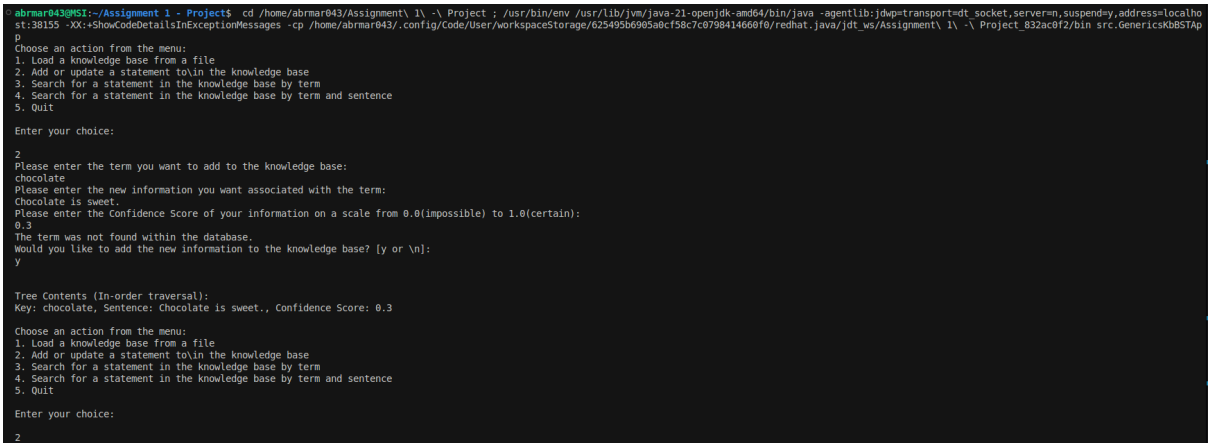
GenericsKbBSTApp:

```
41  +            //System.out.println("Inserting: " + key + ", " + sentence + ", " + CS); // Debug statement Test insertion
42  +
```

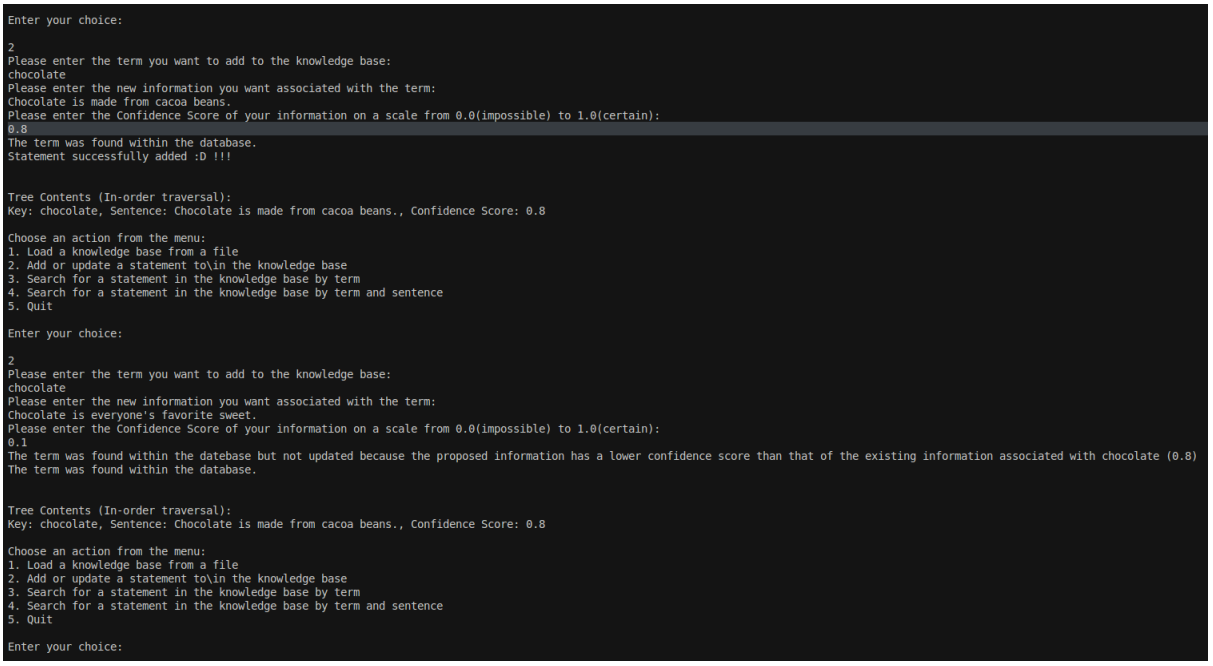
```
47      -        System.out.println("\n");
45      +        System.out.println("\n");
46      +        System.out.println("Root after insertion: " + tree.root); // Debug Statement checking for root
48  47           tree.printTree(); //Debug Statement Test loading/updating
```

```
93      +            System.out.println("Root after insertion: " + tree.root); // Debug Statement checking for root
94  94               tree.printTree(); //Debug Statement Test loading/updating
```

Output:



```
abrmar043@MSI:~/Assignment 1 - Project$  cd /home/abrmar043/Assignment\ 1\ -\ Project ; /usr/bin/env /usr/lib/jvm/java-21-openjdk-amd64/bin/java -agentlib:jdwp=transport=dt_socket,server=n,suspend=y,address=localhost:38155 -XX:+ShowCodeDetailsInExceptionMessages -cp /home/abrmar043/.config/Code/User/workspaceStorage/625495b6905a0cf58c7c0798414660f0/redhat.java/jdt_ws/Assignment\ 1\ -\ Project_832ac0f2/bin src.GenericsKbBSTApp
Choose an action from the menu:
1. Load a knowledge base from a file
2. Add or update a statement to\in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:

2
Please enter the term you want to add to the knowledge base:
chocolate
Please enter the new information you want associated with the term:
Chocolate is sweet.
Please enter the Confidence Score of your information on a scale from 0.0(impossible) to 1.0(certain):
0.3
The term was not found within the database.
Would you like to add the new information to the knowledge base? [y or \n]:
y


Tree Contents (In-order traversal):
Key: chocolate, Sentence: Chocolate is sweet., Confidence Score: 0.3

Choose an action from the menu:
1. Load a knowledge base from a file
2. Add or update a statement to\in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:

2
```



```
Enter your choice:

2
Please enter the term you want to add to the knowledge base:
chocolate
Please enter the new information you want associated with the term:
Chocolate is made from cacoa beans.
Please enter the Confidence Score of your information on a scale from 0.0(impossible) to 1.0(certain):
0.8
The term was found within the database.
Statement successfully added :D !!!


Tree Contents (In-order traversal):
Key: chocolate, Sentence: Chocolate is made from cacoa beans., Confidence Score: 0.8

Choose an action from the menu:
1. Load a knowledge base from a file
2. Add or update a statement to\in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:

2
Please enter the term you want to add to the knowledge base:
chocolate
Please enter the new information you want associated with the term:
Chocolate is everyone's favorite sweet.
Please enter the Confidence Score of your information on a scale from 0.0(impossible) to 1.0(certain):
0.1
The term was found within the datebase but not updated because the proposed information has a lower confidence score than that of the existing information associated with chocolate (0.8)
The term was found within the database.


Tree Contents (In-order traversal):
Key: chocolate, Sentence: Chocolate is made from cacoa beans., Confidence Score: 0.8

Choose an action from the menu:
1. Load a knowledge base from a file
2. Add or update a statement to\in the knowledge base
3. Search for a statement in the knowledge base by term
4. Search for a statement in the knowledge base by term and sentence
5. Quit

Enter your choice:
```

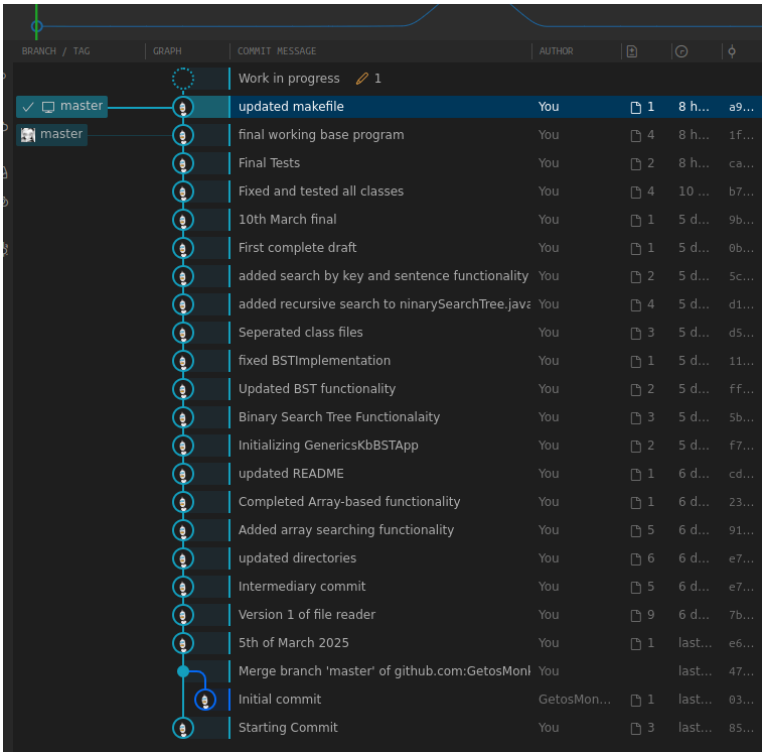
Creative aspect:

I added a welcome screen, which opens when the main functions of my **GenericsKbBSTApp** and **GenericsKbArrayApp** run. I added some custom colors to make it look more pretty and a friendly message to make it more appealing to the user.

I did this by creating a **WelcomeSign** class using Swing when I finished my assignment and simply created a new occurrence of a **WelcomeSign** object within each of the main functions of my otherwise text-based apps.

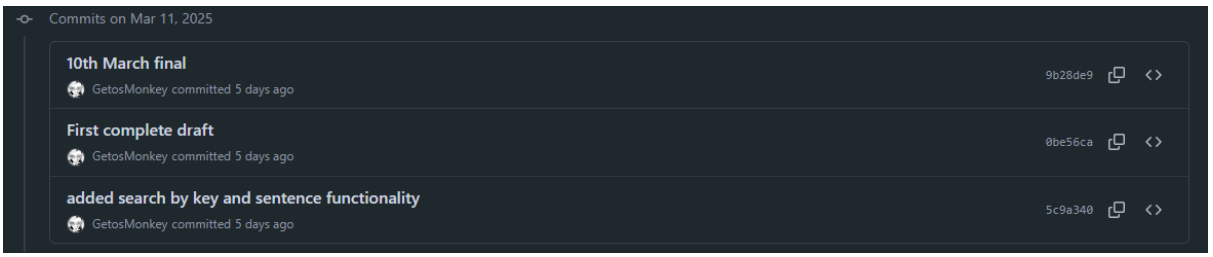
Git Usage:

```
abrmar043@MSI:~/Assignment 1 - Project$ git log | (ln=0; while read l; do echo $ln\: $l; ln=$((ln+1));
done) | (head -10; echo ...; tail -10)
0: commit a9f8412808486a2af8aaa73eccc1e40a753a3914
1: Author: Maryam Abrahams <abrmar043@myuct.ac.za>
2: Date: Sat Mar 15 10:56:49 2025 +0200
3:
4: updated makefile
5:
6: commit 1fa8a4b191217ae3b791e83809bdf97a069ccc7f
7: Author: Maryam Abrahams <abrmar043@myuct.ac.za>
8: Date: Sat Mar 15 10:35:29 2025 +0200
9:
...
147:
148: Initial commit
149:
150: commit 855cdf28bf54bcc8ca93c319ec13452adc419f34
151: Author: Maryam Abrahams <abrmar043@myuct.ac.za>
152: Date: Wed Mar 5 19:07:09 2025 +0200
153:
154: Starting Commit
155:
156: Start of my project with the basics of what I need as files made but unpopulated
abrmar043@MSI:~/Assignment 1 - Project$
```



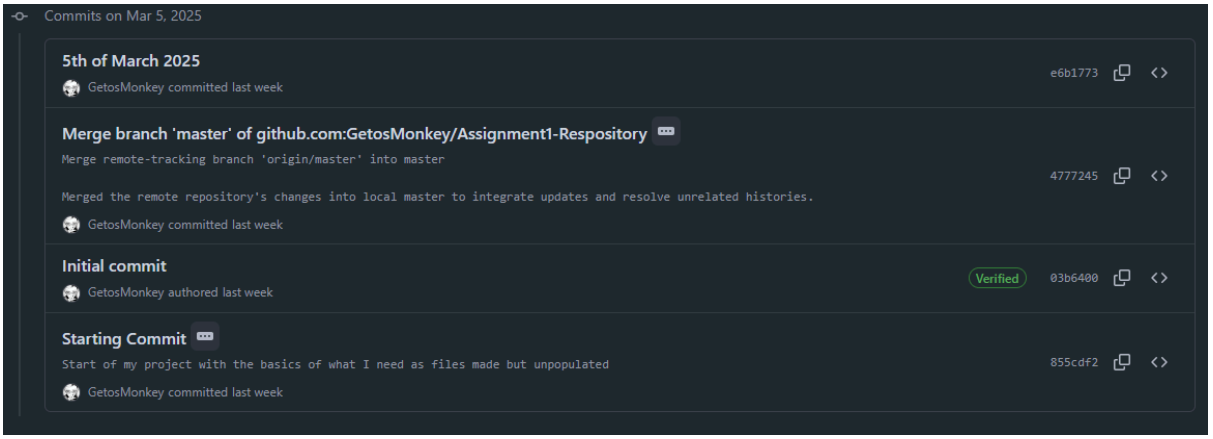
https://github.com/GetosMonkey/Assignment1-Respository.git


Commits on Mar 15, 2025
final working base program
GetosMonkey committed 7 hours ago
1fa8a4b
Final Tests
Finally my code is working as intended, this is the version with trace statements
GetosMonkey committed 8 hours ago
cae2784
Fixed and tested all classes
Only issue is still with my search functionality for the BST version.
GetosMonkey committed 9 hours ago
b7b7395


Commits on Mar 11, 2025
10th March final
GetosMonkey committed 5 days ago
9b28de9
First complete draft
GetosMonkey committed 5 days ago
0be56ca
added search by key and sentence functionality
GetosMonkey committed 5 days ago
5c9a340


Commits on Mar 10, 2025
added recursive search to ninarySearchTree.java
GetosMonkey committed 5 days ago
d16632b
Seperated class files
GetosMonkey committed 5 days ago
d57ba07
fixed BSTImplementation
GetosMonkey committed 5 days ago
11e977f
Updated BST functionality
removed generalization of node type, and refined classes
GetosMonkey committed 5 days ago
ff74d3b
Binary Search Tree Functionalaity
This is not my original work, it's an implementation from a youtube video explaining the logic behind BST trees but I want to fit it to my code to use since we are allowed to use any external resources
GetosMonkey committed 5 days ago
5b4689c
Initializing GenericsKbBSTApp
copied over the functionality of the array app into the BST app
GetosMonkey committed 5 days ago
f73a7ed


Commits on Mar 9, 2025
updated README
GetosMonkey committed last week
cda761e
Completed Array-based functionality
My shayla that took me unecessarily long
GetosMonkey committed last week
23144ba
Added array searching functionality
GetosMonkey committed last week
918874a
updated directories
GetosMonkey committed last week
e7cec79
Intermediary commit
Changes to Parsefile to make it not rely on the main function and return the parsed textfile + the beginnings of GenericsKbArrayApp.java
GetosMonkey committed last week
e744aa9
Version 1 of file reader
GetosMonkey committed last week
7bcb468



The resources I used were highlighted in my READ.ME file.
