Assignment 1, Report

The Aim:

The aims of the this project is to prove ‘GenericsKbBSTApp’ and the ‘GenericsKbArrayApp’ function differently managing knowledge base files, as they use different underlying data structures, which leads to distinct advantages and use cases.

Object-oriented Design:

For this project, I implemented five primary classes: Data, BSTNode, BST, GenericsKbBSTApp, GenericsKbArrayApp. Some of these classes work together to store, search and update statements in the knowledge base either using binary search trees or typical array(linear) search.

- Data Class:

  Represents a knowledge base entry with three attributes: term (the keyword), statement (the description), and score (the confidence score).This class helps collect data from files of knowledge base in an organised way. For good coding, I implemented toString method that prints information of a term (the keyword).

- BSTNode Class:

  Represents a node in the BST (Binary Search Tree). Contains a Data object and pointers to left and right child nodes. It is the base functionality of binary search tree.

- BST Class:

  Implements the Binary Search Tree. Supports insertion of Data objects, ensuring that terms are stored in a sorted manner. Updates an entry if a new statement or statement with a higher confidence score is provided. Implements a search function to locate a statement based on both term and statement input.

- GenericsKbBSTApp Class:

  The main BST functionality. Allows user’s input with the menu it provides. Loads data from an input file into the BST. Allows users to search for a statement using a term and statement input. Displays the corresponding statement and confidence score if found.

- GenericsKbArrayApp Class:

  This class is the same as the ‘GenericsKbBSTApp’ but this one only updates the statements it does not allow new statements. And it uses an array instead of a Binary Search Tree (BST) to store the Data.

Interactions:

- GenericsKbArrayApp and GenericsKbBSTApp:

  Both classes handle the knowledge base but have different ways of dealing with them.

- GenericsKbBSTApp and BSTNode:

  Node is the fundamental building block of the array in the GenericsKbBSTApp, as it is used for storing information about terms, sentences, and confidence scores.

Traditional Array Implementation:

This implementation provides this program is for managing a knowledge base using an array data structure. The standard array data structure stores and manages data from the knowledge base, whereby each element in the array corresponds to a piece of information (term, sentence, confidence score). Data is stored in memory locations, accessing elements is done through indexing, insertion happens at the end of the array.

Binary Search Tree implementation:

This implementation provides this program is for managing a knowledge base using a Binary Search Tree data structure. The Binary Search Tree data structure involves using nodes to organize and store the information. Each node in the tree holds a piece of information, which is the term, sentence, and confidence score, and the tree provides efficient searching, inserting, and retrieval capabilities. The use of a Binary Search Tree allows for efficient searching and organizing of the knowledge base.

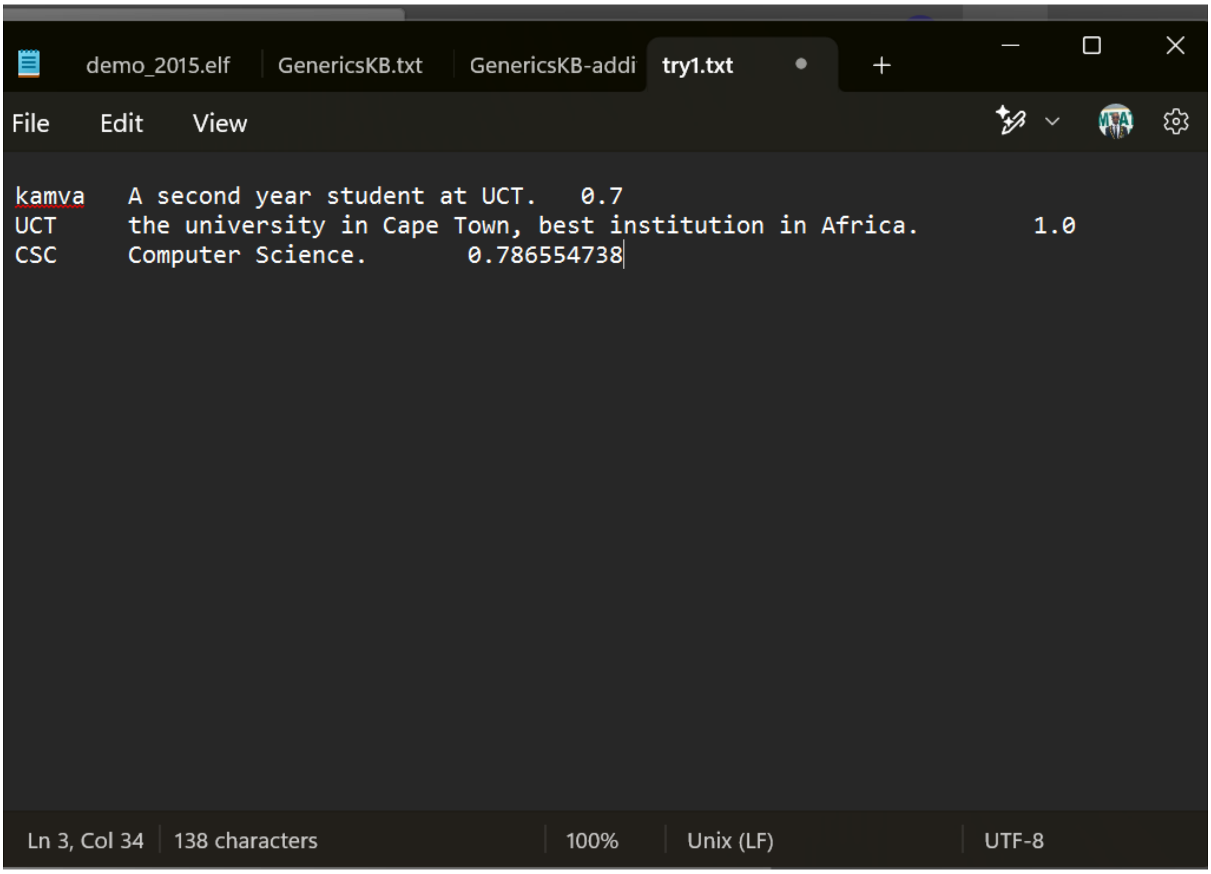
Testing

Objective:

Ensure the correct functionality of the Generics Knowledge Base Application, including loading from a file, adding/updating statements, and searching for items.

Cases:

I had test cases for varies cases, first when the file does not have a lot of knowledge base.



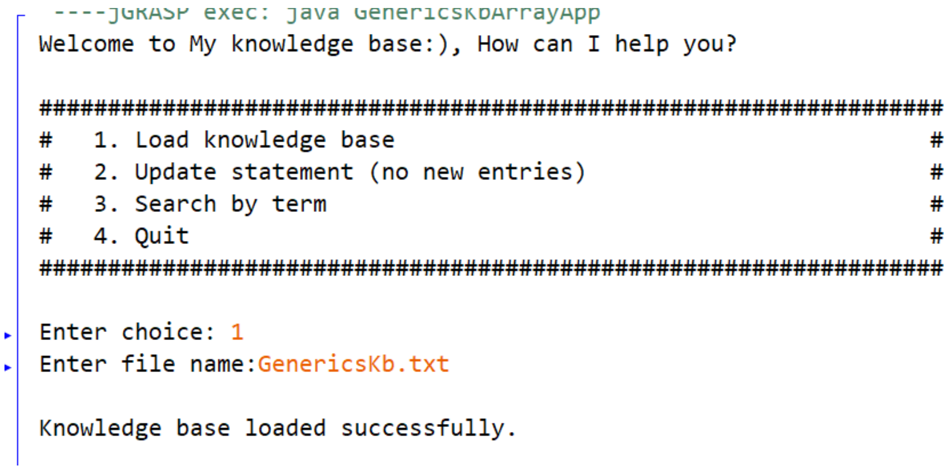
```
kamva   A second year student at UCT.   0.7
UCT     the university in Cape Town, best institution in Africa.        1.0
CSC     Computer Science.       0.786554738
```

This try helped me detect that my code works before having a loads of data passed through it.

```
Welcome to My knowledge base:), How can I help you?

##################################################################
#   1. Load knowledge base                                       #
#   2. Update statement (no new entries)                         #
#   3. Search by term                                            #
#   4. Quit                                                      #
##################################################################

Enter choice: 3
Enter term: kamva
Statement found: A second year student at UCT (Confidence score: 0,70000)
```

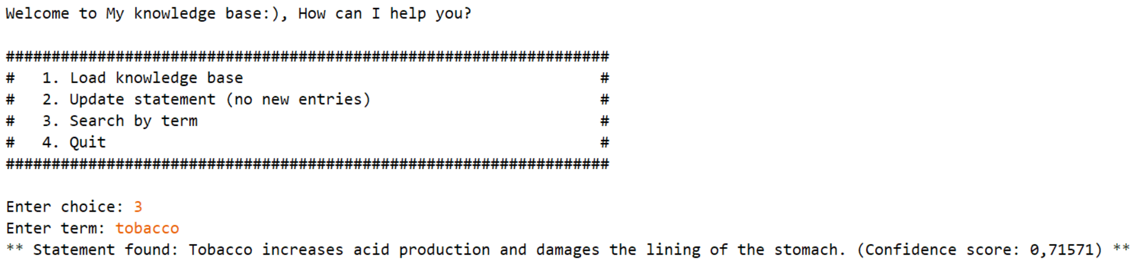
The first case proved my theory, the code works.

The second case; I used the large that. In this case I will be testing the loading functionality.



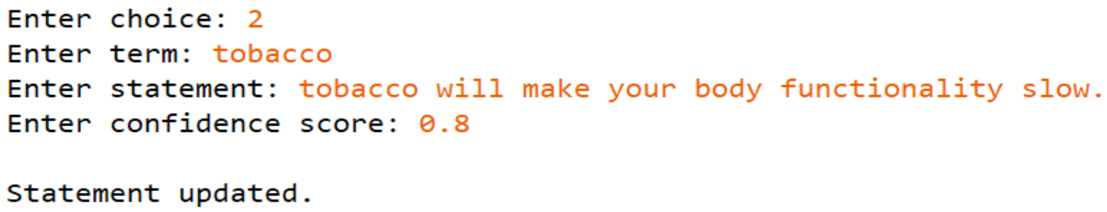
```
 ----jGRASP exec: java GenericsKbArrayApp
Welcome to My knowledge base:), How can I help you?

###################################################################
#   1. Load knowledge base                                        #
#   2. Update statement (no new entries)                          #
#   3. Search by term                                             #
#   4. Quit                                                       #
###################################################################

Enter choice: 1
Enter file name:GenericsKb.txt

Knowledge base loaded successfully.
```

The third case; having to search for the term. I expect to get the statement and confidence score.



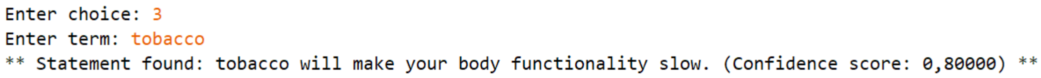
```
Welcome to My knowledge base:), How can I help you?

###################################################################
#   1. Load knowledge base                                        #
#   2. Update statement (no new entries)                          #
#   3. Search by term                                             #
#   4. Quit                                                       #
###################################################################

Enter choice: 3
Enter term: tobacco
** Statement found: Tobacco increases acid production and damages the lining of the stomach. (Confidence score: 0,71571) **
```

The fourth case; Is to update the confidance score.



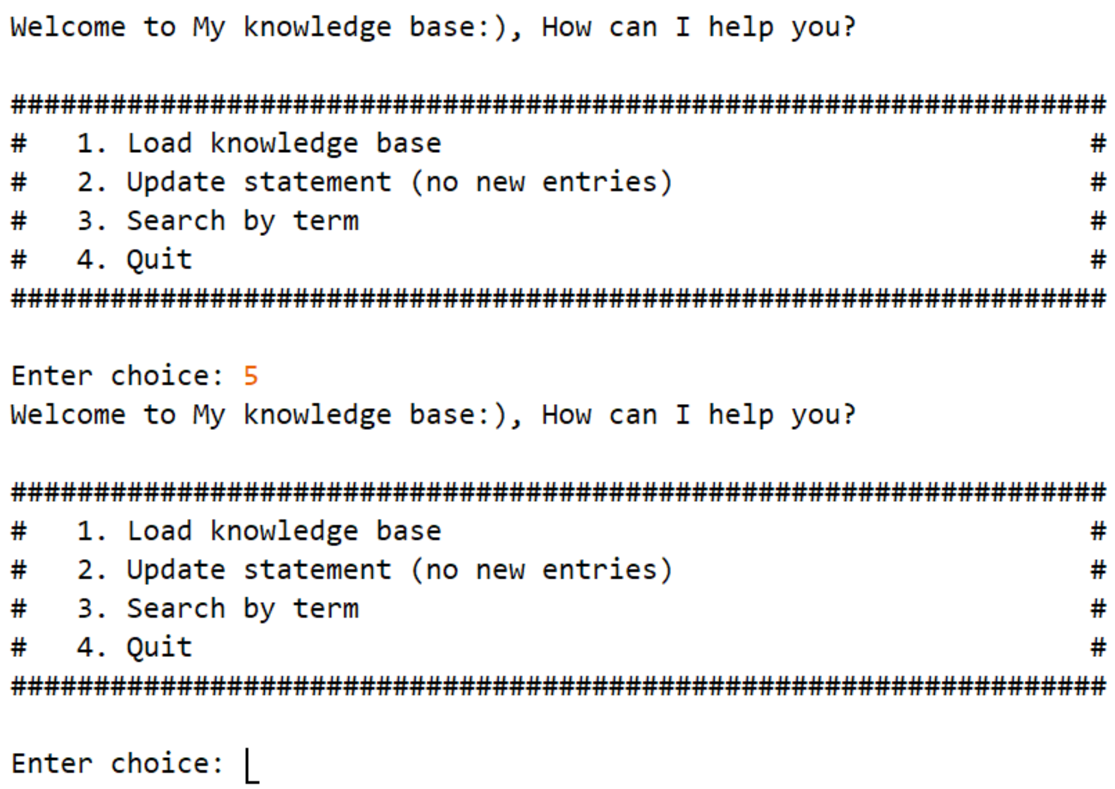
```
Enter choice: 2
Enter term: tobacco
Enter statement: tobacco will make your body functionality slow.
Enter confidence score: 0.8

Statement updated.
```

Now I'll test if it has updated:



```
Enter choice: 3
Enter term: tobacco
** Statement found: tobacco will make your body functionality slow. (Confidence score: 0,80000) **
```

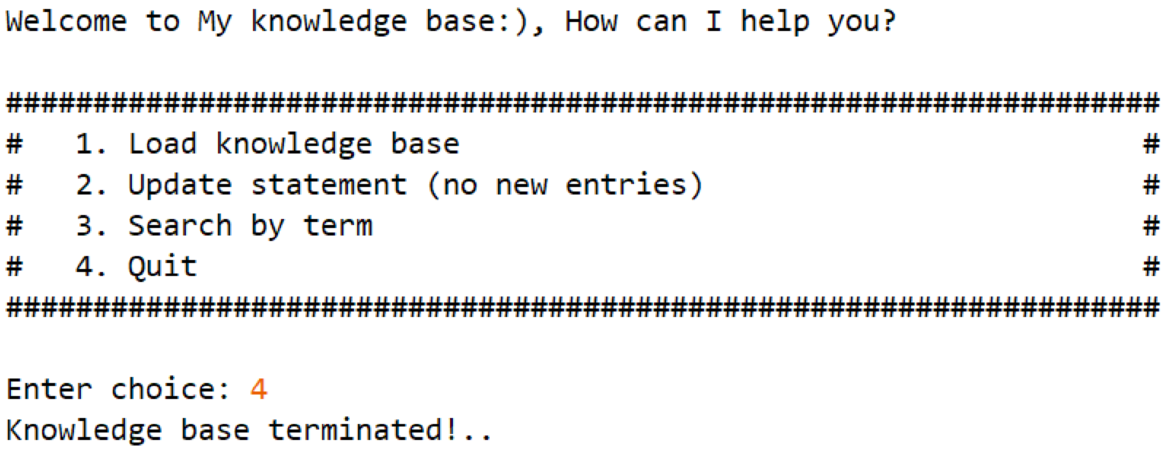
Testing for error input:



```
Welcome to My knowledge base:), How can I help you?

##################################################################
#   1. Load knowledge base                                       #
#   2. Update statement (no new entries)                         #
#   3. Search by term                                            #
#   4. Quit                                                      #
##################################################################

Enter choice: 5
Welcome to My knowledge base:), How can I help you?

##################################################################
#   1. Load knowledge base                                       #
#   2. Update statement (no new entries)                         #
#   3. Search by term                                            #
#   4. Quit                                                      #
##################################################################

Enter choice: 
```

It will do nothing but give you a chance to try again.

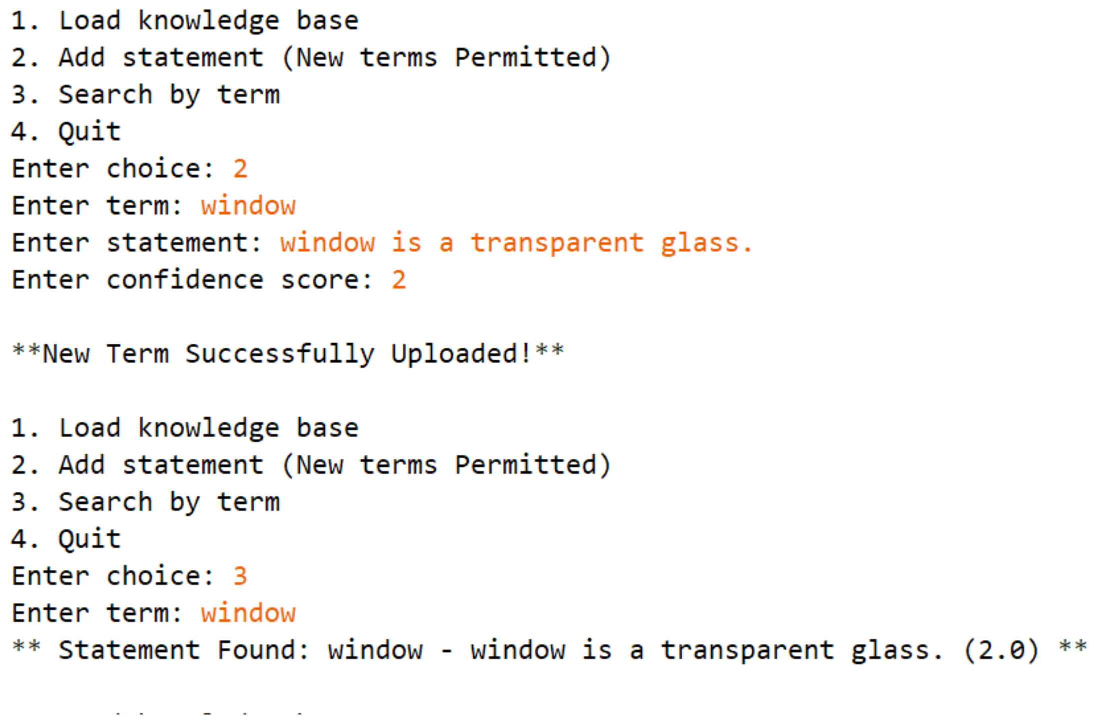
Testing the quit option:



```
Welcome to My knowledge base:), How can I help you?

##################################################################
#   1. Load knowledge base                                       #
#   2. Update statement (no new entries)                         #
#   3. Search by term                                            #
#   4. Quit                                                      #
##################################################################

Enter choice: 4
Knowledge base terminated!..
```

The program will print a message then terminates.

Now test the option of adding a new term to the program:



```
1. Load knowledge base
2. Add statement (New terms Permitted)
3. Search by term
4. Quit
Enter choice: 2
Enter term: window
Enter statement: window is a transparent glass.
Enter confidence score: 2

**New Term Successfully Uploaded!**

1. Load knowledge base
2. Add statement (New terms Permitted)
3. Search by term
4. Quit
Enter choice: 3
Enter term: window
** Statement Found: window - window is a transparent glass. (2.0) **
```

Using the GenericsKbBSTApp program I successfully added a new term to the knowledge base.

User interface testing ensures that the user interface is user-friendly and responsive. Through out the testing the user interface has show instructions on what is required from the user.

Creativity:

User-Friendly Interface Improvements:

Clear instructions and structured output formatting improve readability. The application handles invalid inputs gracefully, ensuring a smooth user experience.

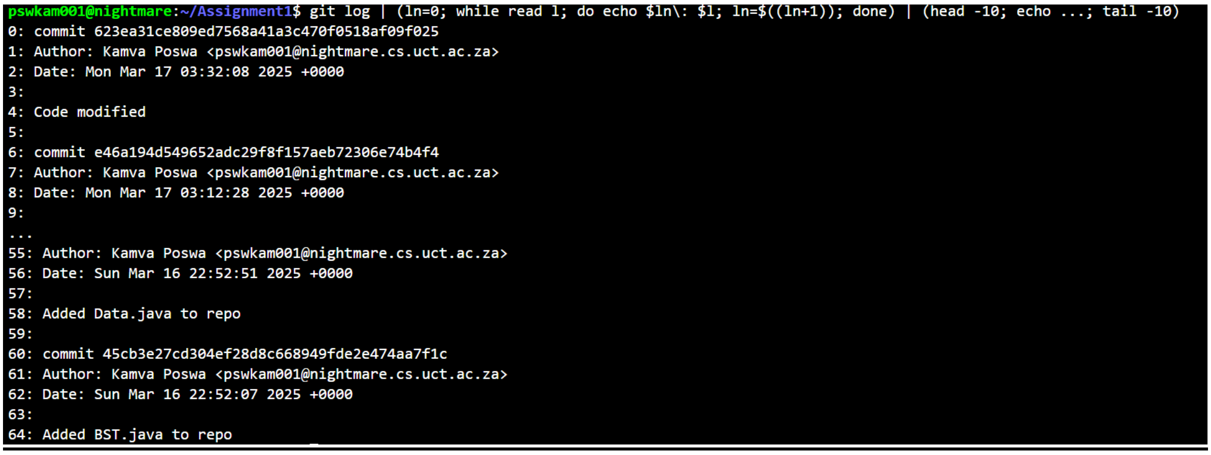
Confidence Score-Based Updates:

If a new entry is inserted with an existing term, the system updates it only if the confidence score is higher. This prevents unnecessary overwriting of valuable information.

Conclusion:

The BST and Array classes incorporate checks and provide messages to the user when certain events occur such as successfully loading data from the file or when certain conditions are not met such as not loading the knowledge base before performing operations. This helps enhance the user experience by providing feedback on the outcome of operations. Both classes also make use of print statements to provide informative information about the execution of various methods, which aid in understanding the flow of the program.

Git Usage Summary



```
pswkam001@nightmare:~/Assignment1$ git log | (ln=0; while read l; do echo $ln\: $l; ln=$((ln+1)); done) | (head -10; echo ...; tail -10)
0: commit 623ea31ce809ed7568a41a3c470f0518af09f025
1: Author: Kamva Poswa <pswkam001@nightmare.cs.uct.ac.za>
2: Date: Mon Mar 17 03:32:08 2025 +0000
3:
4: Code modified
5:
6: commit e46a194d549652adc29f8f157aeb72306e74b4f4
7: Author: Kamva Poswa <pswkam001@nightmare.cs.uct.ac.za>
8: Date: Mon Mar 17 03:12:28 2025 +0000
9:
...
55: Author: Kamva Poswa <pswkam001@nightmare.cs.uct.ac.za>
56: Date: Sun Mar 16 22:52:51 2025 +0000
57:
58: Added Data.java to repo
59:
60: commit 45cb3e27cd304ef28d8c668949fde2e474aa7f1c
61: Author: Kamva Poswa <pswkam001@nightmare.cs.uct.ac.za>
62: Date: Sun Mar 16 22:52:07 2025 +0000
63:
64: Added BST.java to repo
```