

CSC2001F 2024 Data Structures Assignment 1

Report – MRRJOS007

In the provided Java code, an object-oriented design approach is employed to create a program that manages a knowledge base using a Binary Search Tree and a program that manages a knowledge base using a 1-Dimensional array. Here's an overview of the classes created, their purposes and how they interact:

GenericsKbArrayApp:

- This class represents the `main()` application for managing a knowledge base using a 1D array.
- It contains methods for loading data from a text file, adding new entries, searching for entries by term or sentence and updating entries.
- The class utilizes a 1D array (`String[]` items) to store knowledge base entries.
- Interaction with the user is facilitated through the `run()` method, which presents a menu of options and handles user input.
- Methods such as `loadFile()`, `addStatement()`, `searchTerm()` and `searchSentence()` manipulate the array based on user actions.
- The class also includes a method `writeTextFile()` for writing the updated knowledge base back to the text file.

GenericsKbBSTApp:

- This class serves as the main entry point for the binary search program.
- It contains the `main()` method for starting the application and the `run()` method for managing user interactions.
- This program also has methods such as `loadFile()`, `addStatement()`, `searchTerm()` and `searchSentence()`, but they manipulate the BST based on user actions.
- The class also includes a method `writeTextFile()` for writing the updated knowledge base back to the text file but uses the `inOrderTraversal` to acquire each line and update the knowledge base with user input.
- It interacts with the `BinarySearchTree` class to perform operations such as finding, inserting and using `inOrderTraversal` for added information into the knowledge base.

BinarySearchTree:

- This class represents the binary search tree data structure.
- It contains methods for inserting, finding and traversing nodes within the tree.
- It uses a generic type (`Entry`) to store data in each node.
- This class extends `BinaryTree` which uses classes, `BTQueue` and `BTQueueNode` for some methods

Entry:

- This class represents an entry in the knowledge base.
- It contains fields for storing the term, statement and confidence score of each entry.
- It provides methods for accessing and modifying these fields (``getTerm()``, ``getStatement()``, ``getScore()``, ``setStatement()``, ``setScore()``).

These classes interact as follows:

- When the program starts, an instance of ``GenericsKbBSTApp`` is created, which in turn creates an instance of ``BinarySearchTree``.
- The ``loadFile()`` method in ``GenericsKbBSTApp`` reads entries from a text file, creates ``Entry`` objects for each entry and inserts them into the ``BinarySearchTree``.
- Users can choose to add new entries to the knowledge base using the ``addStatement()`` method. This method does not add a new entry into the knowledge base but rather updates an existing one by creating a new ``Entry`` object and searching into the ``BinarySearchTree`` if it does exist, the method updates the existing entry only if the new confidence score is higher.
- Searching for entries by term or by term and sentence is done through the ``searchTerm()`` and ``searchSentence()`` methods, respectively. These methods utilise the ``find()`` method in the ``BinarySearchTree`` class to locate the desired entry.
- The processes for ``GenericsKbArrayApp`` are identical but rather store the knowledge base in a 1-D array and all methods simply search through array rather than creating a binary search tree.

Overall, this design provides a modular and extensible solution for managing a knowledge base, allowing for efficient insertion, retrieval and updating of entries using a binary search tree or 1-D array data structure.

GenericsKbArrayApp Testing:

If user inputs anything not in the range 1 to 5, program will produce this

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

Enter your choice: 8

Invalid choice. Please enter a number between 1 and 5.
```

When option 1 is chosen the user is asked to input file name, if the text file cannot be found it will say file can't be found and print out the statements or if it is found it will load text file into an array.

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

Enter your choice: 1

Enter file name: FILENAME

Could not find file.

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

Enter your choice: 1

Enter file name: GenericsKB.txt

Knowledge base loaded successfully.
```

When option 2 is chosen, user is asked to supply term, statement and confidence score. If term cannot be found in knowledge base then program produces, "Could not find term in knowledge base". If term is found and confidence score is equal or higher it will update term in the knowledge base with new statement and if confidence score is less then program will produce, "Did not update as confidence score is less".

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

Enter your choice: 2

Enter the term: DOES NOT EXIST
Enter the statement: RANDOM STATEMENT
Enter the confidence score: 1

Could not find term in knowledge base

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

Enter your choice: 2

Enter the term: cusp
Enter the statement: A cusp is definitely a point
Enter the confidence score: 1

Statement for cusp has been updated

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

Enter your choice:
2

Enter the term: cusp
Enter the statement: I think cusp is a point
Enter the confidence score: 0,5

Did not update as confidence score is less
```

GenericsKB.txt before: cusp A cusp is a point 1.0

GenericsKB.txt after: cusp A cusp is definitely a point 1.0

When option 3 is chosen the user is asked to input a term to be searched. If the term does not exist in knowledge base then program produces, "Could not find term in knowledge base" else if the term is found the program produces, "Statement found: *statement* (Confidence score:*score*)".

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

Enter your choice: 3

Enter the term to search: RANDOM TERM

Could not find term in knowledge base

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

Enter your choice: 3

Enter the term to search: cusp

Statement found: A cusp is definitely a point (Confidence score: 1.0)
```

When option 4 is chosen, the user is asked to input term to search and statement. If both term and statement, just term or just statement cannot be found in knowledge base then program produces, "Could not find term or statement in knowledge base" else if it can be found it produces, "Statement found: *statement* (Confidence score:*score*)".

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

Enter your choice: 4

Enter the term to search: RANDOM TERM
Enter the statement to search for: RANDOM STATEMENT

Could not find term or statement in knowledge base

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

Enter your choice: 4

Enter the term to search: cusp
Enter the statement to search for: RANDOM STATEMENT

Could not find term or statement in knowledge base

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

Enter your choice: 4

Enter the term to search: RANDOM TERM
Enter the statement to search for: A cusp is definitely a point

Could not find term or statement in knowledge base

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

Enter your choice: 4

Enter the term to search: cusp
Enter the statement to search for: A cusp is definitely a point

Statement found: A cusp is definitely a point (Confidence score: 1.0)
```

Finally if option 5 is chosen, the program will simply quit.

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

Enter your choice: 5

PS C:\Users\Josh\OneDrive - University of Cape Town\csc2001f_practical_assignments\Assignment 1> █
```

GenericsKbBSTApp Testing:

If user inputs anything not in the range 1 to 5, program will produce this

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

Enter your choice: 6

Invalid choice. Please enter a number between 1 and 5.
```

When option 1 is chosen the user is asked to input file name, if the text file cannot be found it will say file can't be found and print out the statements or if it is found it will load text file into a BST.

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

Enter your choice: 1

Enter file name: NO NAME FILE

Could not find file.

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

Enter your choice: 1

Enter file name: GenericsKB.txt

Knowledge base loaded successfully.
```

When option 2 is chosen, user is asked to supply term, statement and confidence score. If term cannot be found in knowledge base then program produces, "Could not find term in knowledge base". If term is found and confidence score is equal or higher it run the inOrderTraversal method to acquire all lines from the knowledge base and will update term in the BST and will result in the knowledge base with new statement. If confidence score is less then program will produce, "Did not update as confidence score is less".

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

Enter your choice: 2

Enter the term: RANDOM TERM
Enter the statement: RANDOM STATEMENT
Enter the confidence score: 1

Could not find term in knowledge base

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

Enter your choice: 2

Enter the term: gasp
Enter the statement: A gasp is definitely an inhalation
Enter the confidence score: 1

Statement for gasp has been updated

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

Enter your choice: 2

Enter the term: gasp
Enter the statement: A gasp is exhalation
Enter the confidence score: 0,5

Did not update as confidence score is less
```


GenericsKB.txt before:	gasp	A gasp is inhalation	1.0
GenericsKB.txt after:	gasp	A gasp is definitely an inhalation	1.0

When option 3 is chosen the user is asked to input a term to be searched. If the term does not exist in knowledge base then program produces, "Could not find term in knowledge base" else if the term is found the program produces, "Statement found: *statement* (Confidence score:*score*)".

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

Enter your choice: 3

Enter the term to search: RANDOM TERM

Could not find term in knowledge base

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

Enter your choice: 3

Enter the term to search: gasp

Statement found: A gasp is definitely an inhalation (Confidence score: 1.0)
```

When option 4 is chosen, the user is asked to input term to search and statement. If both term and statement, just term or just statement cannot be found in knowledge base then program produces, "Could not find term or statement in knowledge base" else if it can be found it produces, "Statement found: *statement* (Confidence score:*score*)".

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

Enter your choice: 4

Enter the term to search: RANDOM TERM
Enter the statement to search for: RANDOM STATEMENT

Could not find term or statement in knowledge base

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

Enter your choice: 4

Enter the term to search: gasp
Enter the statement to search for: RANDOM STATEMENT

Could not find term or statement in knowledge base

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

Enter your choice: 4

Enter the term to search: RANDOM TERM
Enter the statement to search for: A gasp is definitely an inhalation

Could not find term or statement in knowledge base

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

Enter your choice: 4

Enter the term to search: gasp
Enter the statement to search for: A gasp is definitely an inhalation

Statement found: A gasp is definitely an inhalation (Confidence score: 1.0)
```

Finally if option 5 is chosen, the program will simply quit.

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

Enter your choice: 5

PS C:\Users\Josh\OneDrive - University of Cape Town\csc2001f_practical_assignments\Assignment 1> |
```

Creativity:

I changed the `inOrderTraversal` in the `BinarySearchTree` to my own custom method that instead of using the `visit` method (which prints out the BST in order) I rather created a List of type `BinaryTreeNode<Entry>` and inserted each node in order. I did this as a creative way to rewrite the text file. So when the user chose option 2 and a term was to be updated with a new statement. It would keep the text file in the completely same order but now containing the new updated term.

When I created the `Entry` class, I went above and beyond by creating `get` and `set` methods for all variables as well as implementing the `Comparable` interface. I did this to reduce the security threats as my instance variables are all private.

GIT LOG:

```
josh@VirtualBox:~/Assignments/Assignment_1$ git log | (ln=0; while read l; do ec
ho $ln\: $l; ln=$((ln+1));done) | (head -10; echo ...; tail -10)
0: commit b588a9ad2f4391647382404ec32167d72b270676
1: Author: Josh Murray <mrrjos007@myuct.ac.za>
2: Date: Thu Mar 7 22:18:48 2024 +0200
3:
4: Added more javadoc comments
5:
6: commit 246de3fab016e8beb1b97a924c58bd213f4a13f4
7: Author: Josh Murray <mrrjos007@myuct.ac.za>
8: Date: Thu Mar 7 11:38:08 2024 +0200
9:
...
109: Author: Josh Murray <mrrjos007@myuct.ac.za>
110: Date: Tue Mar 5 16:17:16 2024 +0200
111:
112: Created and downloaded necessary files
113:
114: commit b041d5249a2920873a31c3aa6a306e97da6892ac
115: Author: Josh Murray <mrrjos007@myuct.ac.za>
116: Date: Tue Mar 5 14:17:50 2024 +0200
117:
118: Initial git commit
```

Disclaimer: When testing on my UNIX machine java would not run `GenericsKbBTSApp.java` but when I ran the project in VS code it worked perfectly.