CSE116A,B Introduction to Computer Science II Fall 1999

Bina Ramamurthy
Project 3: Knowledge Representation and Retrieval

November 17, 1999

1 Objective

Major objective of the project is to learn to use

- To work with Tree ADT.
- To use binary search tree for knowledge (data) representation.
- To apply java serialization capabilities for streaming objects in and out.

2 Problem Statement

For this project, you will write an interactive game-playing program. The program will ask a human user yes/no questions until it either guesses the object of which the user is thinking, or gives up. If it has to give up, the system will ask the user to teach it something that it could use in future games. Your main program will consist (essentially) of a loop that plays a game and asks if the user wants to play again, until the user says no. When a program run first begins, the system should offer the user information about the game, but only give explanations if requested. If the user doesn’t need info, go straight to the play of the game.

You will implement a text version first and then the graphical version.

3 Problem Analysis and Design

The main data structure your program will need is a binary decision tree. Each node (except for leaves) should contain a question to ask the user, and the leaves should contain names/descriptions of objects that the system will offer as guesses. Play will consist of following the path from the root to the leaf indicated by the users responses. Once at a leaf, the system will have reached the best candidate for a match of which it knows. If it is wrong, it will “learn” by modifying its decision tree.
Scenarios of Interaction

Given the following tree at the start of the interaction:

```
Is it an animal?
  /y    \n /         \
Does it have a mane?  broccoli
  /y    \n /         \
a horse      a spider
```

and a user who was thinking of a spider, the program would correctly guess "spider". If, on the other hand, the user was thinking of a dog, the system should ask for a question distinguishing spiders from dogs. Suppose the user suggested web-spinning. Then the system should change its tree to reflect the new info:

```
Is it an animal?
  /y    \n /         \
Does it have a mane?  broccoli
  /y    \n /         \
a horse      Does it spin webs?
  /y    \n /         \
spider      dog
```

See the sample interchange enclosed at the end of this document.

4 Implementation Details

Once the classes are identified the next step is to design the interface, data structures, and functionality of the classes. For this purpose write down the responsibilities of each of the classes, and design the data structures needed.

1. Data Structures: The underlying data structure is a binary search tree. Clearly define a general binary search tree and its methods. This class will implement java.io.Serializable.

2. An object of the above mentioned tree will be instantiated in the driver class to represent the knowledge base.

3. Initially all the interaction will be text based or OptionalPane based. Add the GUI after completion of text-based application.

4. Do incremental development. Add the code in steps, and test it before you add more code.

5. Your program should start each gaming session with a tree that is 2 to 4 levels deep (your choice exactly how many levels, and what objects/questions to include.) You should show at least 4 sample runs, and at least one of them should loop at least 6 times.
6. Document appropriately using Name box at the top of your applet and application, PREcondition, POST-condition, ASSERTions and other comments.

5  Materials to Submit & Tentative Grading Policy

A detailed grading policy will be given to you later. Submit prj3.jar file that contains all the files needed including the documentation.

1. (5 points) A README that gives the list of files in your submission, the purpose of each file.
2. (75 points) Source files.
3. (10 points) Class diagram with classes and solutions explaining your design.
4. (5 points) Technical Manual explaining the project.
5. (5 points) User manual telling how to install and execute your knowledge acquisition program.

Other items to check: Points that will be taken off if any of these items are not present.

1. (5 points) Internal documentation. Comments.
2. (5 points) Program appearance: indentation, spacing, readability.
3. (5 points) There should be a name box that gives your name, file name and description of the contents of the file.

6  Due Date

`~\bina\submit_cse116b filenames separated by space for bsection
~\bina\submit_cse116a filenames separated by space for asection
BEFORE 12 midnight on 12/8/99.`
A Sample exchange:

Computer: I'm ready to play the guessing game.
Would you like information on how to play? [y/n]
User: y
Computer: You think of something – anything you want, and I'll try
to guess it by asking you yes-no questions.
If I cannot guess what you're thinking of,
I'll ask for advice on how I can play
better next time. We can play as often as you wish, but I
warn you: the longer we play, the better I get. OK. Now,
think of something. Are you ready? [y/n]
User: y
Computer: Is it an animal? [y/n]
User: y
Computer: Is it a lion? [y/n]
User: n
Computer: I give up. What were you thinking about?
User: a chimpanzee
Computer: I want to learn from my mistakes. Please give me a
question that you would answer "yes" about a lion and
"no" about a chimpanzee.
User: Does it roar?
Computer: Thank you. Would you like to play again [y/n]
User: y
Computer: Is it an animal? [y/n]
User: y
Computer: Does it roar? [y/n]
User: n
Computer: Is it a chimpanzee?
User: n
Computer: I give up. What were you thinking about?
User: Grandmother's cat.
Computer: I want to learn from my mistakes. Please give me a
question that you would answer "no" about a chimpanzee and
"yes" about Grandmother's cat.
User: Does it purr?
Computer: Thank you. Would you like to play again [y/n]
User: n
Computer: Bye, then. It was fun.

Another Sample exchange:

Computer: I'm ready to play the guessing game.
Would you like information on how to play? [y/n]
User: n
Computer: Are you thinking of something?
User: y
Computer: Is it an animal?
User: y
Computer: Does it roar? [y/n]
User: n
Computer: Does it purr?
User: y
Computer: Grandmother's cat
Computer: Would you like to play again [y/n]
User: n
Computer: Bye, then. It was fun.