Guessing game using Binary Tree
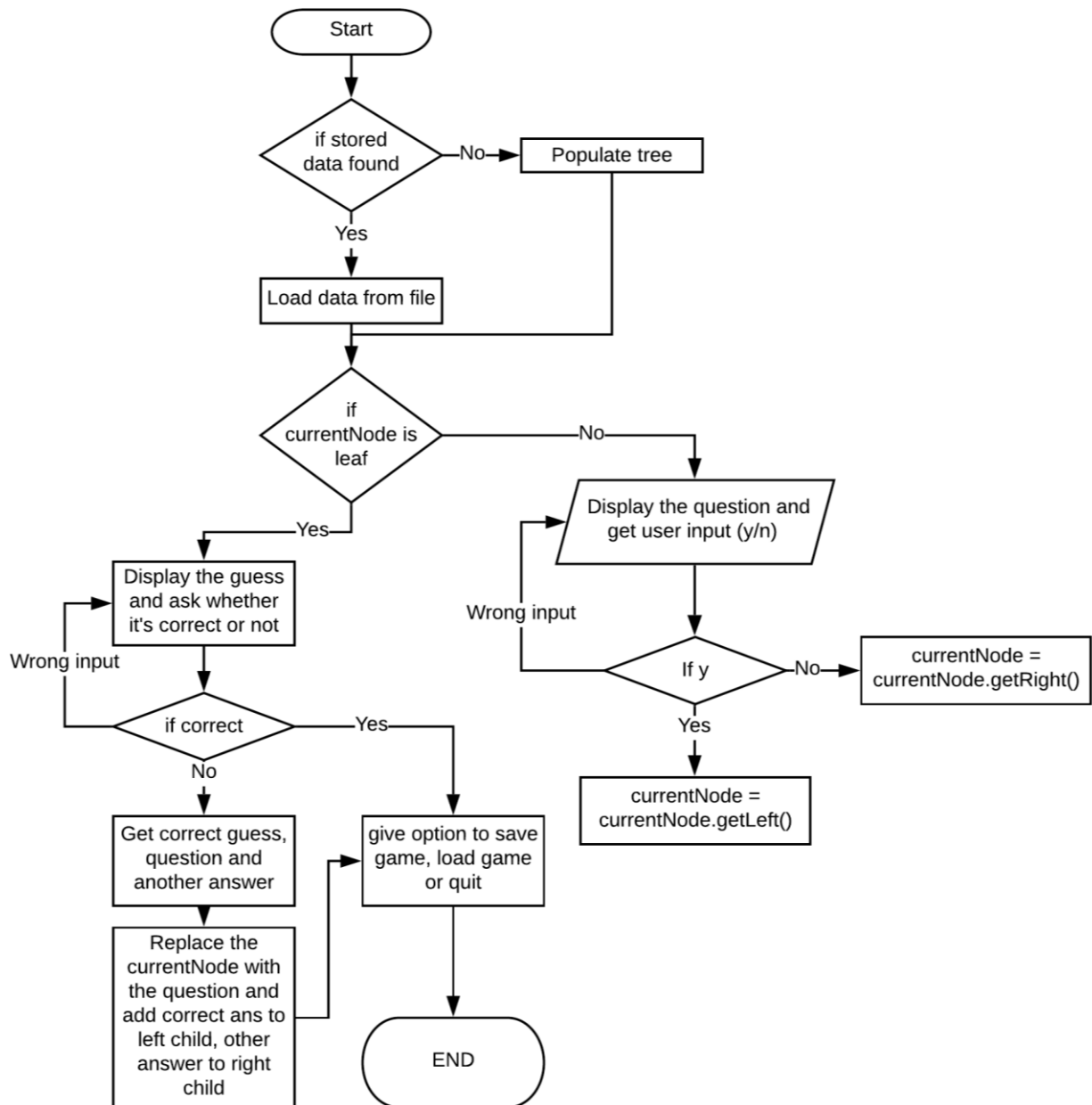
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1. Problem Statement

This is a guessing game created with the use of Binary Trees. A tree has to be created initially with the nodes containing question and leaf containing guesses. The traversal of the tree is based on user input i.e. if yes then move to left child, if no move to right child.

After reaching the leaf / guess, the user is asked whether the guess is correct or not. If the user tells it's correct, then the game ends. If the user tells it's wrong guess then the user is asked for the correct answer, distinguishable question and other guess answer. After getting these inputs, the question should replace the current node and the answers should be added as children for the question. The user is then given choice to play again, save the data to file, load from file, print the tree or exit the game.

The data of the tree should be stored in file and retrieved so that the data exists even after the user exits the program.

During the first time of starting the game, the tree has to be populated up to 4 levels.

2. Analysis and Design Notes

```
                          ┌─────────┐
                          │  Start  │
                          └────┬────┘
                               │
                               ▼
                         ╱─────────────╲
                        ╱   if stored    ╲──No──▶┌───────────────┐
                        ╲   data found   ╱        │ Populate tree │
                         ╲──────┬────────╱        └───────┬───────┘
                               Yes                        │
                               ▼                          │
                     ┌───────────────────┐                │
                     │ Load data from file│               │
                     └─────────┬─────────┘                │
                               │◀───────────────────────────┘
                               ▼
                         ╱─────────────╲
                        ╱      if        ╲
                        ╲  currentNode is ╲──────No───────────────┐
                        ╱     leaf        ╱                        │
                         ╲──────┬────────╱                         ▼
                               Yes                    ┌──────────────────────────┐
                                                      │ Display the question and │
                                                      │   get user input (y/n)   │
                               ▼                      └────────────┬─────────────┘
                  ┌───────────────────┐   Wrong input              │
              ┌──▶│ Display the guess │                            ▼
              │   │ and ask whether   │                     ╱─────────────╲       ┌──────────────────────┐
              │   │ it's correct or not│                    ╱    If y       ╲─No──▶│ currentNode =        │
              │   └─────────┬─────────┘                     ╲               ╱       │ currentNode.getRight()│
  Wrong input │             │                                ╲─────┬───────╱        └──────────────────────┘
              │             ▼                                     Yes
              │      ╱─────────────╲                               ▼
              └──────╱  if correct   ╲──Yes──┐          ┌──────────────────────┐
                     ╲               ╱        │          │ currentNode =        │
                      ╲──────┬──────╱         │          │ currentNode.getLeft()│
                            No                │          └──────────────────────┘
                             ▼                ▼
                  ┌──────────────────┐  ┌──────────────────┐
                  │ Get correct guess,│  │ give option to save│
                  │ question and      │  │ game, load game    │
                  │ another answer    │  │    or quit         │
                  └─────────┬────────┘  └─────────┬─────────┘
                            │                     │
                            ▼                     ▼
                  ┌──────────────────┐      ┌─────────────┐
                  │ Replace the      │      │     END     │
                  │ currentNode with │      └─────────────┘
                  │ the question and │
                  │ add correct ans to│
                  │ left child, other │
                  │ answer to right  │
                  │ child            │
                  └──────────────────┘
```

populateTree() method takes in binary tree as argument and creates nodes containing questions and guesses and then add it accordingly to the tree.

saveTree() method takes in the Binary tree as argument and then serializes the tree data into a string using *serializeBinaryTree()* function and then writes it to a file using Files API (Package - java.nio.File).

serializeBinaryTree() is a recursive function that takes in root node of the tree data and string variable str as arguments. While doing a pre-order traversal, it adds the node data to a str separated by "," and when root value is null then "null" is added to the string. Once whole tree is traversed the recursive function stops and exits.

loadTree() method open and gets all the data from the file and puts it into a string and deserializes the data using *deserializeBinaryTree()* function and return the root node of the tree built.

deserializeBinaryTree() method takes in the file data as string and extracts each node values separated by "," and puts it into a double ended linked list Queue. Then returns the root node of the tree created using *buildTree()* function.

buildTree() is a recursive function takes in the Queue as arguments and add the nodes as left and right children accordingly and finally return the root node of the tree built.

dataExists() method checks whether the file is present using Files API and returns true if found or else false.

printTree() is a recursive method takes in root node and initial space count as input and prints all the nodes of right children first with increasing space count for each level, then prints all the nodes of left children with the same spaces patter as for left.

The function prints all the contents of the tree as String representation in horizontal view.

3. Testing

```
----------------------------
Welcome the the Guessing Game
----------------------------
No Game Data to Load!
Status: Populating treee
----------------------------
------- Starting Game -------

Are you thinking of an animal?(Y/N) : y
Is it a mammal?(Y/N) : n
Is it a bird?(Y/N) : y
Can it fly?(Y/N) : n
The Guess: Is it a penguin?
Correct? (Y/N): y
----------------
1 - Play Again
2 - Save Game Data and Play Again
3 - Load Saved Tree and Play
4 - Save and Quit
5 - Print Tree and Quit
6 - Quit without Saving
Enter your choice :6
----------------


Process finished with exit code 0
```

```
                                              -->  Is it a Wakame Algae?
                               -->  Is it a Fungi?
                                              -->  Is it a Sac Fungi?
              -->  Is it a plant?
                                              -->  Is it a Ferns?
                               -->  Is it Non-vascular?
                                              -->  Is it a pincuchion Moss?
-->  Are you thinking of an animal?
                                                          -->  Is it Frog?
                                         -->  Is it fish?
                                                          -->  Is it a Shark?
                          -->  Is it a bird?
                                                          -->  Is it a penguin?
                                         -->  Can it fly?
                                                          -->  Is it a Eagle?
              -->  Is it a mammal?
                                              -->  Is it Lion?
                               -->  Is it a Herbivorous?
                                              -->  Is it Cow?
```

Figure 1: Output when the guess is correct

```
----------------------------
Welcome the the Guessing Game
----------------------------
No Game Data to Load!
Status: Populating treee
----------------------------
------- Starting Game -------

Are you thinking of an animal?(Y/N) : y
Is it a mammal?(Y/N) : n
Is it a bird?(Y/N) : y
Can it fly?(Y/N) : n
The Guess: Is it a penguin?
Correct? (Y/N): n
I don't Know!
Enter your answer (Yes option): Ostrich
Enter Distinguishable Question: Does it run fast?
Enter value for No option: Penguin
----------------
1 - Play Again
2 - Save Game Data and Play Again
3 - Load Saved Tree and Play
4 - Save and Quit
5 - Print Tree and Quit
6 - Quit without Saving
Enter your choice :5
----------------
```

```
                                                  --> Is it a Wakame Algae?
                                  --> Is it a Fungi?
                                                  --> Is it a Sac Fungi?
                        --> Is it a plant?
                                                  --> Is it a Ferns?
                                  --> Is it Non-vascular?
                                                  --> Is it a pincuchion Moss?
    --> Are you thinking of an animal?
                                                             --> Is it Frog?
                                          --> Is it fish?
                                                             --> Is it a Shark?
                        --> Is it a bird?
                                                                        --> Penguin
                                                  --> Does it run fast?
                                                                        --> Is it Ostrich?
                                          --> Can it fly?
                                                  --> Is it a Eagle?
                        --> Is it a mammal?
                                                  --> Is it Lion?
                                  --> Is it a Herbivorous?
                                                  --> Is it Cow?
```

Figure 2: Output when the guess is wrong

```
------------------------------
Welcome the the Guessing Game
------------------------------
No Game Data to Load!
Status: Populating treee
------------------------------
------- Starting Game -------

Are you thinking of an animal?(Y/N) : n
Is it a plant?(Y/N) : y
Is it Non-vascular?(Y/N) : n
The Guess: Is it a Ferns?
Correct? (Y/N): n
I don't Know!
Enter your answer (Yes option): Bamboo
Enter Distinguishable Question: Is is grass family?
Enter value for No option: Oak
----------------
1 - Play Again
2 - Save Game Data and Play Again
3 - Load Saved Tree and Play
4 - Save and Quit
5 - Print Tree and Quit
6 - Quit without Saving
Enter your choice :2
----------------

Game Data Saved !
```

```
Reloading game
Are you thinking of an animal?(Y/N) : y
Is it a mammal?(Y/N) : n
Is it a bird?(Y/N) : n
Is it fish?(Y/N) : n
The Guess: Is it Frog?
Correct? (Y/N): n
I don't Know!
Enter your answer (Yes option): Snake
Enter Distinguishable Question: Is it a Reptile?
Enter value for No option: Frog
----------------
1 - Play Again
2 - Save Game Data and Play Again
3 - Load Saved Tree and Play
4 - Save and Quit
5 - Print Tree and Quit
6 - Quit without Saving
Enter your choice :4
----------------

Game Data Saved !
Exiting
```

Figure 3: Output when adding new questions and answers and saving data

```
----------------------------
Welcome the the Guessing Game
----------------------------
Game Data Found!
Status: Loading tree
----------------------------
------- Starting Game -------

Are you thinking of an animal?(Y/N) : y
Is it a mammal?(Y/N) : n
Is it a bird?(Y/N) : n
Is it fish?(Y/N) : n
Is it a Reptile?(Y/N) : y
The Guess: Is it Snake?
Correct? (Y/N): y
----------------
1 - Play Again
2 - Save Game Data and Play Again
3 - Load Saved Tree and Play
4 - Save and Quit
5 - Print Tree and Quit
6 - Quit without Saving
Enter your choice :5
```

```
                                                --> Is it a Wakame Algae?
                            --> Is it a Fungi?
                                                --> Is it a Sac Fungi?
              --> Is it a plant?
                                                            --> Oak
                                  --> Is it grass family?
                                                      --> Is it Bamboo?
                            --> Is it Non-vascular?
                                            --> Is it a pincuchion Moss?
--> Are you thinking of an animal?
                                                            --> Frog
                                        --> Is it a Reptile?
                                                        --> Is it Snake?
                              --> Is it fish?
                                            --> Is it a Shark?
                    --> Is it a bird?
                                            --> Is it a penguin?
                              --> Can it fly?
                                            --> Is it a Eagle?
              --> Is it a mammal?
                                        --> Is it Lion?
                        --> Is it a Herbivorous?
                                        --> Is it Cow?
```

Figure 4: Output when loading from stored data and traversing through it

```
----------------------------
Welcome the the Guessing Game
----------------------------
Game Data Found!
Status: Loading tree
----------------------------
------- Starting Game -------

Are you thinking of an animal?(Y/N) : 5
Enter Valid Answer
Are you thinking of an animal?(Y/N) : y
Is it a mammal?(Y/N) : s
Enter Valid Answer
Is it a mammal?(Y/N) : y
Is it a Herbivorous?(Y/N) : 12s2
Enter Valid Answer
Is it a Herbivorous?(Y/N) : n
The Guess: Is it Lion?
Correct? (Y/N): y
----------------
1 - Play Again
2 - Save Game Data and Play Again
3 - Load Saved Tree and Play
4 - Save and Quit
5 - Print Tree and Quit
6 - Quit without Saving
Enter your choice :9
```

```
----------------

Enter Correct choice
----------------
1 - Play Again
2 - Save Game Data and Play Again
3 - Load Saved Tree and Play
4 - Save and Quit
5 - Print Tree and Quit
6 - Quit without Saving
Enter your choice :6
----------------



Process finished with exit code 0
```
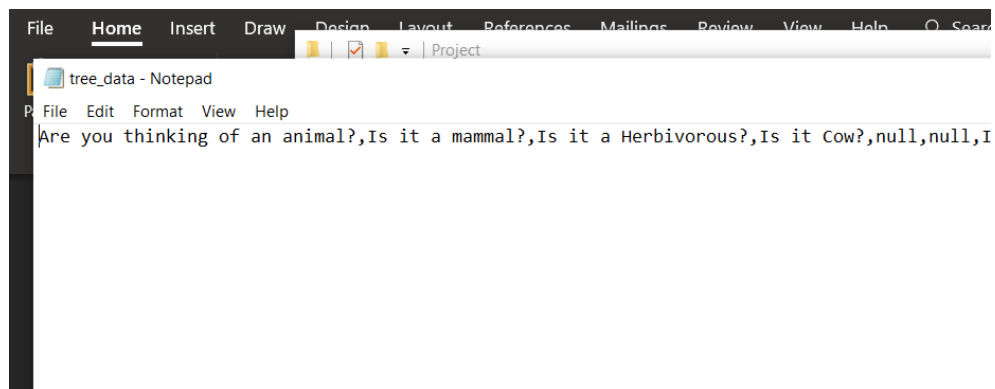
Figure 5: Output of handling wrong inputs

Figure 6: Data stored in .txt file

Figure 7: Proof of stored .txt file (tree_data.txt)