GIT Department of Computer Engineering

CSE 222/505 - Spring 2020

Homework 4 Report

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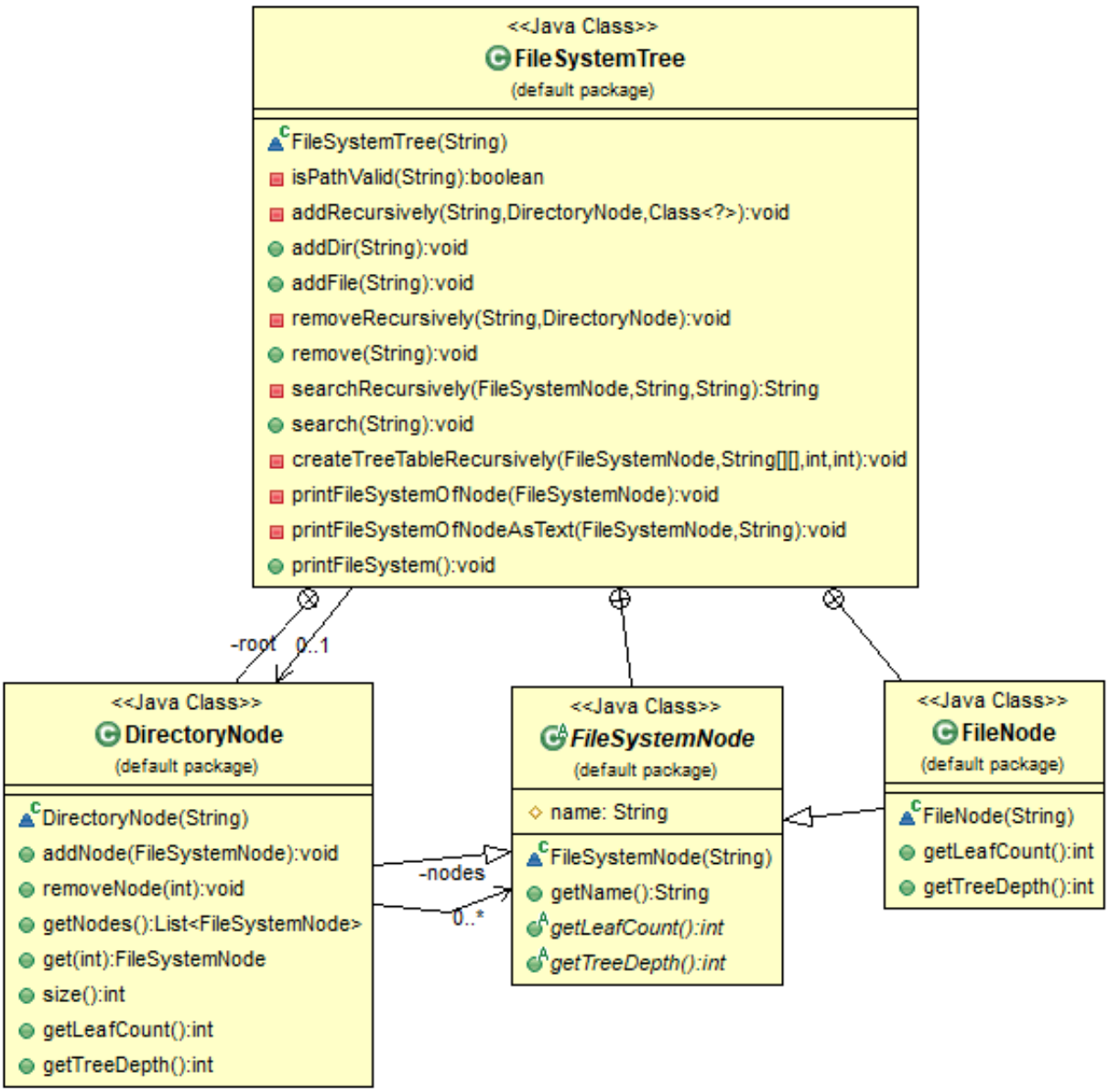
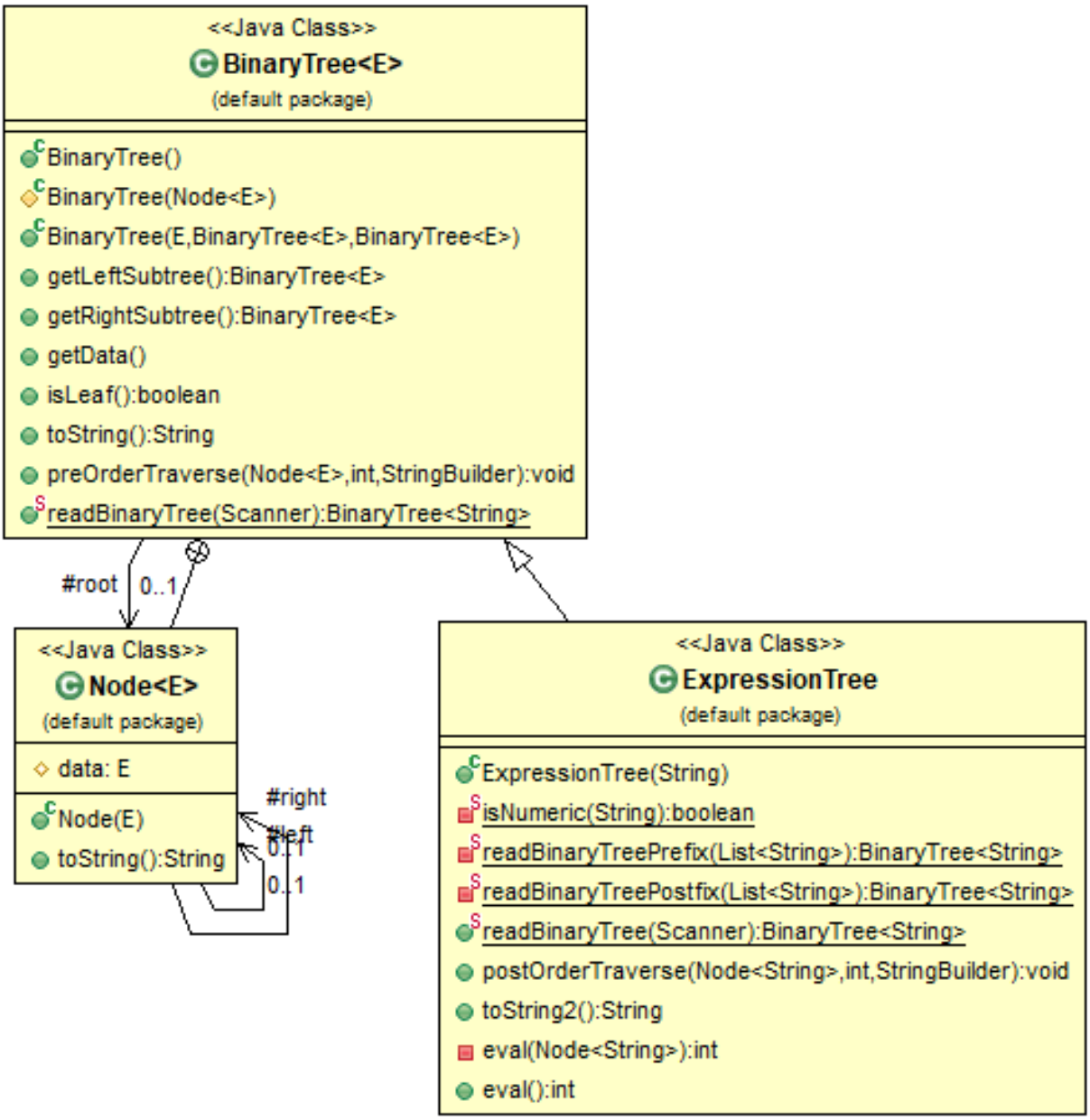
CLASS DIAGRAMS:

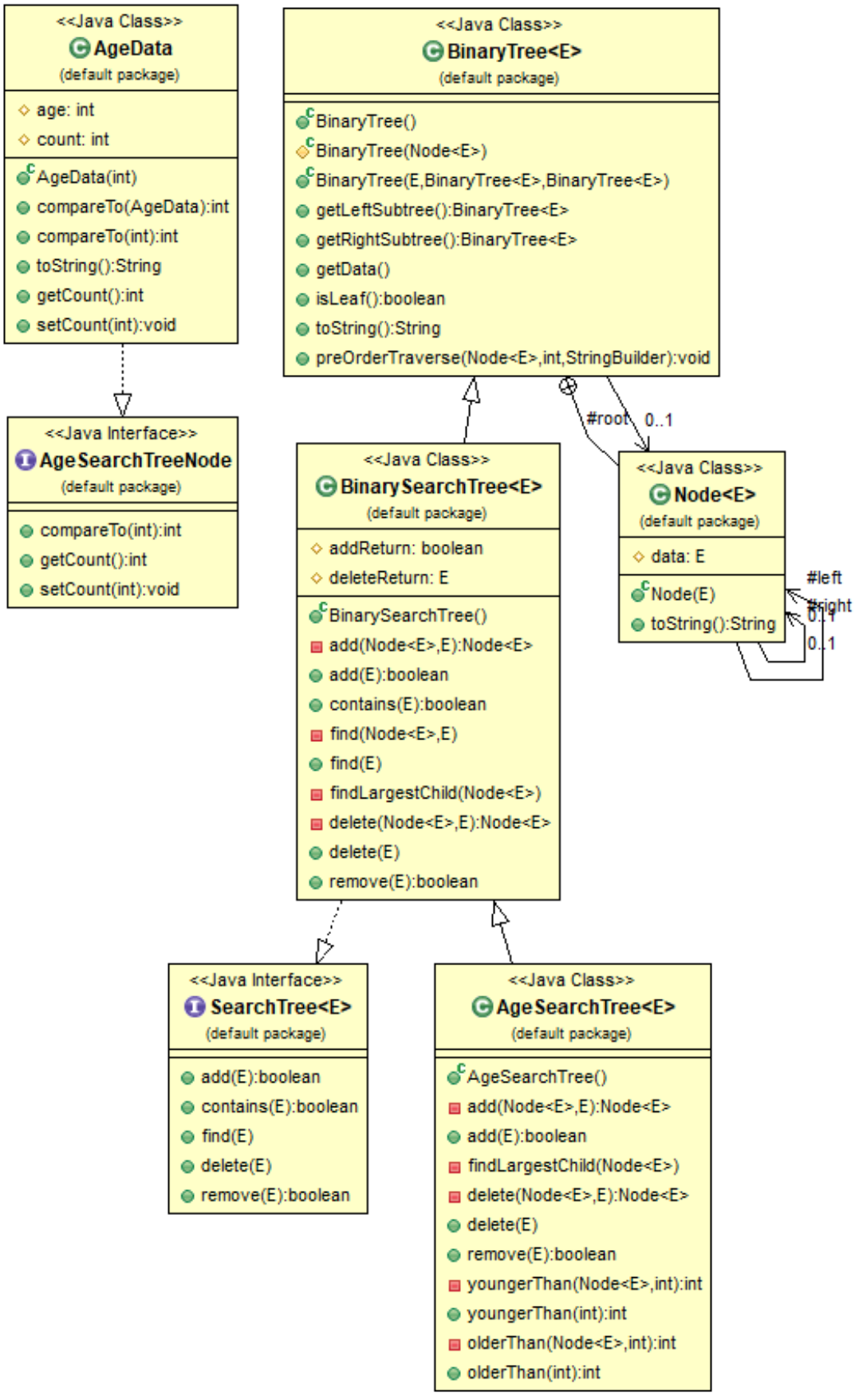
Q1:



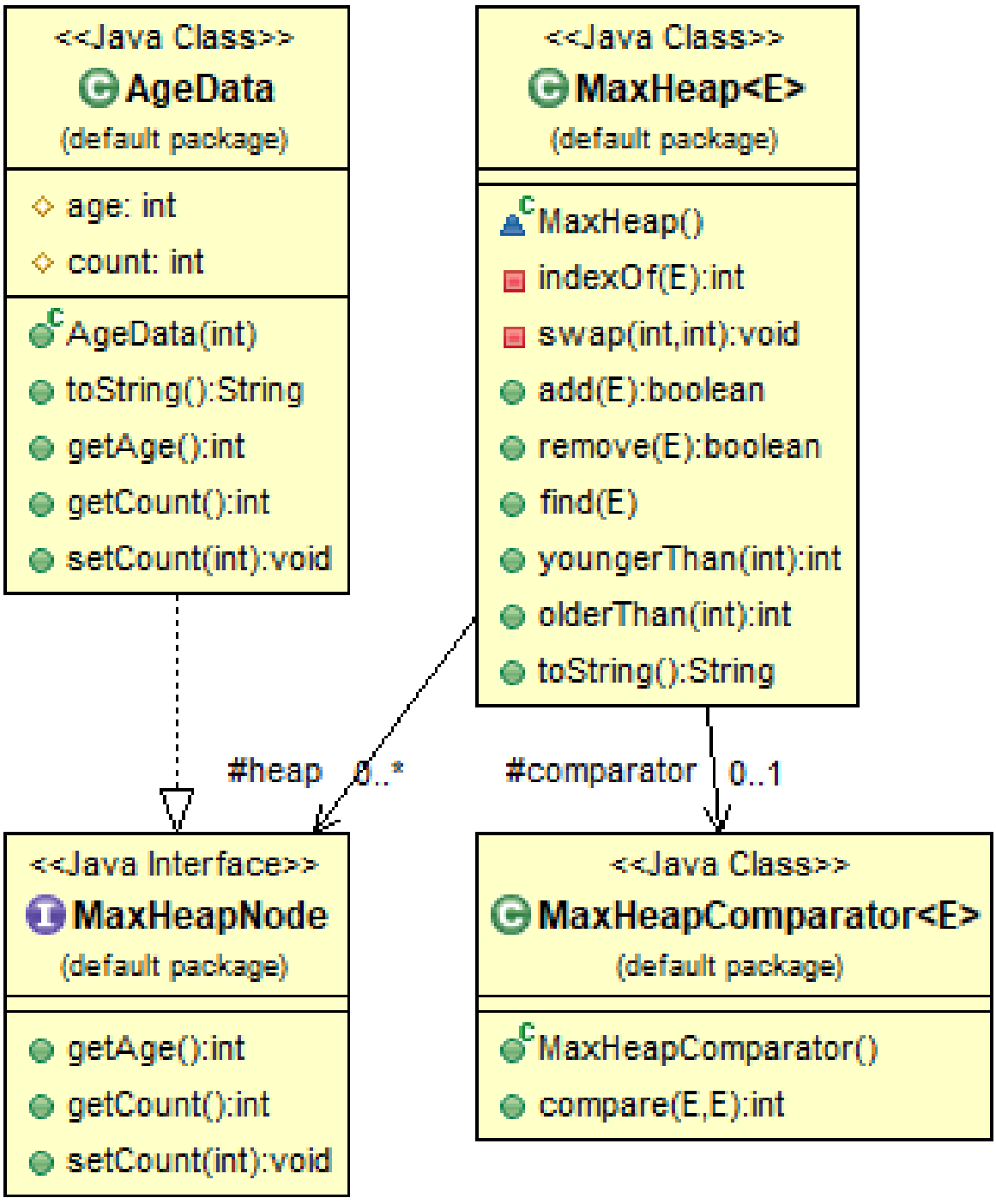
Q2:


<<Java Class>>
BinaryTree<E>
(default package)
BinaryTree()
BinaryTree(Node<E>)
BinaryTree(E,BinaryTree<E>,BinaryTree<E>)
getLeftSubtree():BinaryTree<E>
getRightSubtree():BinaryTree<E>
getData()
isLeaf():boolean
toString():String
preOrderTraverse(Node<E>,int,StringBuilder):void
readBinaryTree(Scanner):BinaryTree<String>
#root
0..1
<<Java Class>>
Node<E>
(default package)
data: E
Node(E)
toString():String
#right
#left
0..1
0..1
<<Java Class>>
ExpressionTree
(default package)
ExpressionTree(String)
isNumeric(String):boolean
readBinaryTreePrefix(List<String>):BinaryTree<String>
readBinaryTreePostfix(List<String>):BinaryTree<String>
readBinaryTree(Scanner):BinaryTree<String>
postOrderTraverse(Node<String>,int,StringBuilder):void
toString2():String
eval(Node<String>):int
eval():int

Q3:


<<Java Class>>
AgeData
(default package)
age: int
count: int
AgeData(int)
compareTo(AgeData):int
compareTo(int):int
toString():String
getCount():int
setCount(int):void
<<Java Interface>>
AgeSearchTreeNode
(default package)
compareTo(int):int
getCount():int
setCount(int):void
<<Java Class>>
BinaryTree<E>
(default package)
BinaryTree()
BinaryTree(Node<E>)
BinaryTree(E,BinaryTree<E>,BinaryTree<E>)
getLeftSubtree():BinaryTree<E>
getRightSubtree():BinaryTree<E>
getData()
isLeaf():boolean
toString():String
preOrderTraverse(Node<E>,int,StringBuilder):void
#root
0..1
<<Java Class>>
BinarySearchTree<E>
(default package)
addReturn: boolean
deleteReturn: E
BinarySearchTree()
add(Node<E>,E):Node<E>
add(E):boolean
contains(E):boolean
find(Node<E>,E)
find(E)
findLargestChild(Node<E>)
delete(Node<E>,E):Node<E>
delete(E)
remove(E):boolean
<<Java Class>>
Node<E>
(default package)
data: E
Node(E)
toString():String
#left
#right
0..1
0..1
<<Java Interface>>
SearchTree<E>
(default package)
add(E):boolean
contains(E):boolean
find(E)
delete(E)
remove(E):boolean
<<Java Class>>
AgeSearchTree<E>
(default package)
AgeSearchTree()
add(Node<E>,E):Node<E>
add(E):boolean
findLargestChild(Node<E>)
delete(Node<E>,E):Node<E>
delete(E)
remove(E):boolean
youngerThan(Node<E>,int):int
youngerThan(int):int
olderThan(Node<E>,int):int
olderThan(int):int

Q4:


<<Java Class>>
AgeData
(default package)
age: int
count: int
AgeData(int)
toString():String
getAge():int
getCount():int
setCount(int):void
<<Java Class>>
MaxHeap<E>
(default package)
MaxHeap()
indexOf(E):int
swap(int,int):void
add(E):boolean
remove(E):boolean
find(E)
youngerThan(int):int
olderThan(int):int
toString():String
#heap
0..*
#comparator
0..1
<<Java Interface>>
MaxHeapNode
(default package)
getAge():int
getCount():int
setCount(int):void
<<Java Class>>
MaxHeapComparator<E>
(default package)
MaxHeapComparator()
compare(E,E):int

PROBLEM SOLUTION APPROACHES:

Q1: In this question I implemented my program by firstly creating an abstract FileSystemNode class which is a class every element of the FileSystemTree extends. Then I derived 2 subclasses from that class which are FileNode and Directory node. And through whole program I controlled if a node is directory or file by using instanceof operator. I separated FileNode and Directory node classes into two different classes cause not letting FileNode to hold an array list in it, seems a better way of implementation to me. Since the example implementations in the pdf don't use generic and we are warned about not changing methods, class names, definitions etc. in the pdf, I couldn't use generic also so I implemented like that. Also since in the pdf it was not well explained how are we expected to print the file hierarchy, I mistakenly spent hours to design an algorithm to print full tree representation of the tree to the console and then when I realized that was probably not the way we are expected to implement, I also added print method like you wanted.

Q2: In this the tricky part was mostly getting the infix or postfix expressions as a string, so I added lots of check mechanisms to prevent illegal arguments like null pointer, incorrect operands or not allowed operators. Since the methods we are expected to implement are just a little bit changed versions of already existing methods in the inherited class, I took them and changed a little bit. Evaluation part was simple and was basically just evaluating the bottom two operands with its operator and pass it to parent.

Q3: Since in the example in pdf, generic was used and it also sounded to me more object oriented way, I also made the class generic by creating an extra AgeSearchTreeNode interface for it. In my implementation I let user to add or remove an AgeNode which has a count value more than 1. So in my implementation when we want to add an AgeNode with age 20 count 3 to the Tree which has already AgeNode with age 20 count 2, the tree wil have AgeNode with age 20 count 5. In removal if we try to remove a node with count 4 from tree which has that node with count 2, it wont remove it since there are less people than expected.

Q4: In heap mostly I conerted recursive methods to linear ones with a for or while loop and in this class I also used generic which accepts any type which implements MaxHeapNode. After every insertion and removal operation, I reordered the array and that was it.

TEST CASES:

Q1:

```
33
34          FileSystemTree newFileSystem = new FileSystemTree(null);
35
```

Servers Debug Console Problems Progress Debug Shell Search (x)= Variables

```
<terminated> Main (8) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe  (2 May 2020 21:44:52 – 21:
Exception in thread "main" java.lang.NullPointerException: Given argument cannot be null
        at FileSystemTree.<init>(FileSystemTree.java:23)
        at Main.main(Main.java:34)
```

```
31
32
33
34          FileSystemTree newFileSystem = new FileSystemTree("root//new_dir");
35
```

Servers Debug Console Problems Progress Debug Shell Search (x)= Variables

```
<terminated> Main (8) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe  (2 May 2020 21:46:45 – 21:46:47
Exception in thread "main" java.lang.IllegalArgumentException: Given path is not valid
        at FileSystemTree.<init>(FileSystemTree.java:26)
        at Main.main(Main.java:34)
```

```
34
35          FileSystemTree myFileSystem = new FileSystemTree("root");
36          myFileSystem.addDir("root/first_directory");
37          myFileSystem.addDir("root/second_directory");
38          myFileSystem.addFile("root/second_directory");
39
```

Servers Debug Console Problems Progress Debug Shell Search (x)= Variables Breakpoints Expres

```
<terminated> Main (8) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe  (2 May 2020 21:49:56 – 21:49:58)
Exception in thread "main" java.lang.IllegalArgumentException: There is already a file with the same name
        at FileSystemTree.addRecursively(FileSystemTree.java:73)
        at FileSystemTree.addFile(FileSystemTree.java:99)
        at Main.main(Main.java:38)
```

Q2:

```
36        System.out.println(new ExpressionTree("+ + 10 % 5 15 20").eval());
37
```

Servers Debug Console Problems Progress Debug Shell Search (x)= Variables Breakpoint

```
<terminated> Main (9) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe (2 May 2020 21:54:15 – 21:54:15)
Exception in thread "main" java.lang.IllegalArgumentException: The operator % is not legal
        at ExpressionTree.eval(ExpressionTree.java:136)
        at ExpressionTree.eval(ExpressionTree.java:131)
        at ExpressionTree.eval(ExpressionTree.java:130)
        at ExpressionTree.eval(ExpressionTree.java:145)
        at Main.main(Main.java:36)
```

```
35
36        new ExpressionTree(null);
37
```

Servers Debug Console Problems Progress Debug Shell Search (x)= Variables

```
<terminated> Main (9) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe (2 May 2020 22:01:13 – 22:01:
Exception in thread "main" java.lang.NullPointerException: Given argument cannot be null
        at ExpressionTree.<init>(ExpressionTree.java:18)
        at Main.main(Main.java:36)
```

```
34
35
36        new ExpressionTree("");
37
```

Servers Debug Console Problems Progress Debug Shell Search (x)= Variables

```
<terminated> Main (9) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe (2 May 2020 22:01:47 – 22:01:49)
Exception in thread "main" java.lang.IllegalArgumentException: Given argument is not valid
        at ExpressionTree.<init>(ExpressionTree.java:19)
        at Main.main(Main.java:36)
```

Q3:

```
34
35        new AgeSearchTree<AgeData>().add(null);
```

Servers Debug Console Problems Progress Debug Shell Search (x)= Variables

```
<terminated> Main (10) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe (2 May 2020 22:10:42 – 22:10:42)
Exception in thread "main" java.lang.NullPointerException: Given argument cannot be null
        at AgeSearchTree.add(AgeSearchTree.java:34)
        at Main.main(Main.java:35)
```

```
33
34
35          new AgeSearchTree<AgeData>().delete(null);
```

Servers | Debug | Console | Problems | Progress | Debug Shell | Search | (x)= Variables

```
<terminated> Main (10) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe (2 May 2020 22:11:08 – 22:1
Exception in thread "main" java.lang.NullPointerException: Given argument cannot be null
        at AgeSearchTree.delete(AgeSearchTree.java:96)
        at Main.main(Main.java:35)
```

```
34
35          new AgeData(5).setCount(-5);
```

Servers | Debug | Console | Problems | Progress | Debug Shell

```
<terminated> Main (10) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw
Exception in thread "main" java.lang.IllegalArgumentException
        at AgeData.setCount(AgeData.java:47)
        at Main.main(Main.java:35)
```

Q4:

```
34          new MaxHeap<AgeData>().add(null);
35
```

Servers | Debug | Console | Problems | Progress | Debug Shell | Search | (x)= Variables | Breakp

```
<terminated> Main (11) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe (2 May 2020 22:18:05 – 22:18:05)
Exception in thread "main" java.lang.NullPointerException: Given argument cannot be null
        at MaxHeap.add(MaxHeap.java:50)
        at Main.main(Main.java:34)
```

```
34          new MaxHeap<AgeData>().remove(null);
35
```

Servers | Debug | Console | Problems | Progress | Debug Shell | Search | (x)= Variables | Breakpoi

```
<terminated> Main (11) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe (2 May 2020 22:18:28 – 22:18:28)
Exception in thread "main" java.lang.NullPointerException: Given argument cannot be null
        at MaxHeap.remove(MaxHeap.java:76)
        at Main.main(Main.java:34)
```

```
33
34          new MaxHeap<AgeData>().find(null);
35
```

Servers | Debug | Console | Problems | Progress | Debug Shell | Search | (x)= Variables

```
<terminated> Main (11) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe (2 May 2020 22:18:45 – 22:18:
Exception in thread "main" java.lang.NullPointerException: Given argument cannot be null
        at MaxHeap.find(MaxHeap.java:137)
        at Main.main(Main.java:34)
```

RUNNING COMMAND AND RESULTS:

Q1:

```
Hierarchy created
root(D)
root/first_directory(D)
root/first_directory/new_file.txt(F)
root/first_directory/new_file2.txt(F)
root/second_directory(D)
root/second_directory/new_directory(D)
root/second_directory/new_directory/new_file.doc(F)
root/second_directory/new_directory/new_file2.doc(F)
root/second_directory/new_directory2(D)
root/second_directory/new_directory3(D)
root/third_directory(D)
root/file.txt(D)

root
|
o----------------------o----------------------o----------------------o----------------------o----------------------o----------------------o
|                      |                      |                      |                      |                      |                      |
first_directory (D)    second_directory (D)                                                   third_directory (D)    file.txt (D)
|                      |
o----------------------o                      o----------------------o----------------------o
|                      |                      |                      |                      |
new_file.txt (F)       new_file2.txt (F)      new_directory (D)      new_directory2 (D)     new_directory3 (D)
                                              |
                                              o----------------------o
                                              |                      |
                                              new_file.doc (F)       new_file2.doc (F)


Searching files and folders that contain "new" in their names.
root/first_directory/new_file.txt(F)
root/first_directory/new_file2.txt(F)
root/second_directory/new_directory(D)
root/second_directory/new_directory/new_file.doc(F)
root/second_directory/new_directory/new_file2.doc(F)
root/second_directory/new_directory2(D)
root/second_directory/new_directory3(D)
```

```
Removing "root/first_directory/new_file.txt"

Removing "root/second_directory/new_directory"

It seems the folder you are trying to delete is not empty.
The folder will be deleted along with all the files in it.

new_directory(D)
new_directory/new_file.doc(F)
new_directory/new_file2.doc(F)


new_directory
|
o-------------------------o
|                         |
new_file.doc (F)          new_file2.doc (F)


Do you want to proceed? y/n : y
root(D)
root/first_directory(D)
root/first_directory/new_file2.txt(F)
root/second_directory(D)
root/second_directory/new_directory2(D)
root/second_directory/new_directory3(D)
root/third_directory(D)
root/file.txt(D)

root
|
o-------------------------o-------------------------o-------------------------o-------------------------o
|                         |                         |                         |                         |
first_directory (D)       second_directory (D)                                third_directory (D)       file.txt (D)
|                         |
o                         o-------------------------o
|                         |                         |
new_file2.txt (F)         new_directory2 (D)        new_directory3 (D)
```

Q2:

```java
public class Main {

    public static void main(String[] args) {
        ExpressionTree tree2 = new ExpressionTree("/ + 10 * 5 15 20");
        System.out.println(tree2.toString());
        System.out.println(tree2.eval());
        ExpressionTree expTree = new ExpressionTree("+ + 10 * 5 15 20");
        ExpressionTree expTree2 = new ExpressionTree("10 5 15 * + 20 +");
        System.out.println(expTree.eval());
        System.out.println(expTree2.eval());
    }
```

Servers Debug Console Problems Progress Debug Shell Search

<terminated> Main (9) [Java Application] C:\Program Files\Java\jdk1.8.0_241\bin\javaw.exe (2 May 2020 2

```
/
 +
  10
   null
   null
  *
   5
    null
    null
   15
    null
    null
 20
  null
  null

4
105
105
```

Q3:

```
Created tree
10 - 2
 5 - 1
  null
  null
 20 - 1
  15 - 1
   null
   null
  null

The amount of people younger than 15
3
Node with age 10
10 - 2
```

Q4:

```
<terminated> Main (11) [Java Application] C:\Program
21 inserted
10 - 2
5 - 2
70 - 1
50 - 1
15 - 1
21 - 1

21 became root
21 - 3
5 - 2
10 - 2
50 - 1
15 - 1
70 - 1

21 became even more root
21 - 6
5 - 2
10 - 2
50 - 1
15 - 1
70 - 1

21 is no more root
5 - 2
21 - 2
10 - 2
50 - 1
15 - 1
70 - 1

rest in peace 21
5 - 2
50 - 1
10 - 2
21 - 1
15 - 1

The amount of people older than 10
2
Node with age 10
10 - 2
```