



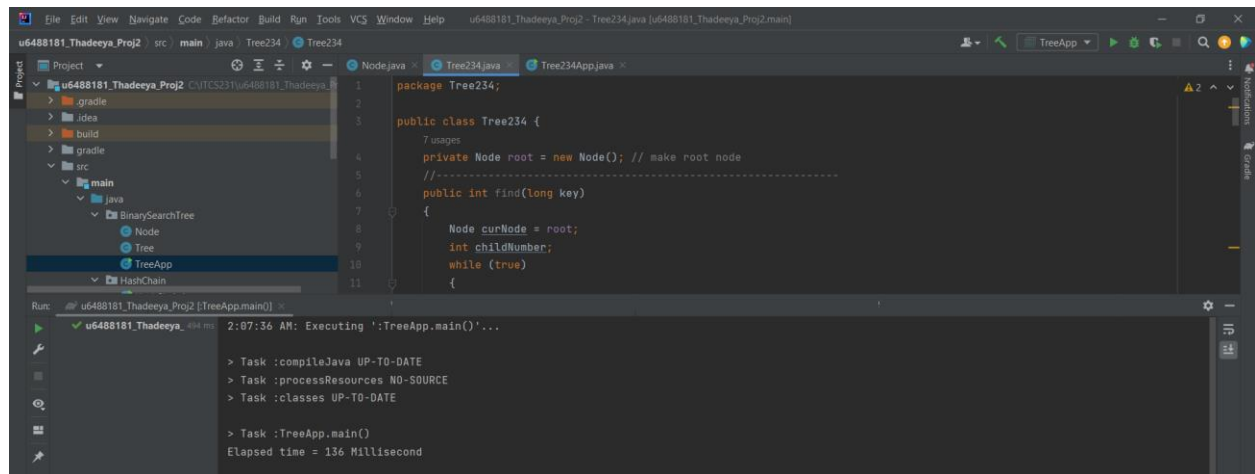
**The Faculty of Information and Communication Technology
Mahidol University**

**ITCS231 Data Structures and Algorithm Analysis
Semester 1, 2022**

**Project 2
Compare Execution Time**

Submission Date: December 2, 2022
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Binary Search



```
1 package Tree234;
2
3 public class Tree234 {
4     7 usages
5     private Node root = new Node(); // make root node
6     //-----
7     public int find(long key)
8     {
9         Node curNode = root;
10        int childNumber;
11        while (true)
12        {
```

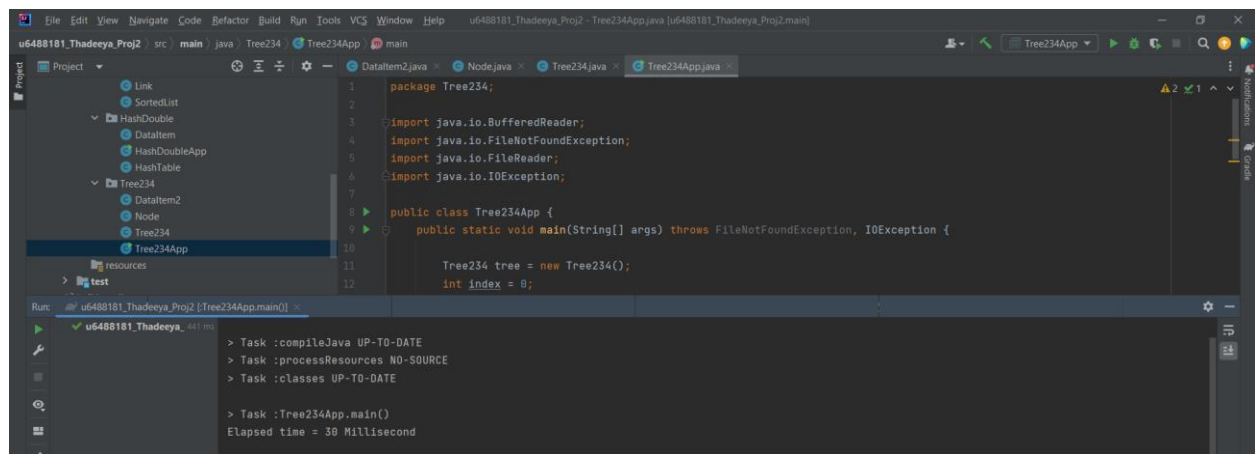
Run: u6488181_Thadeeya_Proj2 [TreeApp.main()]

u6488181_Thadeeya_484 ms 2:07:36 AM: Executing ':TreeApp.main()'...

> Task :compileJava UP-TO-DATE
> Task :processResources NO-SOURCE
> Task :classes UP-TO-DATE

> Task :TreeApp.main()
Elapsed time = 136 Millisecond

2-3-4 Tree



```
1 package Tree234;
2
3 import java.io.BufferedReader;
4 import java.io.FileNotFoundException;
5 import java.io.FileReader;
6 import java.io.IOException;
7
8 public class Tree234App {
9     public static void main(String[] args) throws FileNotFoundException, IOException {
10
11        Tree234 tree = new Tree234();
12        int index = 0;
```

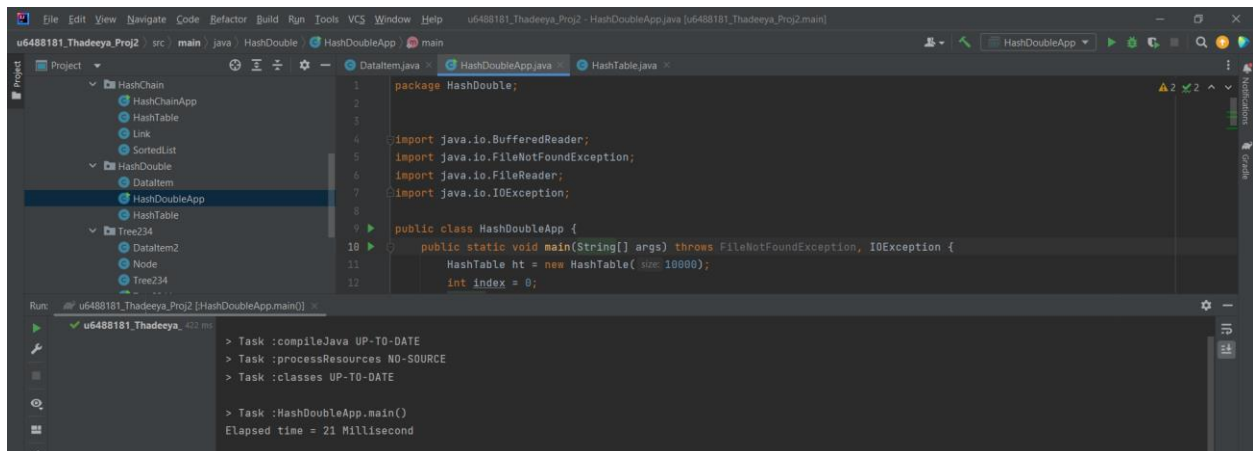
Run: u6488181_Thadeeya_Proj2 [Tree234App.main()]

u6488181_Thadeeya_441 ms

> Task :compileJava UP-TO-DATE
> Task :processResources NO-SOURCE
> Task :classes UP-TO-DATE

> Task :Tree234App.main()
Elapsed time = 38 Millisecond

Hash table with Double hashing



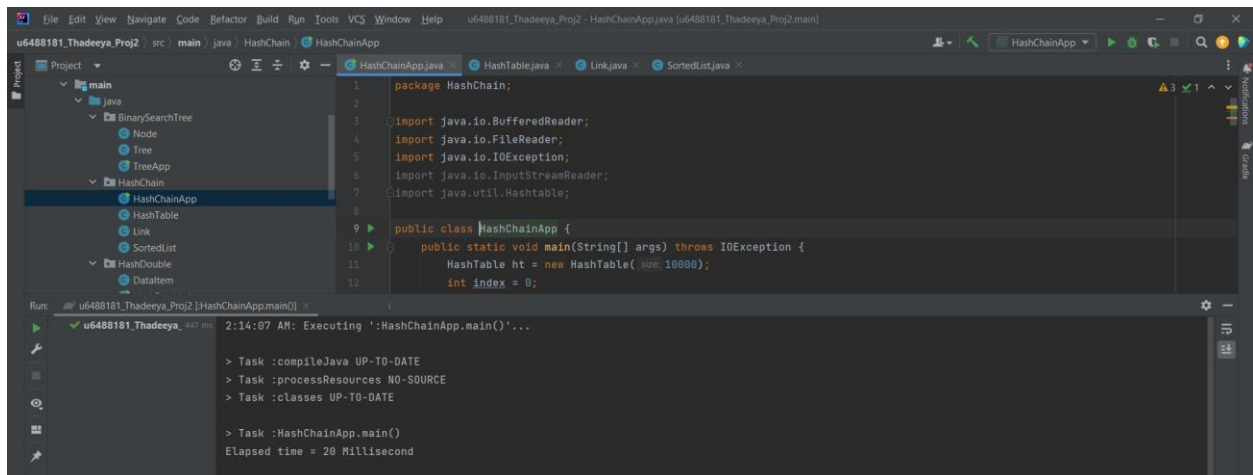
```
1 package HashDouble;
2
3
4 import java.io.BufferedReader;
5 import java.io.FileNotFoundException;
6 import java.io.FileReader;
7 import java.io.IOException;
8
9 public class HashDoubleApp {
10     public static void main(String[] args) throws FileNotFoundException, IOException {
11         HashTable ht = new HashTable( size: 10000);
12         int index = 0;
```

Run: u6488181_Thadeeya_Proj2 [HashDoubleApp.main()]

- > Task :compileJava UP-TO-DATE
- > Task :processResources NO-SOURCE
- > Task :classes UP-TO-DATE
- > Task :HashDoubleApp.main()

Elapsed time = 21 Millisecond

Hash table with Chaining



```
1 package HashChain;
2
3 import java.io.BufferedReader;
4 import java.io.FileReader;
5 import java.io.IOException;
6 import java.io.InputStreamReader;
7 import java.util.Hashtable;
8
9 public class HashChainApp {
10     public static void main(String[] args) throws IOException {
11         HashTable ht = new HashTable( size: 10000);
12         int index = 0;
```

Run: u6488181_Thadeeya_Proj2 [HashChainApp.main()]

- > Task :compileJava UP-TO-DATE
- > Task :processResources NO-SOURCE
- > Task :classes UP-TO-DATE
- > Task :HashChainApp.main()

Elapsed time = 20 Millisecond

Result: Binary Search > 2-3-4 Tree > Double hashing > Chaining
Avg. Elapsed time: $136 + 30 + 21 + 20 = 207/4 = 51.75$ Millisecond