

# Data Structures & Algorithm for Information Processing

## 95-771 A

Prof. Michael Mccarthy

Fall 2023

### Project 1

Submitted by:  
**Abhineet Chaudhary**  
andrewID: abhineec

#### Part 1 (1 to 7)

```
Run ObjectNode x
/Library/Java/JavaVirtualMachines/temurin-17.jdk/Contents/Home/bin/java -javaagent:/Applications/IntelliJ IDEA.app/Contents/lib/idea_rt.jar=50478:/Applications/IntelliJ
/Users/abhineetchaudhary/Desktop/CMU/Fall2023/Data_Structures/95771-Fall23/Project1/ObjectNode-Project/out/production/ObjectNode-Project edu.colorado.nodes.ObjectNode
Hello and welcome!
This assignment was submitted by:
Name: Abhineet Chaudhary
AndrewId: abhineec
Course: 95-771 A Fall 2023

abcdefghijklmnopqrstuvwxyz
cflorux
Number of nodes = 26
Number of nodes = 26
abcdefghijklmnopqrstuvwxyz
Number of nodes in k = 26
Number of nodes in k = 26
abcdefghijklmnopqrstuvwxyz
Number of nodes in k2 = 26
Number of nodes in k2 = 26

Process finished with exit code 0
```

## Part 1 (8 and 9)

```
Run SinglyLinkedList x
/Library/Java/JavaVirtualMachines/temurin-17.jdk/Contents/Home/bin/java -javaagent:/Applications/IntelliJ IDEA.app/Contents/lib/idea_rt.jar=50506:/Applications/IntelliJ IDEA.app/C
/Users/abhineetchaudhary/Desktop/CMU/Fall2023/Data_Structures/95771-Fall23/Project1/ObjectNode-Project/out/production/ObjectNode-Project andrew.cmu.edu.abhineec.SinglyLinkedList
Hello and welcome!

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a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z,
abcdefghijklmnopqrstuvwxyz

Process finished with exit code 0
```

## Part 1 (10)

```
Run OrderedLinkedListOfIntegers x
/Library/Java/JavaVirtualMachines/temurin-17.jdk/Contents/Home/bin/java -javaagent:/Applications/IntelliJ IDEA.app/Contents/lib/idea_rt.jar=50523:/Applications/IntelliJ IDEA.app/Contents/bin
/Users/abhineetchaudhary/Desktop/CMU/Fall2023/Data_Structures/95771-Fall23/Project1/ObjectNode-Project/out/production/ObjectNode-Project andrew.cmu.edu.abhineec.OrderedLinkedListOfIntegers
Hello and welcome!

This assignment was submitted by:
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AndrewId: abhineec
Course: 95-771 A Fall 2023

First List Numbers added:83, 39, 71, 40, 73, 36, 68, 96, 93, 37, 9, 70, 46, 36, 99, 87, 87, 47, 39, 65,
9, 36, 36, 37, 39, 39, 40, 46, 47, 65, 68, 70, 71, 73, 83, 87, 87, 93, 96, 99,
28

Second List Numbers added:79, 59, 68, 77, 50, 78, 42, 73, 39, 46, 82, 87, 63, 72, 14, 36, 34, 75, 38, 85,
14, 34, 36, 38, 39, 42, 46, 50, 59, 63, 68, 72, 73, 75, 77, 78, 79, 82, 85, 87,
28

9, 14, 34, 36, 36, 36, 37, 38, 39, 39, 39, 40, 42, 46, 46, 47, 50, 59, 63, 65, 68, 68, 70, 71, 72, 73, 73, 75, 77, 78, 79, 82, 83, 85, 87, 87, 87, 93, 96, 99,
40

Process finished with exit code 0
```

## Part 2

```
Run  andrew.cmu.edu.abhineec.MerkleHellmanKnapsackCryp... x
/Library/Java/JavaVirtualMachines/temurin-17.jdk/Contents/Home/bin/java -javaagent:/Applications/IntelliJ IDEA.app/Contents/lib/idea_rt.jar=50554:/Applications/IntelliJ ID
/Users/abhineetchaudhary/Desktop/CMU/Fall2023/Data Structures/95771-Fall23/Project1/Merkle-Hellman-Knapsack-Crypto-Project/out/production/Merkle-Hellman-Knapsack-Crypto-P
/Data Structures/95771-Fall23/Project1/Merkle-Hellman-Knapsack-Crypto-Project/out/production/ObjectNode-Project andrew.cmu.edu.abhineec.MerkleHellmanKnapsackCryptosystem
Hello and welcome!

This assignment was submitted by:
Name: Abhineet Chaudhary
AndrewId: abhineec
Course: 95-771 A Fall 2023

Enter a string and I will encrypt it as single large integer.
|
```

```
Run  andrew.cmu.edu.abhineec.MerkleHellmanKnapsackCryp... x
/Library/Java/JavaVirtualMachines/temurin-17.jdk/Contents/Home/bin/java -javaagent:/Applications/IntelliJ IDEA.app/Contents/lib/idea_rt
.jar=53050:/Applications/IntelliJ IDEA.app/Contents/bin -Dfile.encoding=UTF-8 -classpath /Users/abhineetchaudhary/Desktop/CMU/Fall2023/Data
Structures/95771-Fall23/Project1/Merkle-Hellman-Knapsack-Crypto-Project/out/production/Merkle-Hellman-Knapsack-Crypto-Project:/Users/abhineetchaudhary/Desktop/CMU
/Fall2023/Data Structures/95771-Fall23/Project1/Merkle-Hellman-Knapsack-Crypto-Project/out/production/ObjectNode-Project andrew.cmu.edu.abhineec
.MerkleHellmanKnapsackCryptosystem
Hello and welcome!

This assignment was submitted by:
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Course: 95-771 A Fall 2023

Enter a string and I will encrypt it as single large integer.

Welcome to Data Structures & Algorithm

Clear Text:Welcome to Data Structures & Algorithm
Number of clear text bytes = 38

Welcome to Data Structures & Algorithm is encrypted as
17130180024926961057829958502498322413965877857970926010302574428029032003923596204126525429363784717186642899146569927117114496187829224326229642053213937764548415
75309383610307990371816892848490947538362

Result of decryption: Welcome to Data Structures & Algorithm

Process finished with exit code 0
```

## Part 3

```

/Library/Java/JavaVirtualMachines/temurin-17.jdk/Contents/Home/bin/java -javaagent:/Applications/IntelliJ IDEA.app/Contents/lib/idea_rt
.jar=52999:/Applications/IntelliJ IDEA.app/Contents/bin -Dfile.encoding=UTF-8 -classpath /Users/abhineetchaudhary/Desktop/CMU/Fall2023/Data
Structures/95771-Fall23/Project1/MerkleTree-Project/out/production/MerkleTree-Project:/Users/abhineetchaudhary/Desktop/CMU/Fall2023/Data
Structures/95771-Fall23/Project1/MerkleTree-Project/out/production/ObjectNode-Project andrew.cmu.edu.abhineec.MerkleTree
Hello and welcome!

This assignment was submitted by:
Name: Abhineet Chaudhary
AndrewId: abhineec
Course: 95-771 A Fall 2023

Please ensure your project directory is correct. It should be the absolute path till ...Project1/MerkleTree-Project
Project Directory: /Users/abhineetchaudhary/Desktop/CMU/Fall2023/Data_Structures/95771-Fall23/Project1/MerkleTree-Project

Calculating merkle root for CrimeLatLonXY1990_Size2.csv...
Merkle Root for CrimeLatLonXY1990_Size2.csv = DDD49991D04273A7300EF24CFAD21E2706C145001483D161D53937D90F76C001

Calculating merkle root for CrimeLatLonXY1990_Size3.csv...
Merkle Root for CrimeLatLonXY1990_Size3.csv = 313A2AD830ED85B5203C8C2A9895ADFA521CD4ABB74B83C25DA2C6A47AE08818

Calculating merkle root for CrimeLatLonXY.csv...
Merkle Root for CrimeLatLonXY.csv = A5A74A770E0C3922362202DAD62A97655F8652064CCCB7D3EA2B588C7E07B58

It can be interpreted that CrimeLatLonXY.csv has the target merkle root of A5A74A770E0C3922362202DAD62A97655F8652064CCCB7D3EA2B588C7E07B58

Process finished with exit code 0
```

## References:

1. <https://www.geeksforgeeks.org/java-math-random-method-examples/>
  - a. Used to generate random values for W and B lists in Part 2
2. <https://stackoverflow.com/questions/31342689/how-do-i-use-classes-from-another-project-in-intellij-idea>
  - a. Used to add ObjectNode-Project as a dependency module in IntelliJ
3. <https://www.geeksforgeeks.org/largest-number-less-than-or-equal-to-n-2-which-is-coprime-to-n/>
  - a. Derived my own solution based on the ideas discussed in this article
4. <https://www.w3schools.com/java/>
  - a. To refer common java functions or syntax