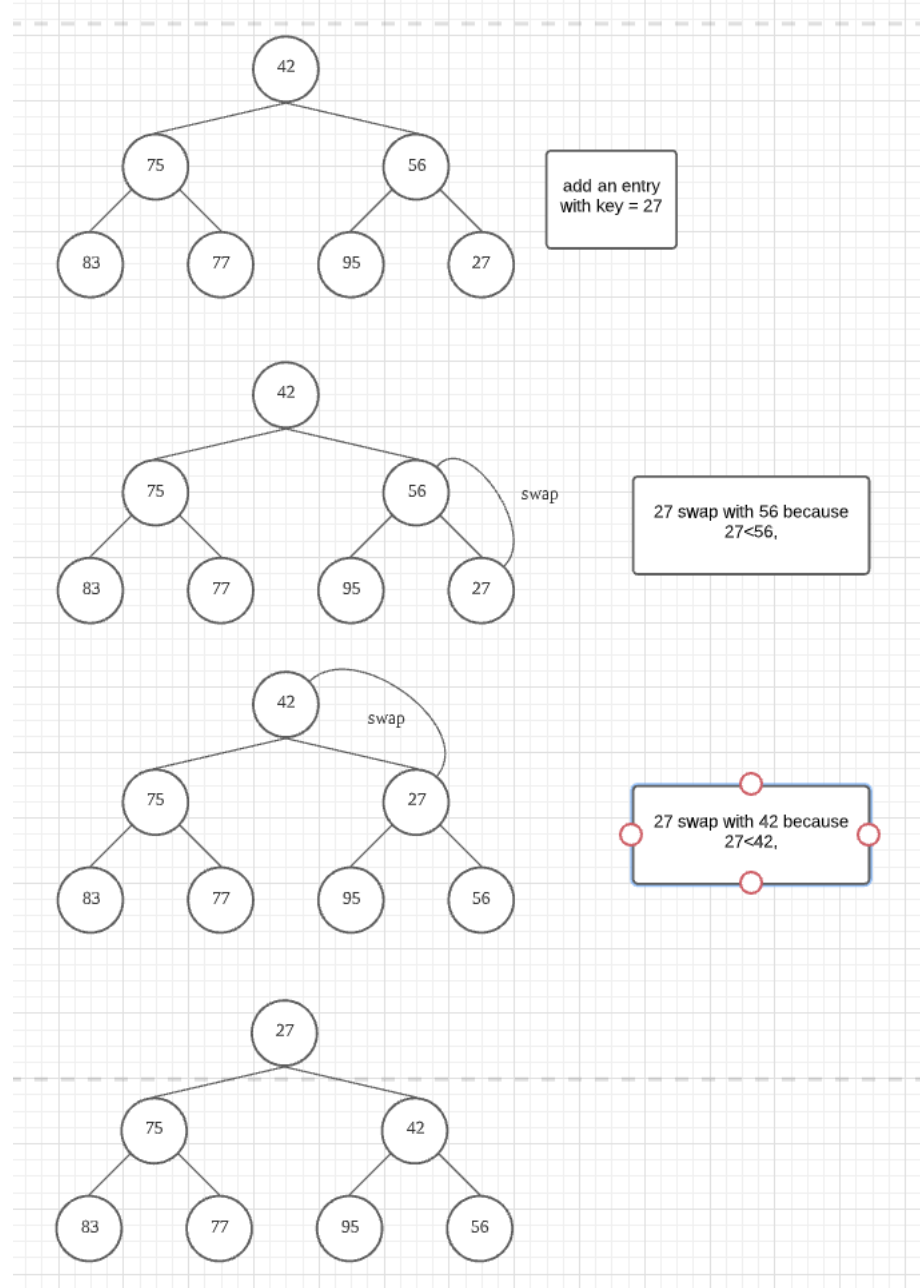
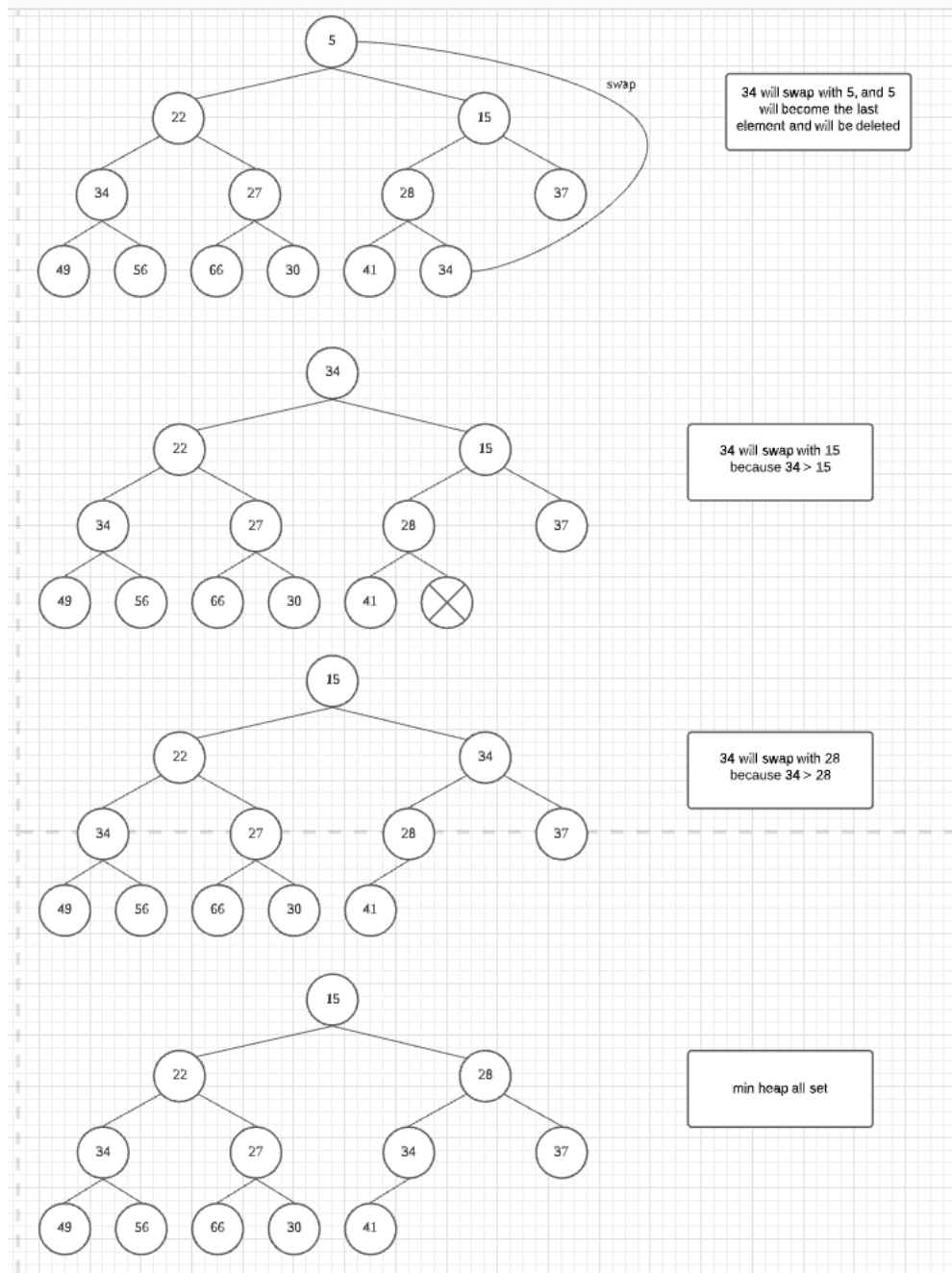


Problem 1:



Problem 2



Problem 3

ArraySequence of keys to be inserted: <5, 8, 44, 23, 12, 20, 35, 32, 14, 16>

$h(5) = 5 \bmod 11 = 5$
 $h(8) = 8 \bmod 11 = 8$
 $h(44) = 44 \bmod 11 = 0$
 $h(23) = 23 \bmod 11 = 1$
 $h(12) = 12 \bmod 11 = 1$
 $h(20) = 20 \bmod 11 = 9$
 $h(35) = 35 \bmod 11 = 2$
 $h(32) = 32 \bmod 11 = 10$
 $h(14) = 14 \bmod 11 = 3$
 $h(16) = 16 \bmod 11 = 5$

| | | |
|----|----|------|
| 0 | 44 | |
| 1 | 23 | → 12 |
| 2 | 35 | |
| 3 | 14 | |
| 4 | | |
| 5 | 5 | → 16 |
| 6 | | |
| 7 | | |
| 8 | 8 | |
| 9 | 20 | |
| 10 | 21 | |

Problem 4

ArraySequence of keys to be inserted: <5, 8, 44, 23, 12, 20, 35, 32, 14, 16>

$h(5) = 5 \bmod 11 = 5$
 $h(8) = 8 \bmod 11 = 8$
 $h(44) = 44 \bmod 11 = 0$
 $h(23) = 23 \bmod 11 = 1$
 $h(12) = 12 \bmod 11 = 1$
 position 1 exist key, try to access index(2)
 $h(20) = 20 \bmod 11 = 9$
 $h(35) = 35 \bmod 11 = 2$
 position 2 exist key, try to access index(3)
 $h(32) = 32 \bmod 11 = 10$
 $h(14) = 14 \bmod 11 = 3$
 position 3 exist key, try to access index(4)
 $h(16) = 16 \bmod 11 = 5$
 position 5 exist key, try to access index(5)

| | |
|----|----|
| 0 | 44 |
| 1 | 23 |
| 2 | 12 |
| 3 | 35 |
| 4 | 14 |
| 5 | 5 |
| 6 | 16 |
| 7 | |
| 8 | 8 |
| 9 | 20 |
| 10 | 32 |

Problem 5

| | |
|----|----|
| 0 | |
| 1 | |
| 2 | 2 |
| 3 | 29 |
| 4 | |
| 5 | 18 |
| 6 | 16 |
| 7 | |
| 8 | 21 |
| 9 | 48 |
| 10 | 15 |
| 11 | |
| 12 | |

$N = 13$, $h(k) = k \bmod 13$, $h'(k) = 1 + (k \bmod 11)$

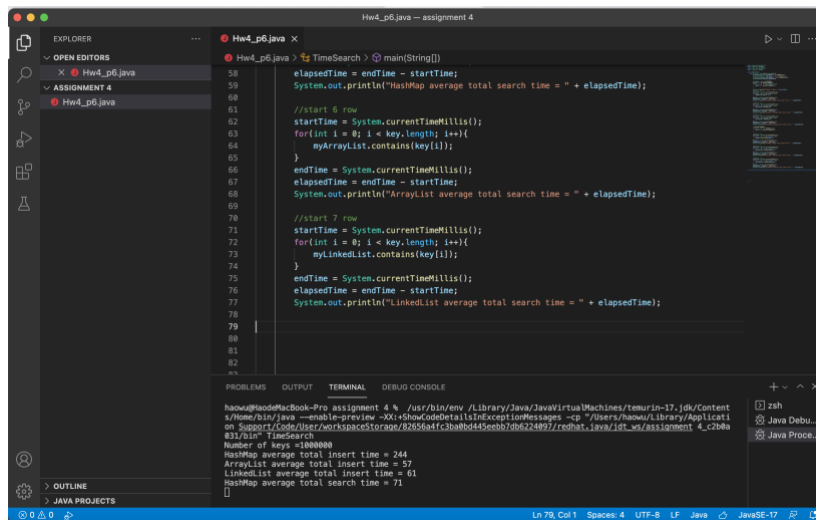
$h(16) = 16 \bmod 13 = 3$
 $h'(16) = 1 + (16 \bmod 11) = 1 + 5 = 6$
 $h(k, i) = (h(k) + i * h'(k)) \bmod N$

$i = 1 : 9 \bmod 13 = 9$ (collision)
 $i = 2 : 15 \bmod 13 = 2$ (collision)
 $i = 3 : 21 \bmod 13 = 8$ (collision)
 $i = 4 : 29 \bmod 13 = 6$ (empty)

Problem 6

In this assignment, I know how to get the code execute time, and I just recognize I can run java project without type “javac ~~~.java” in terminal first. I also learn how to set random int and set range of the seed. Another point that made me understand is that the methods of hashmap and list are different.

But what makes me confuse is that my search time results for the last two lines of the list are not available. I checked my code but I did not find an error. If you saw the error, please told me, I am really confuse. My email address is hwu36@bu.edu.



```

Hw4_p6.java - assignment 4
Hw4_p6.java X
TimeSearch > main(String[])
58     elapsedTime = endTime - startTime;
59     System.out.println("HashMap average total search time = " + elapsedTime);
60
61     //start 6 row
62     startTime = System.currentTimeMillis();
63     for(int i = 0; i < key.length; i++){
64         myArrayList.contains(key[i]);
65     }
66     endTime = System.currentTimeMillis();
67     elapsedTime = endTime - startTime;
68     System.out.println("ArrayList average total search time = " + elapsedTime);
69
70     //start 7 row
71     startTime = System.currentTimeMillis();
72     for(int i = 0; i < key.length; i++){
73         myLinkedList.contains(key[i]);
74     }
75     endTime = System.currentTimeMillis();
76     elapsedTime = endTime - startTime;
77     System.out.println("LinkedList average total search time = " + elapsedTime);
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