MET CS 526
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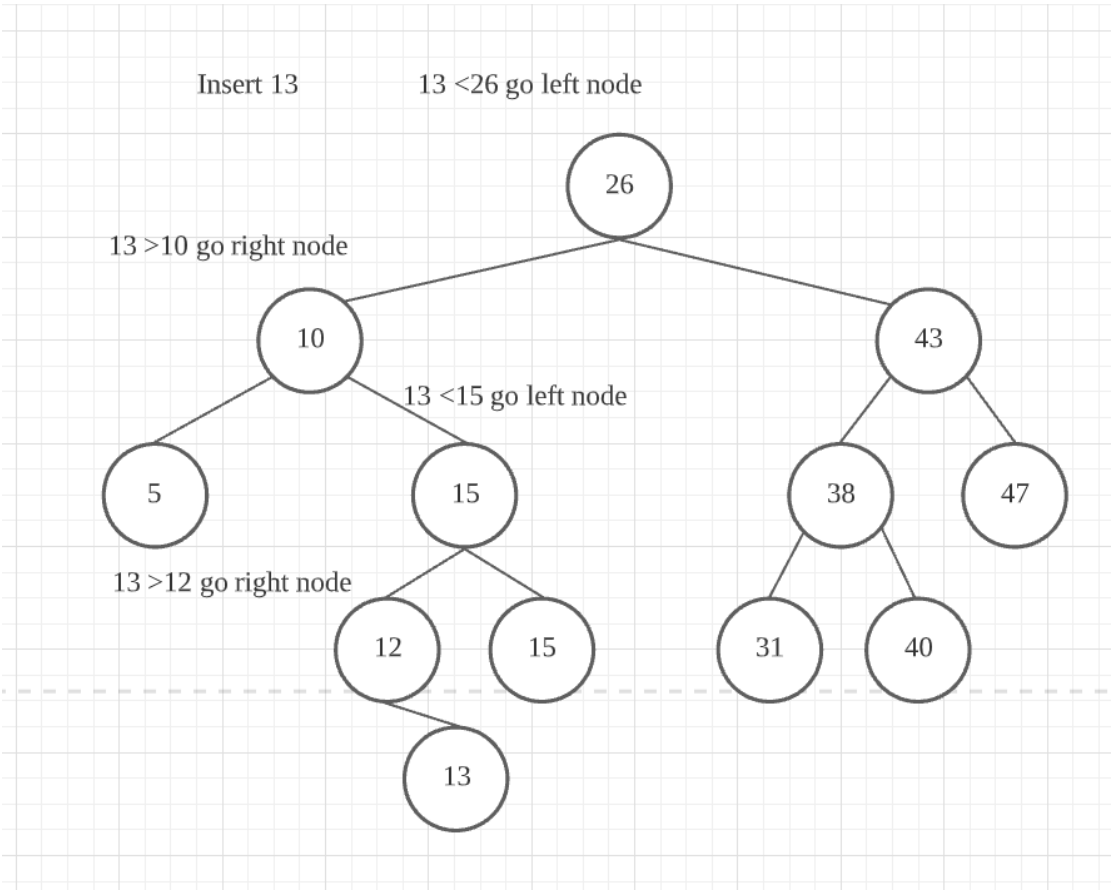
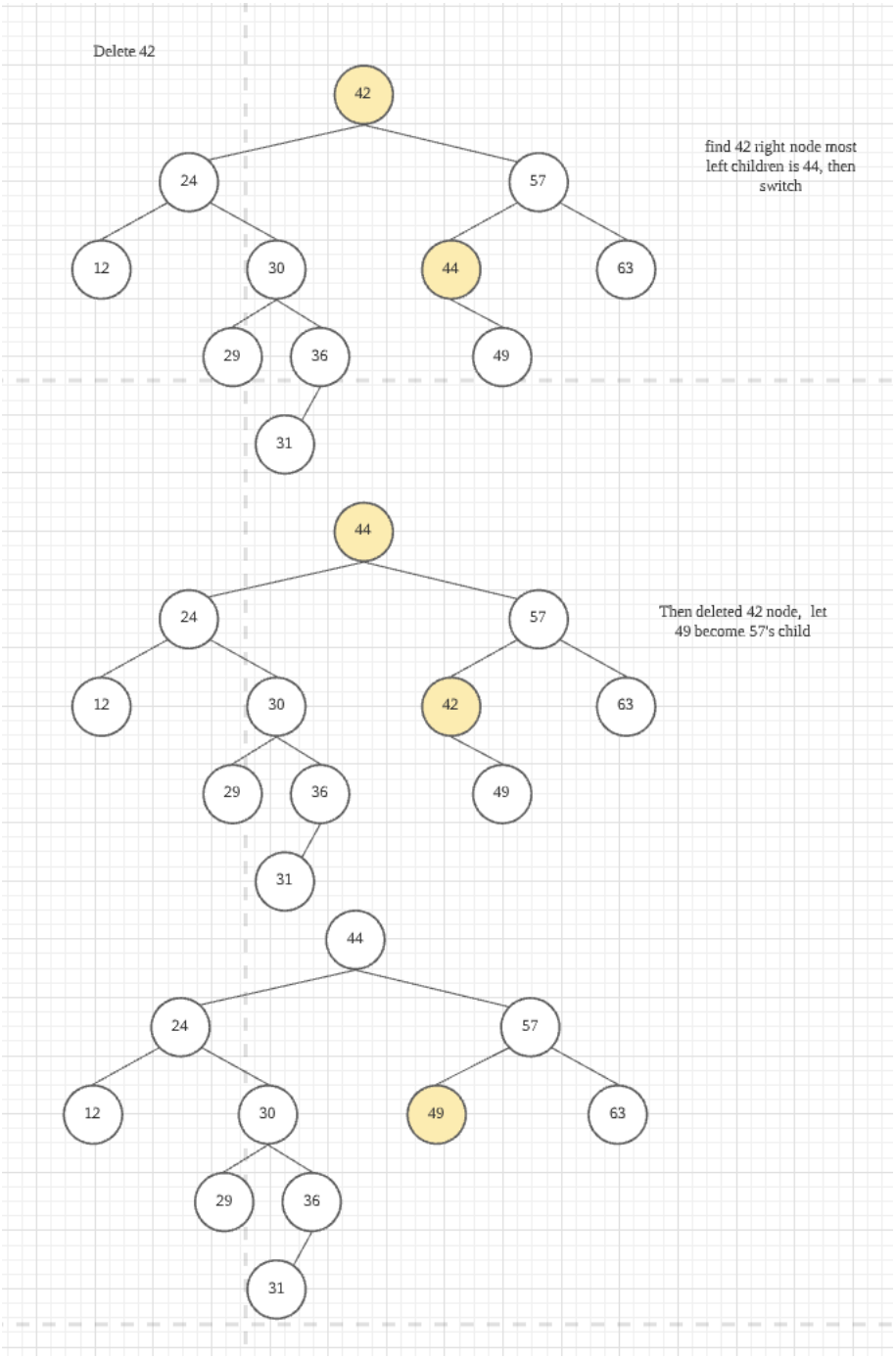
HomeWork 5

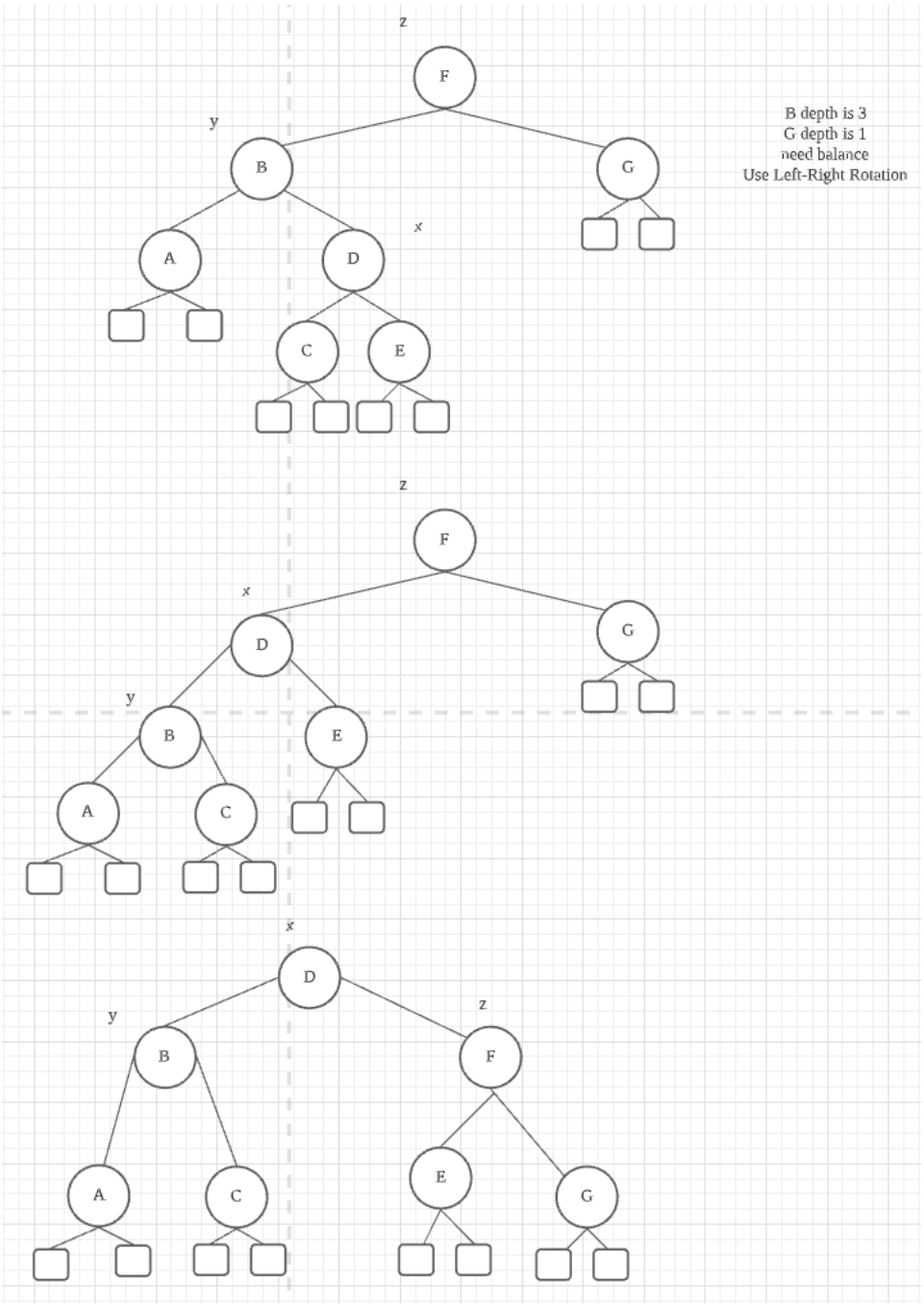
Problem 1



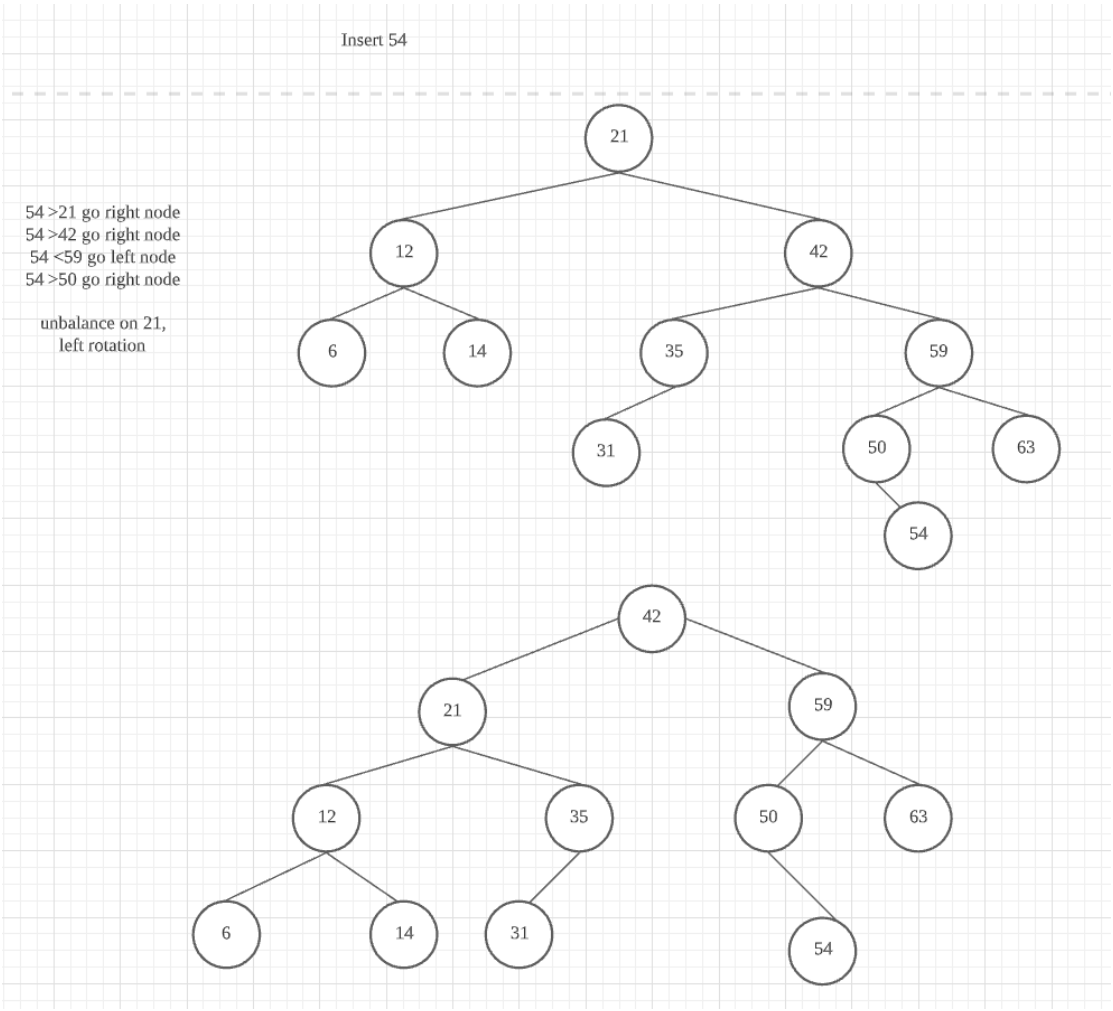
Problem 2


Delete 42
42
24
57
12
30
44
63
29
36
49
31
find 42 right node most left children is 44, then switch
44
24
57
12
30
42
63
29
36
49
31
Then deleted 42 node, let 49 become 57's child
44
24
57
12
30
49
63
29
36
31

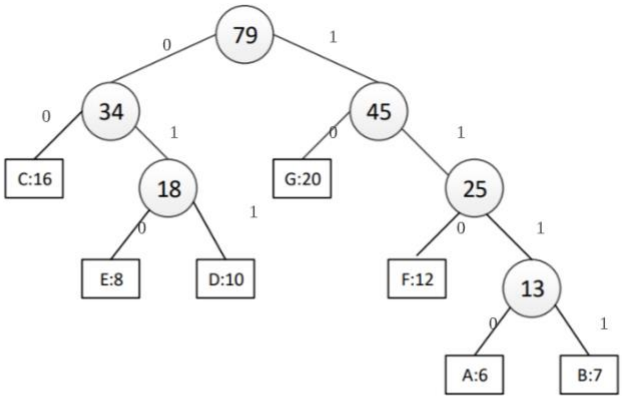
Problem 3


z
F
y
B
G
x
A
D
C
E
B depth is 3
G depth is 1
need balance
Use Left-Right Rotation
z
F
x
D
G
y
B
E
A
C
x
D
y
z
B
F
A
C
E
G

Problem 4


Insert 54
54 >21 go right node
54 >42 go right node
54 <59 go left node
54 >50 go right node
unbalance on 21,
left rotation
21
12
42
6
14
35
59
31
50
63
54
42
21
59
12
35
50
63
6
14
31
54

Problem 5




(1) Encode the string “BDEGC” to a bit pattern using the Huffman tree.

(2) Decode the bit pattern “010111010011” to the original string using the Huffman tree.

**Question 1**
B = 1111
D = 011
E = 010
G = 10
C = 00
Encode = 1110110101000

**Question 2**
010 = E
1110 = A
10 = G
011 = D
Decode = EAGD

Problem 6

$P(i, j)$

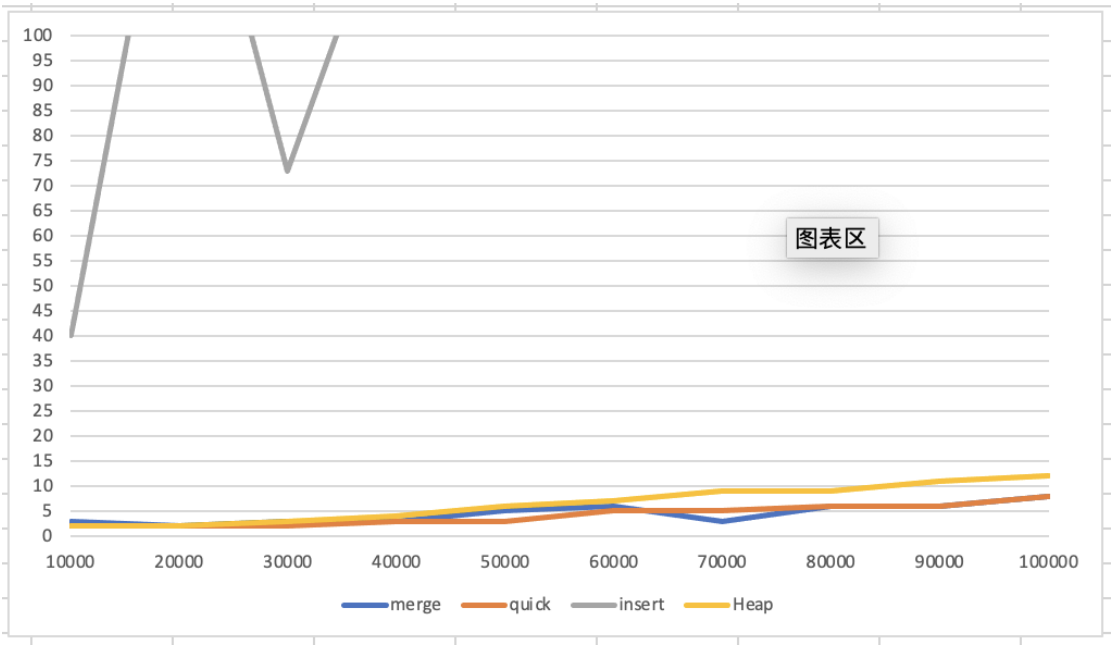
| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | 1 |
| | | | | | | 1 |
| | | | | 13/16 | 15/16 | 1 |
| | | | | 11/16 | 7/8 | 1 |
| | | 3/16 | 5/16 | 1/2 | 3/4 | 1 |
| | | 1/16 | 1/8 | 1/4 | 1/2 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | |

6 5 4 3 2 1 0 ← $j$

6 5 4 3 2 1 0 → $i$

P(1, 1) = (P(0, 1) + P(1, 0)) / 2 = (1 + 0) / 2 = 1/2;
P(1, 2) = (P(0, 2) + P(1, 1)) / 2 = (1 + 1/2) / 2 = 3/4;
P(2, 1) = (P(1, 1) + P(2, 0)) / 2 = (1/2 + 0) / 2 = 1/4;
P(1, 3) = (P(0, 3) + P(1, 2)) / 2 = (1 + 3/4) / 2 = 7/8;
P(2, 2) = (P(1, 2) + P(2, 1)) / 2 = (3/4 + 1/4) / 2 = 1/2;
P(3, 1) = (P(2, 1) + P(3, 0)) / 2 = (1/4 + 0) / 2 = 1/8;
P(1, 4) = (P(0, 4) + P(1, 3)) / 2 = (1 + 7/8) / 2 = 15/16;
P(2, 3) = (P(1, 3) + P(2, 2)) / 2 = (7/8 + 1/2) / 2 = 11/16;
P(3, 2) = (P(2, 2) + P(3, 1)) / 2 = (7/8 + 1/2) / 2 = 5/8;
P(2,4) = P(1,4)+P(2,3)/2 = 11/16+15/16 /2 = 13/16
P(1, 5) = (P(0, 5) + P(1, 4)) / 2 = (1 + 15/16) / 2 = 31/32;
P(4,1) = (P(3,1)+P(4,0))/2 =1+1/8 /2 = 1/16
P(4,2) = (P(3,2)+P(4,1))/2 =5/16+1/16 /2 = 3/16

Problem 7

```
Hw5_p7.java
Hw5_p7.java > Campare > main(String[])
160
161         System.out.print("insertion\t");
162         for(long i: elapsedtimeForInsertion){
163             System.out.print(i+"\t");
164         }
165         System.out.println();
166         System.out.print("merge\t\t");
167         for(long i :elapsedtimeForMerge){
168             System.out.print(i+"\t");
169         }
170         System.out.println();
171         System.out.print("quick\t\t");
172         for(long i : elapsedtimeForQuick){
173             System.out.print(i+"\t");
174         }
175         System.out.println();
176         System.out.print("heap\t\t");
177         for(long i : elapsedtimeForHeap){
178             System.out.print(i+"\t");
179         }
180         System.out.println();
181         System.out.println("-----------------------------------------------------------------------------------------------------------");
182     }
183 }
```

```
PROBLEMS  OUTPUT  TERMINAL  DEBUG CONSOLE

heap            3       3       3       4       5       6       8       9       11      11
-----------------------------------------------------------------------------------------------------------
haowu@HaodeMacBook-Pro Assignment5 %  cd "/Users/haowu/Desktop/Boston University Graduate Study/CS 524/Assignment5" ; /usr/bin/env /Li
Java/JavaVirtualMachines/temurin-17.jdk/Contents/Home/bin/java --enable-preview -XX:+ShowCodeDetailsInExceptionMessages -cp "/Users/ha
brary/Application Support/Code/User/workspaceStorage/8b77863d323ef53385f2143c342c530f/redhat.java/jdt_ws/Assignment5_fe569458/bin" Cam
pare
-----------------------------------------------------------------------------------------------------------

n               10000   20000   30000   40000   50000   60000   70000   80000   90000   100000
-----------------------------------------------------------------------------------------------------------
insertion       36      155     73      133     209     299     429     541     719     875
merge           3       2       3       3       5       6       3       6       6       8
quick           2       2       2       3       3       5       5       6       6       8
heap            2       2       3       4       6       7       9       9       11      12
-----------------------------------------------------------------------------------------------------------
haowu@HaodeMacBook-Pro Assignment5 %

Java Proce...
zsh
```