

Name: Kutay Şenyiğit

ID: 21902377

Section: 1

Homework: 4

Question 1

a)

Insert 2

2

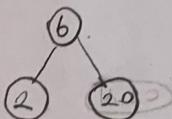
⇒

Insert 20:

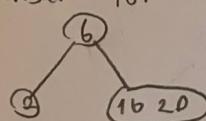
2 20

⇒

Insert 6:

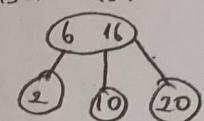


Insert 16:

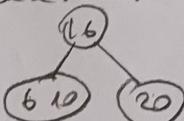


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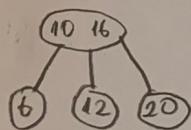
Insert 10:



Delete 2:

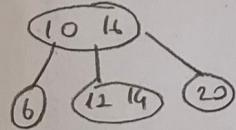


Insert 12:



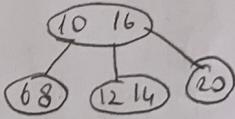
⇒

Insert 14:

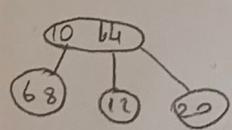


⇒

Insert 8:

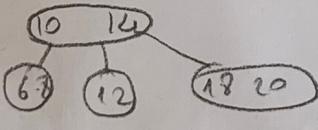


Delete 16:



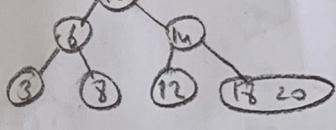
⇒

Insert 18:

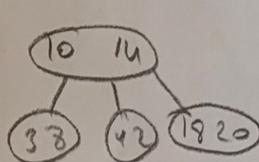


⇒

Insert 3:

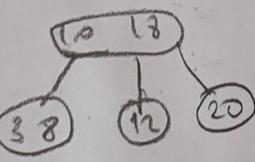


Delete 6:

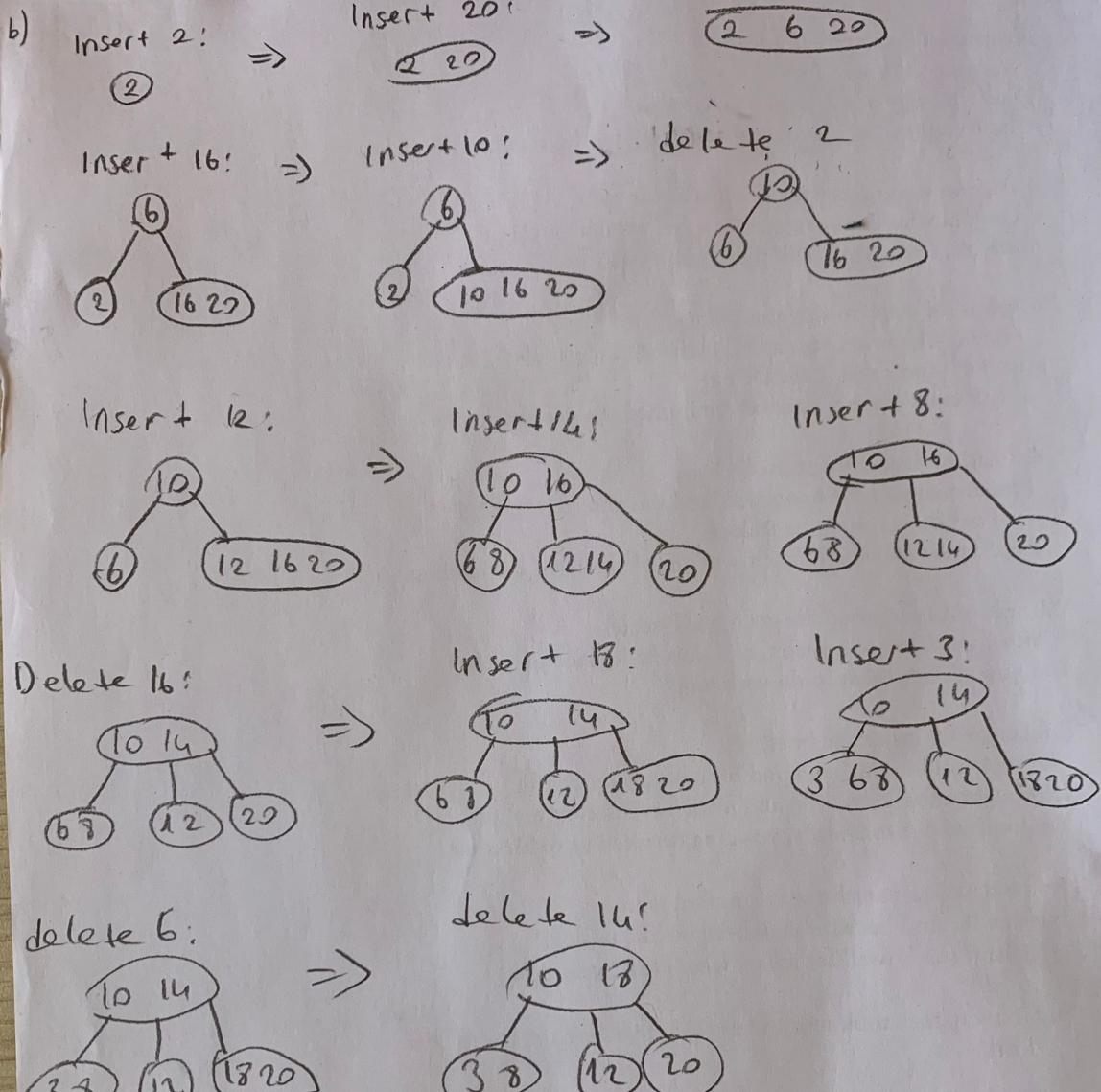


⇒

Delete 14:



Question 2



Question 2

1	26
2	
3	54
4	
5	17
6	69
7	45
8	58
9	32
10	60
11	
12	64

a)

Successful Search

Try 45, 64, 54, 17, 69, 58, 32, 60, 26

45: 6, 64: 12, 54: 2, 17: 4, 69: 4, 5

68: 6, 7, 32: 6, 7, 8, 60: 8, 9, 26: 0

Average Number of Probes for successful search

$$= (1+1+1+2+2+3+2+1) / 9 = 16/9 \approx 1.6$$

Unsuccessful Searches: TRY 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
 (0: 0, 1) (1: 1) (2: 2, 3) (3: 3)
 (4: 4, 5, 6, 7, 8, 9, 10) (5: 5, 6, 7, 8, 9, 10) (6: 6, 7, 8, 9, 10)
 (7: 7, 8, 9, 10) (8: 8, 9, 10) (9: 9, 10)
 (10: 10) (11: 11) (12: 12, 0, 1)

Avg Number of probes for unsuccessful search

$$= (2+1+2+1+9+6+5+4+3+2+1+1+3) / 13$$

$$\approx 38/13 = 2.9$$

b)	26
0	
1	54
2	
3	17
4	69
5	45
6	58
7	60
8	
9	32
10	
11	64
12	

Successful Search: Try 45, 64, 54, 17, 69, 58, 32, 60, 26.
 (45: 6) (64: 12) (54: 2) (17: 4) (69: 4, 5)
 (58: 6, 7) (32: 6, 7, 10) (60: 8) (26: 0)

Avg Number of probes for successful search

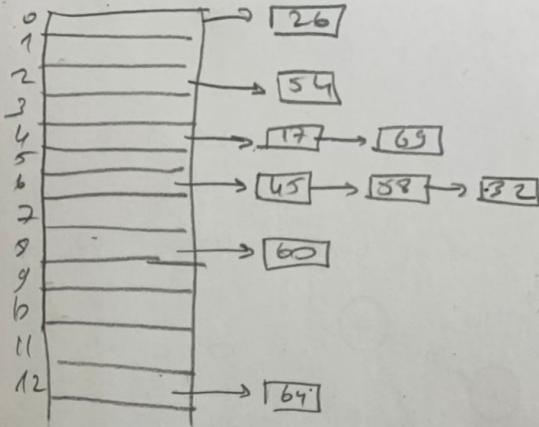
$$= (1+1+1+1+2+2+3+4) / 9 = 13/9 \approx 1.4$$

Unsuccessful Search Try = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
 (0: 0, 1) (1: 1) (2: 2, 3) (3: 3) (4: 4, 5, 6, 7, 8, 9, 10, 11, 12)
 (5: 5, 6, 7, 8, 9, 10, 11, 12) (6: 6, 7, 8, 9, 10, 11, 12) (7: 7, 8, 9, 10, 11, 12)
 (8: 8, 9, 10, 11, 12) (9: 9, 10, 11, 12) (10: 10, 11, 12) (11: 11, 12) (12: 12, 0, 1)

Average Number of Probes for unsuccessful search

$$= (2+1+2+1+2+3+5+3+2+1+2+1+3) / 13 = 33/13 \approx 2.5$$

c)



Successful Search = Try 45, 64, 54, 17, 69, 58, 32, 60, 26
(45: 6.0) (64: 12.0) (54: 2.0) (17: 4.0) (69: 4.0, 4.1)
(58: 6.0, 6.1) (32: 6.0, 6.1, 6.2) (60: 8.0) (26: 0.0)

Avg number of probes for successful search

$$= (1 + 1 + 1 + 1 + 2 + 2 + 3 + 1 + 1) / 9 = 13/9 \approx 1.4$$

Unsuccessful Search = Try 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
(0: 0.0, 0.1) (1: 1.0), (2: 2.0, 2.1) (3: 3.0) (4: 4.0, 4.1, 4.2)
(5: 5.0) (6: 6.0, 6.1, 6.2, 6.3) (7: 7.0) (8: 8.0, 8.1)
(9: 9.0) (10: 10.0) (11: 11.0) (12: 12.0, 12.1)

Avg Number of probes for unsuccessful search

$$(2 + 1 + 2 + 1 + 3 + 1 + 4 + 1 + 2 + 1 + 1 + 1 + 2) / 13$$

$$= 22/13 \approx 1.7$$

Question 3-b)

Insertion operation:

The insertion operation allows us to put edge between two vertices. Since the graph was undirected, when I inserted an edge I have to do two insertions via linked list. Thus its time complexity is $O(1)$.

List Operation:

I implemented the linked list data structure in order to keep track of edges. Listing the elements of a linked list will have time complexity depending on the number of items in the linked list. In this particular situation, the time complexity for listing operation was $O(E)$ where E was the number of edges.

Shortest path:

I implemented the Dijkstra's shortest path algorithm for this specific method. This algorithm has $O(E + V \log V)$ time complexity where E is edge count and V is vertex count.

Minimum cost:

For this particular algorithm, I used the Prim's algorithm and it has $O((V + E) \log V)$ where E is edge count and v is vertex count.