CS-202 HOMEWORK 4

Full Name: Arda İynem
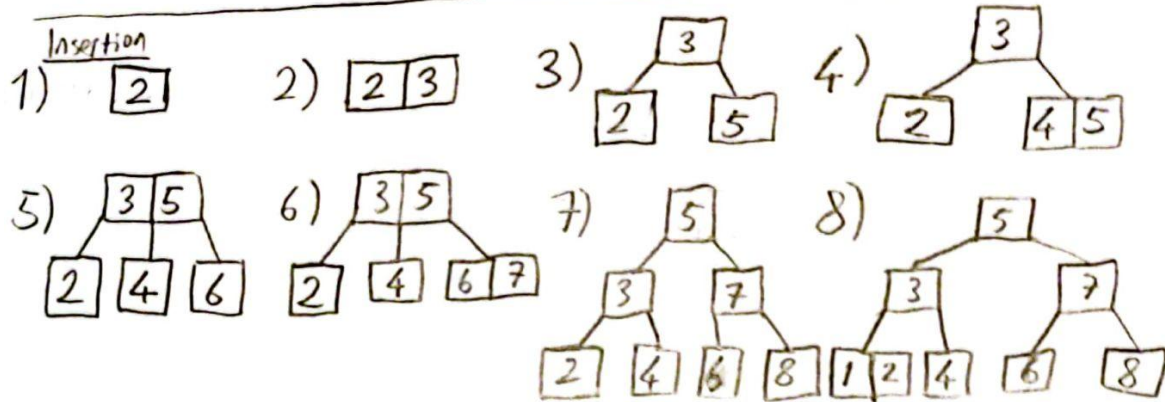**ID:** 22002717
Section: 1
Assignment: 4

Question 1 (a)

Question 1 (d) — 2-3 Tree Insertion & Deletion

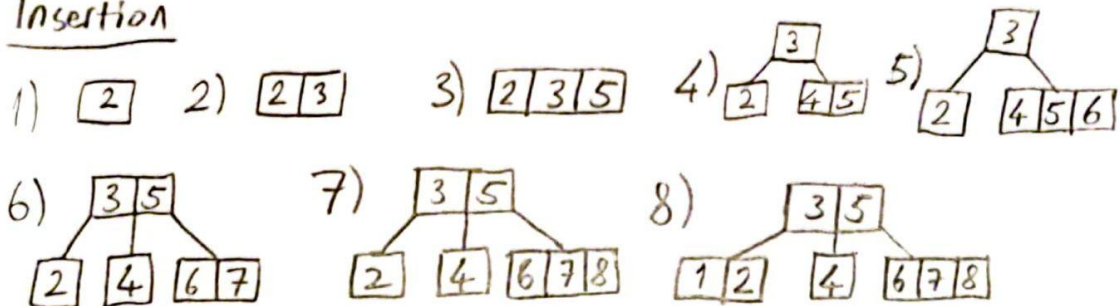**Insertion**

1) `2`

2) `2 3`

3) `3` → `2` `5`

4) `3` → `2` `4 5`

5) `3 5` → `2` `4` `6`

6) `3 5` → `2` `4` `6 7`

7) `5` → `3` `7` → `2` `4` `6` `8`

8) `5` → `3` `7` → `1 2` `4` `6` `8`

Deletion

1) `3 6` → `1 2` `4` `7 8`

2) `3 7` → `1 2` `4` `8`

Question 1 (b)

Question 1 (b) — 2-3-4 Tree Insertion & Deletion

Insertion

1) [2]   2) [2|3]   3) [2|3|5]   4) [3] / [2] [4|5]   5) [3] / [2] [4|5|6]

6) [3|5] / [2] [4] [6|7]

7) [3|5] / [2] [4] [6|7|8]

8) [3|5] / [1|2] [4] [6|7|8]

Deletion

1) [3|6] / [1|2] [4] [7|8]

2) [3|7] / [1|2] [4] [8]

Question 1 (c)

Question 1 (c) — Red-Black Tree Insertion

— Red Pointer
— Black Pointer

Insertion

1) ②

2) ②—③

3) ②—③—⑤

4) ③—②—⑤—④

5) ③—②—⑤—④—⑥

6) ③—②—⑤—④—⑥—⑦

7) ③—②—⑤—④—⑦—⑥—⑧

8) ③—②—①—⑤—④—⑦—⑥—⑧
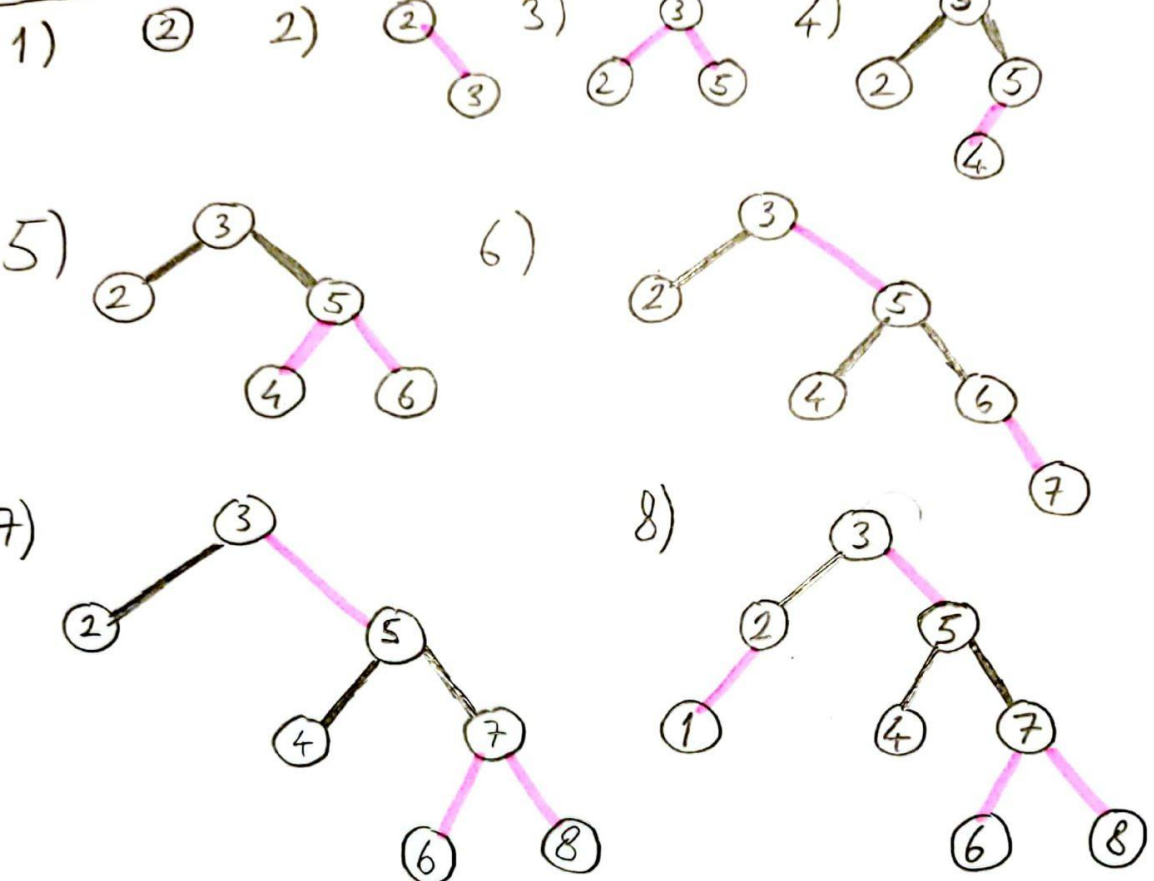
Question 2 - Part a & b & c

Question 2 (a & b & c)

a)

0	34
1	
2	36
3	20
4	2
5	19
6	53
7	37
8	
9	
10	
11	
12	
13	
14	
15	
16	

Open Addressing with Linear Probing

b)

0	34
1	53
2	36
3	20
4	37
5	
6	2
7	
8	
9	
10	
11	19
12	
13	
14	
15	
16	

Open Addressing with Quadratic Probing

c)

0	• → 34
1	
2	• → 36 → 2 → 19 → 53
3	• → 20 → 37
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	

Seperate Chaining