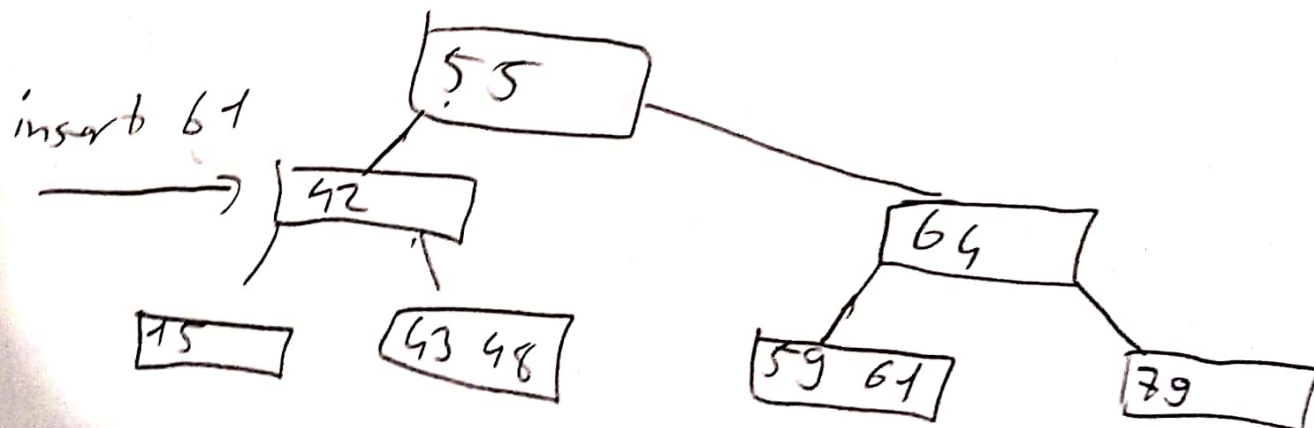
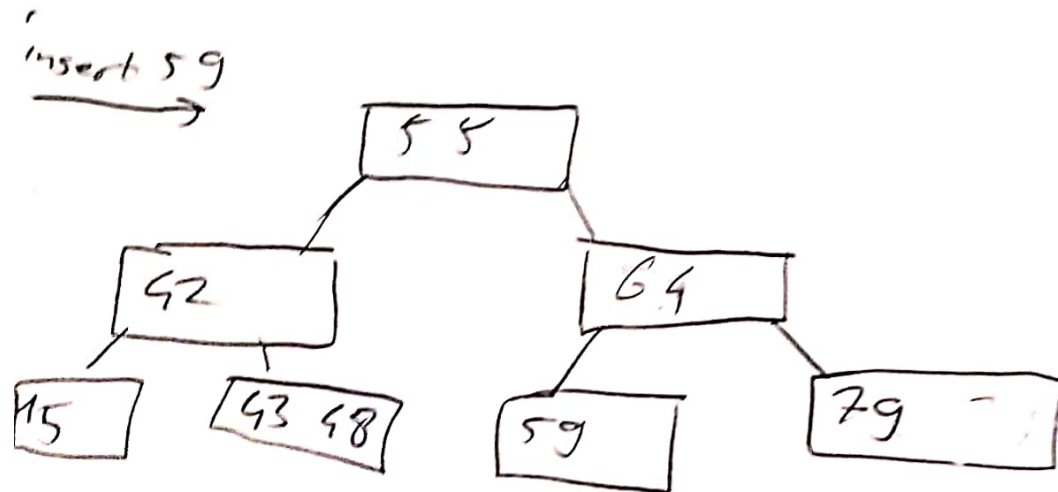
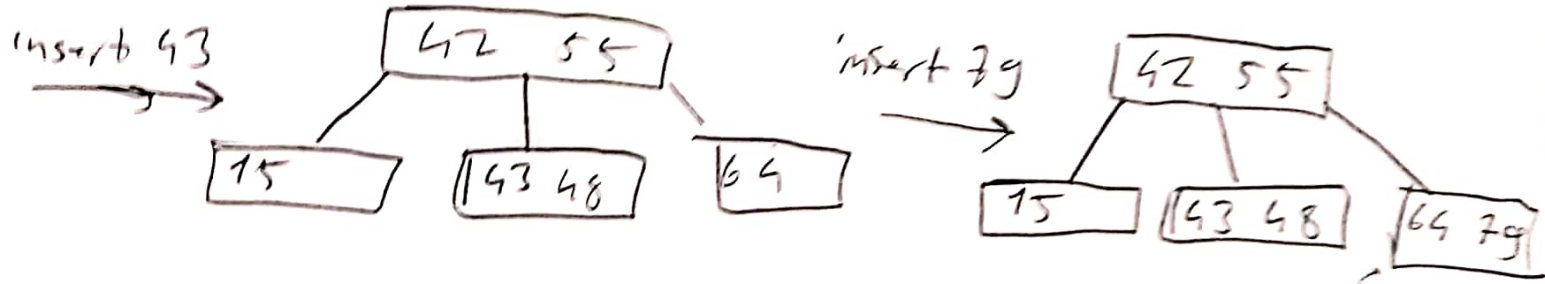
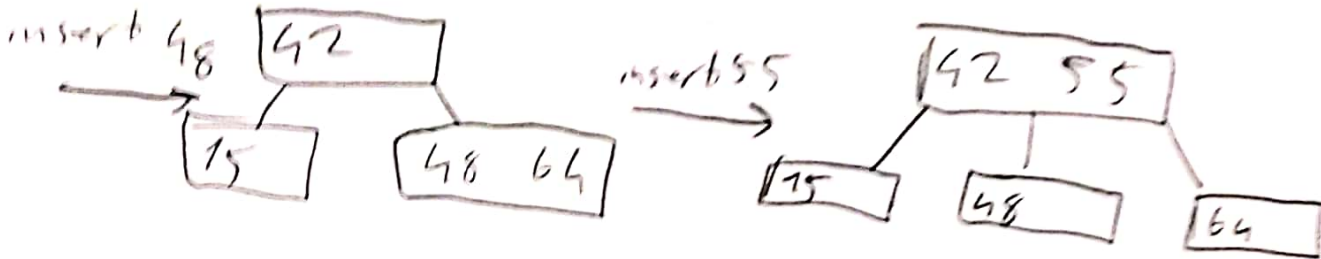
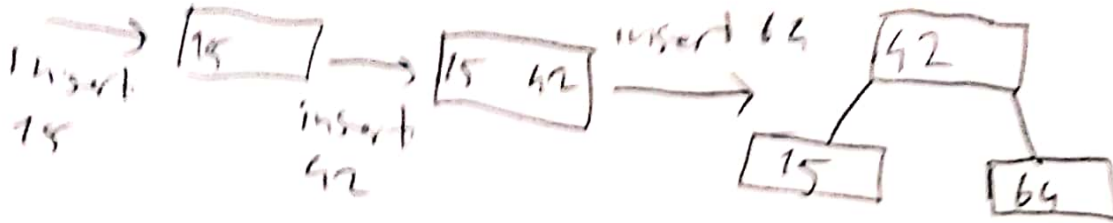


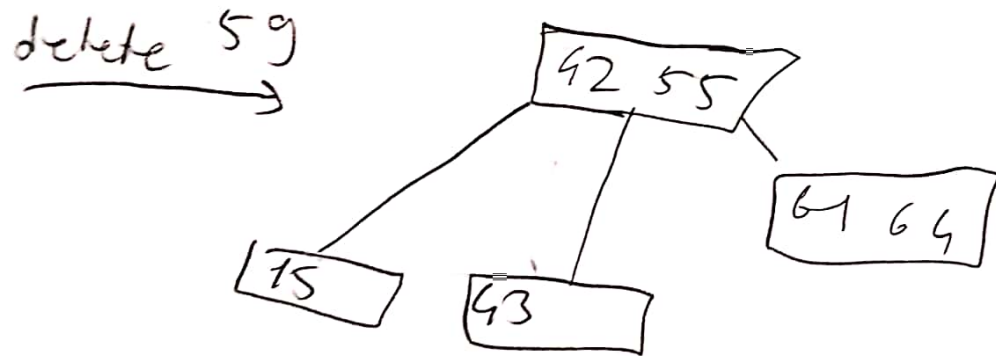
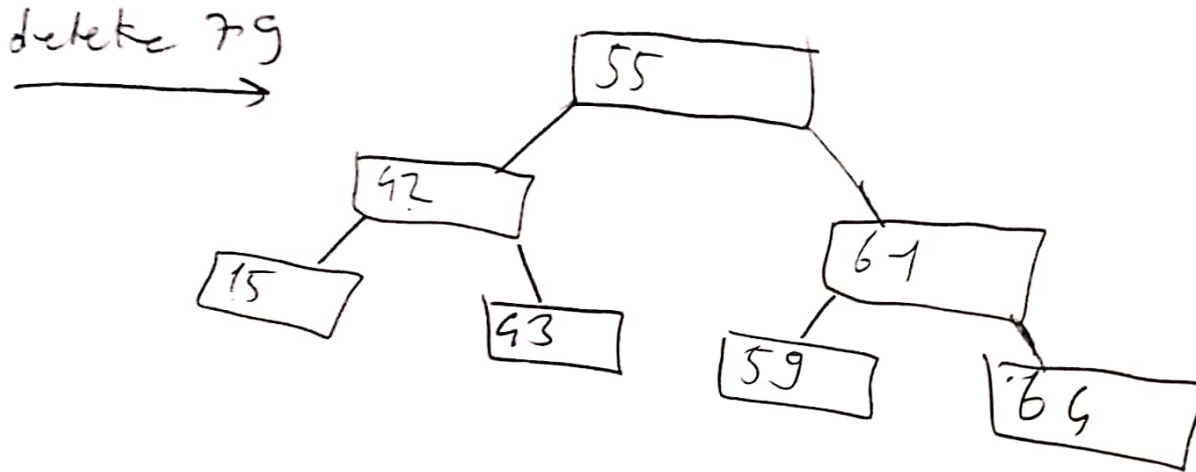
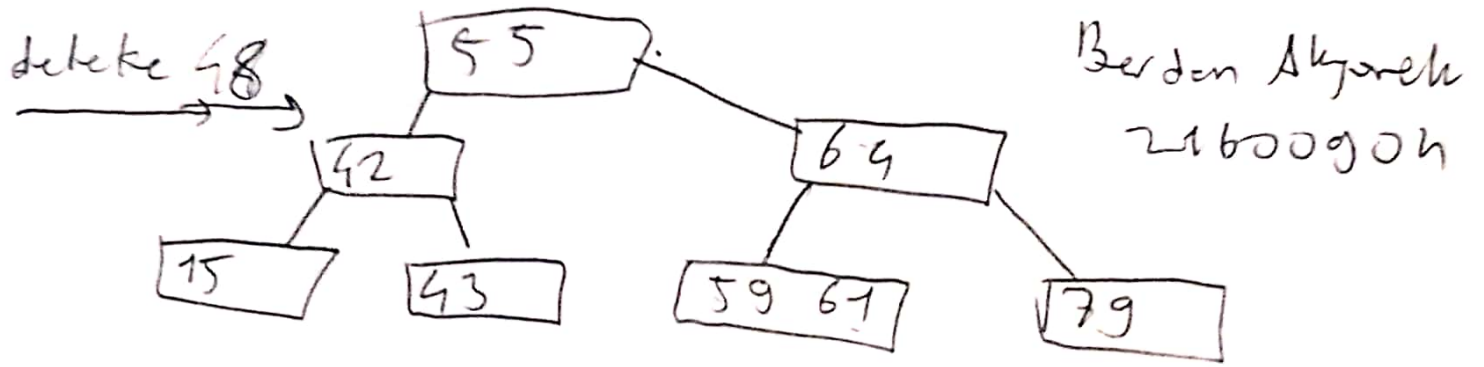
Q1)

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2-3 Tree



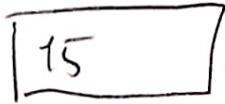
(7)



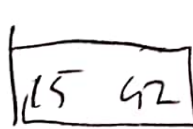
2-3-4 tree

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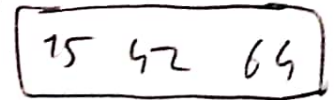
insert 15



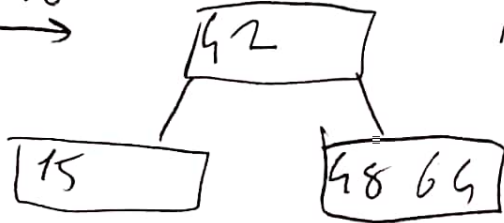
insert 42



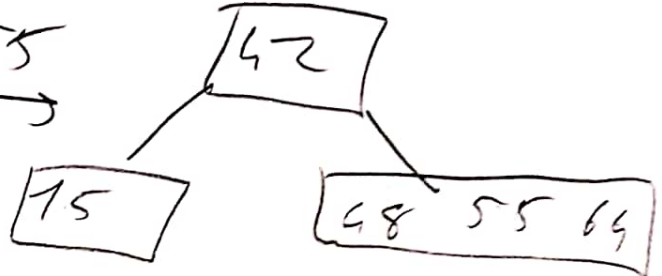
insert 64



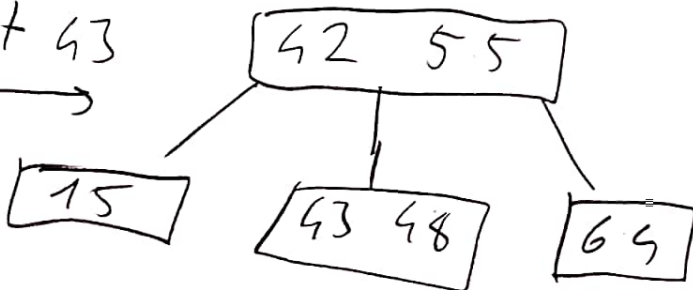
insert 48



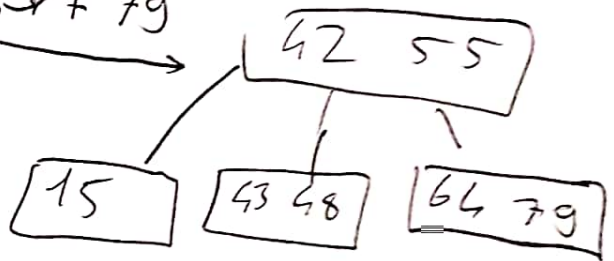
insert 55



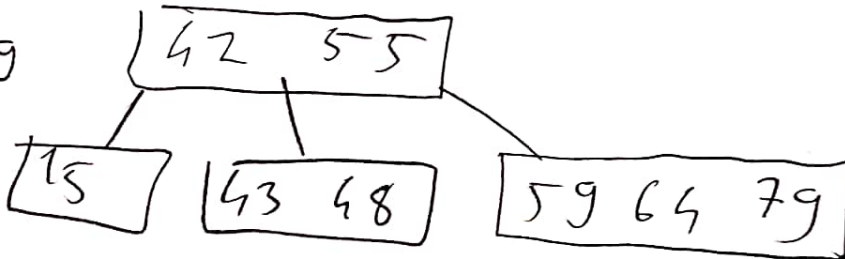
insert 43



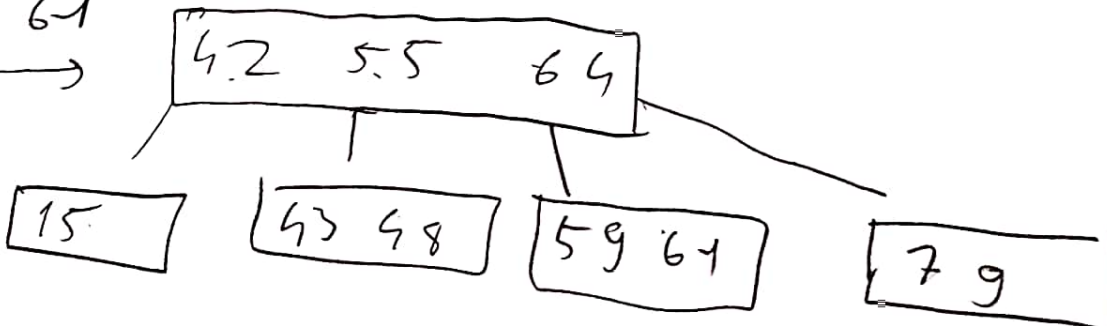
insert 79



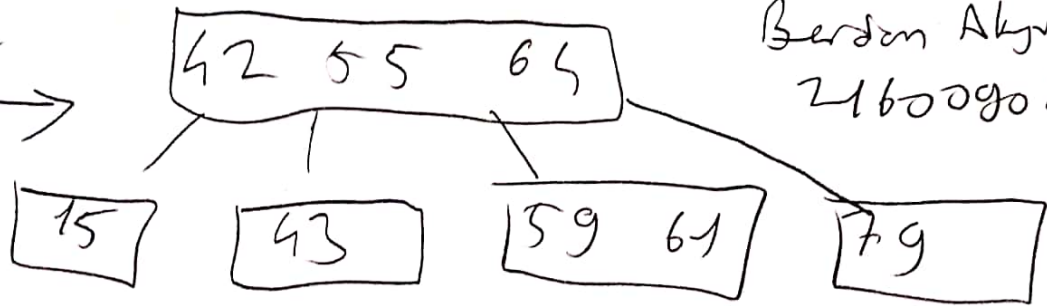
insert 59



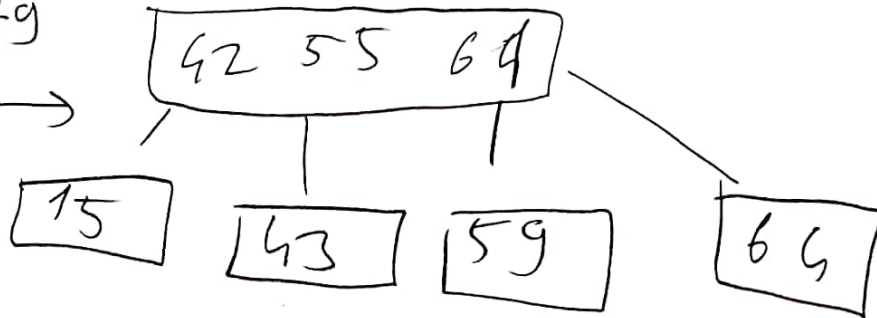
insert 61



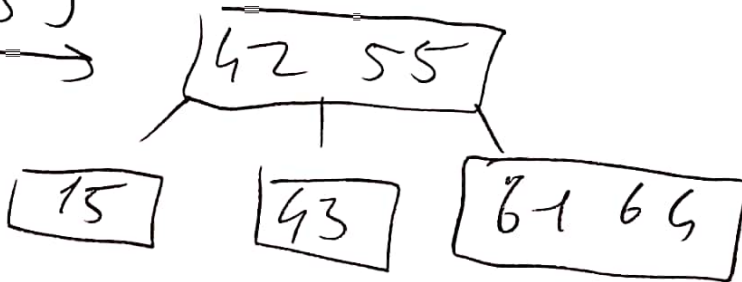
delete 48



delete 79



delete 59



(4)

Red Black Tree

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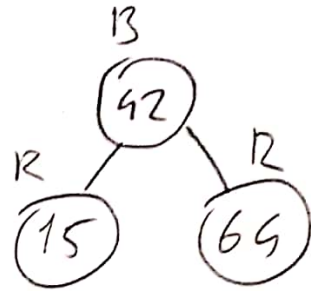
insert 15



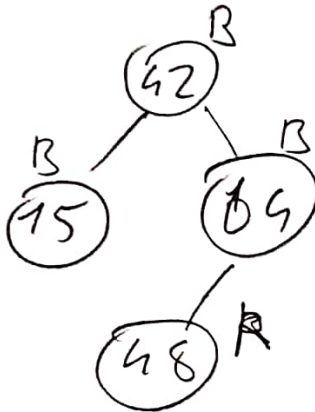
insert 42



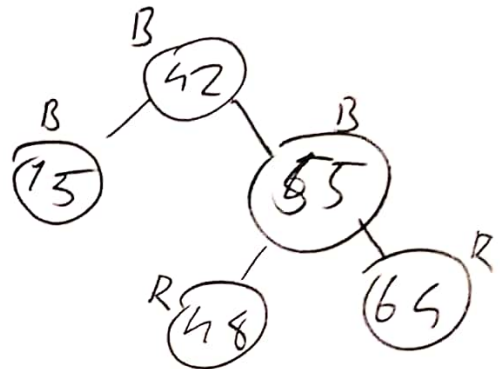
insert 64



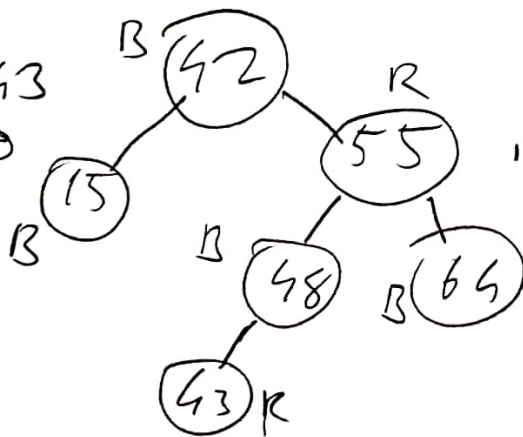
insert 48



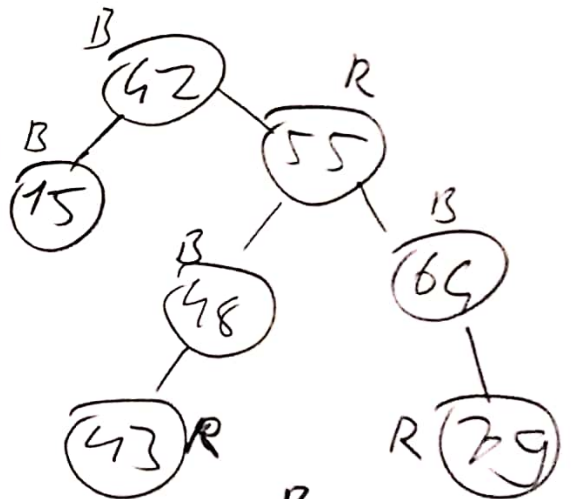
insert 55



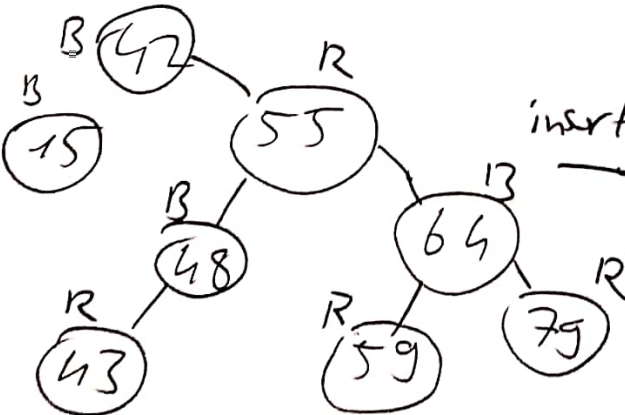
insert 43



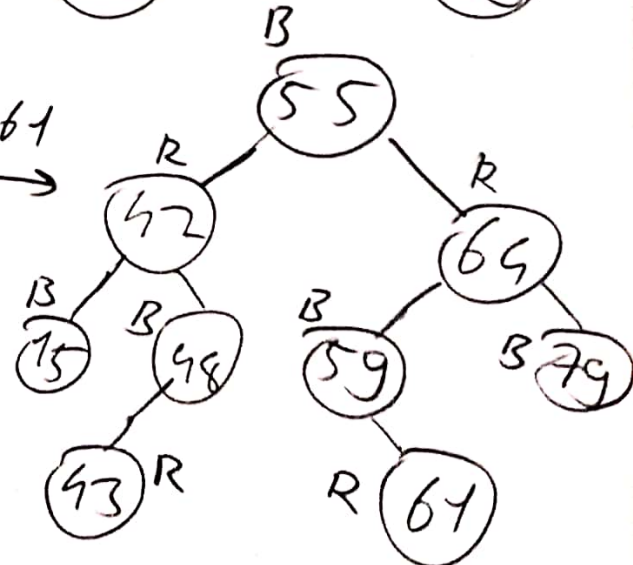
insert 79



insert 59



insert 61



(5)

Q2

1) open addressing, linear probing

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0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
					22											
					22/23											
					22/23	24										
					22	23	24/39									
					22	23	24	39	40							
					22	23	24	39	40	26						
					22	23	24	39	40	26	41					
					22	23	24	39	40	26	41	43				
					22	23	24	39	40	26	41	43				

26 already exists. Did not add it.

(6)

$$(v+i^2) \% 17$$

2) open addressing, quadratic probing. $5 + i^2$

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
					22											

					22	23										
--	--	--	--	--	----	----	--	--	--	--	--	--	--	--	--	--

					22	23	24									
--	--	--	--	--	----	----	----	--	--	--	--	--	--	--	--	--

					22	23	24		39							
--	--	--	--	--	----	----	----	--	----	--	--	--	--	--	--	--

$$i=1 \quad (v+i^2) \% 17 = (5+1^2) \% 17 = 6 \text{ full}$$

$$i=2 \quad 5+2^2 \% 17 = 9$$

					22	23	24		39	40						
--	--	--	--	--	----	----	----	--	----	----	--	--	--	--	--	--

$$i=1 \quad (v+i^2) \% 17 = 7 \text{ full}$$

$$v \quad (8+2^2) \% 17 = 10$$

					22	23	24		39	40		26				
--	--	--	--	--	----	----	----	--	----	----	--	----	--	--	--	--

$$i=1 \quad (9+1^2) \% 17 = 10 \text{ full}$$

$$i=2 \quad (9+2^2) \% 17 = 13$$

					22	23	24	41	39	40		26				
--	--	--	--	--	----	----	----	----	----	----	--	----	--	--	--	--

43					22	23	24	41	39	40		26				
----	--	--	--	--	----	----	----	----	----	----	--	----	--	--	--	--

$$i=1 \quad (9+1^2) \% 17 = 10 \text{ full}$$

$$i=2 \quad (9+2^2) \% 17 = 13 \text{ full}$$

$$i=3 \quad (9+3^2) \% 17 = 18 \% 17 = 1$$

43					22	23	24	41	39	40		26				
----	--	--	--	--	----	----	----	----	----	----	--	----	--	--	--	--

$$i=1 \quad (9+1^2) \% 17 = 10 \text{ full}$$

$i=2 \quad (9+2^2) \% 17 = 13$. Value already exists. Will not add.

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(7)

3) Separate Chaining

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
					22											
					22	23										
					22	23	24									
					22	23	24									
					39											
					22	23	24									
					39	40										
					22	23	24		26							
					39	40										
					22	23	24		26							
					39	40	41									
					22	23	24		26							
					39	40	41		43							
					22	23	24		26							
					39	40	41		43							

Value already exist. Will not be added.

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(8)