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Q.1.17

6	1	2	3	4	5	6	7	8	9	10
			25	3						10
32			25	3						10
32		46	25	3						10
32		46	25	3	58					10
32		46	25	3	58	58				10
32		46	25	3	58	58	26			10
32		46	25	3	58	58	26	17		10
32	65	46	25	3	58	58	26	17		10

average after 8 insertions:

$$(1+2+1+2+1+3+5+4)/8$$

$$= 2.375$$

average at the end:

$$(1+2+1+2+1+3+5+4+2+3)/10$$

$$= 2.4$$

Keys	# probes
25	1
3	2
10	1
32	2
46	1
58	3
58	5
26	4
17	2
65	3

Q15)

6	1	2	3	4	5	6	7	8	9	10
			25	3						10
32			25	3						10
32		46	25	3						10
32		46	25	3		58				10
32		46	25	3		57	58			10
32		46	25	3	26	57	58			10
32		46	25	3	26	57	58	17		10
32		46	25	3	26	57	58	65	17	10

Keys	# probes
25	1
3	2
10	1
32	2
46	1
58	3
57	3
26	2
17	6
65	4

Average number of probes after 8 insertions:

$$(1+2+1+2+1+3+3+2)/8 = 1.875$$

Average number of probes at the end

$$(1+2+1+2+1+3+3+2+6+4)/10 = 2.5$$

Q1C

0	1	2	3	4	5	6	7	8	9	10
			25				3			10
		32	25				3			18
		32	25		46		3			10
		32	25		46		3	58		10
		32	25		46		3	58	57	10
		32	25	26	46		3	58	57	10
		32	25	26	46	17	3	58	57	10
	65	92	25	26	46	17	3	58	57	10

Keys	# probes
25	1
3	2
10	1
32	2
46	2
58	2
57	4
26	1
17	1
65	6

Average of probes after insertion:

$$(1+2+1+2+2+2+4+1)/8 = 1.875$$

Average of probes at the end:

$$(1+2+1+2+2+2+4+1+1+6)/10 = 2.2$$

## Question 2

a) Insert key 16:

$$(3 \cdot 16 + 1) \bmod 11 = \text{probe 5 (filled)}$$

$$(48 + 1^2) \bmod 11 = \text{probe 6 (filled)}$$

$$(48 + 2^2) \bmod 11 = \text{probe 8}$$

So we insert key 16 at index 8

Insert 22

$$(5 \cdot 22) + 1 \bmod 11 \Rightarrow \text{probe 5 (filled)}$$

$$(82 + 1^2) \bmod 11 \Rightarrow \text{probe 6 (filled)}$$

$$(82 + 2^2) \bmod 11 \Rightarrow \text{probe 9 (empty)}$$

We insert key 22 at index 9

0	1	2	3	4	5	6	7	8	9	10
					5	9	2			
					5	9	2	16		
					5	9	2	16	22	

Q2 ( ):

search key 11:

$$(3 \times 11 + 1) \bmod 11 = 1 : \text{available}$$

$$34 + 1^2 \bmod 11 = 2 : \text{available}$$

$$34 + 2^2 \bmod 11 = 5 : \text{Occupied and different}$$

$$34 + 3^2 \bmod 11 = 10 : \text{Found}$$

Q2b) Delete key 0

$$(3 \times 0 + 1) \bmod 11 = 1 : \text{available}$$

$$\rightarrow 1 + 1 \bmod 11 = 2 \Rightarrow \text{found}$$

$\rightarrow$  so we delete key 0 at probe 2

0	1	2	3	4	5	6	7	8	9	
	over	over			5	9	2			

Q2 c) insert

$$(3 \times 2 + 1) \bmod 11 = 0 \text{ (occupied and different)}$$

probing new cell:  $(22 + 1) \bmod 11 = 1$ : available

probing new cell:  $(22 + 2^2) \bmod 11 = 4$  (empty)

So insert key 7 at probe 4

0	1	2	3	4	5	6	7	8	9	10
16	12	11		7	5	9	2			17