

## Initial Table

index	0										10
	0	0	0	0	0	5	0	0	0	0	

Size = 11

$$\text{hash}(x) = x \% \text{table size}$$

$$\text{Quadratic Probing } f(i) = i^2$$

$$\therefore h_i(x) = (\text{hash}(x) + i^2) \% 11 \quad [\text{Remember } (a \bmod n) \bmod n = a \bmod n]$$

## Add 16

$$h_0(16) = (16 \% 11 + 0) \% 11$$

$$= 5 \text{ collision!}$$

$$h_1(16) = (16 \% 11 + 1) \% 11$$

$$= 6 \text{ Valid!}$$

0										10
0	0	0	0	0	5	16	0	0	0	0

## Add 27

$$h_0(27) = (27 \% 11 + 0) \% 11$$

$$= 5 \text{ collision!}$$

$$h_1(27) = (27 \% 11 + 1) \% 11$$

$$= 6 \text{ collision!}$$

$$h_2(27) = (27 \% 11 + 2^2) \% 11$$

$$= (5 + 4) \% 11$$

$$= 9 \text{ Valid!}$$

0										10
0	0	0	0	0	5	16	0	0	27	0

## Add 38

$$h_0(38) = 38 \% 11$$

$$= 5 \text{ collision!}$$

$$h_1(38) = (38 \% 11 + 1) \% 11$$

$$= 6 \text{ collision!}$$

$$h_2(38) = (38 \% 11 + 2^2) \% 11$$

$$= 9 \text{ collision!}$$

$$h_3(38) = (38 \% 11 + 3^2) \% 11$$

$$= (5 + 9) \% 11$$

$$= 3 \text{ Valid!}$$

0										10
0	0	0	38	0	5	16	0	0	27	0

## Delete 16

0										10
0	0	0	38	0	5	D	0	0	27	0

## Add 2

$$h_0(2) = 2 \% 11$$

$$= 2$$

0										10
0	0	2	38	0	5	D	0	0	27	0

## Add 13

$$h_0(13) = 13 \% 11$$

$$= 2 \text{ collision!}$$

$$h_1(13) = (13 \% 11 + 1^2) \% 11$$

$$= 3 \text{ collision!}$$

$$h_2(13) = (13 \% 11 + 2^2) \% 11$$

$$= 6 \% 11$$

$$= 6 \text{ collision with D!}$$

$$h_3(13) = (13 \% 11 + 3^2) \% 11$$

$$= (2 + 3^2) \% 11$$

$$= 0 \text{ Valid!}$$

0										10
13	0	2	38	0	5	D	0	0	27	0

13	0	2	38	0	5	D	0	0	27	0
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Ans