

Özkan Gezmiş

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Özkan

$N=13$

hash = $h_1(k) = k \bmod N$

offset = $h_2(k) = 1 + k \bmod (N-1)$

probing sequence = $h_1(\text{hash} + \text{offset}) = (\text{hash} + \text{offset}) \% N$

I used h_2 and probing sequence even though there is no collision
a)

insert(32):

$$h_1(32) = 32 \% 13 = 6$$

$$h_2(32) = 1 + (32 \% 12) = 9$$

$$\text{probing sequence} = (6 + 9) \% 13 = 2$$

| | | | | | | | | | | | | |
|---|---|----|---|---|---|---|---|---|---|----|----|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | | 32 | | | | | | | | | | |

insert(18):

$$h_1(18) = 18 \% 13 = 5$$

$$h_2(18) = 1 + (18 \% 12) = 7$$

$$\text{probing sequence} = (5 + 7) \% 13 = 12$$

| | | | | | | | | | | | | |
|---|---|----|---|---|---|---|---|---|---|----|----|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | | 32 | | | | | | | | | | 18 |

insert(24):

$$h_1(24) = 24 \% 13 = 11$$

$$h_2(24) = 1 + (24 \% 12) = 1$$

$$\text{probing sequence} = (11 + 1) \% 13 = 12 \rightarrow \text{collision}$$

$$\text{probing sequence} = (12 + 1) \% 13 = 0$$

| | | | | | | | | | | | | |
|----|---|----|---|---|---|---|---|---|---|----|----|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 24 | | 32 | | | | | | | | | | 18 |

insert(39):

$$h_1(39) = 39 \% 13 = 0$$

$$h_2(39) = 1 + (39 \% 12) = 4$$

$$\text{probing sequence} = (0 + 4) \% 13 = 4$$

| | | | | | | | | | | | | |
|----|---|----|---|----|---|---|---|---|---|----|----|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 24 | | 32 | | 39 | | | | | | | | 18 |

insert(27):

$$h_1(27) = 27 \% 13 = 1$$

$$h_2(27) = 1 + (27 \% 12) = 4$$

$$\text{probing sequence} = (1 + 4) \% 13 = 5$$

| | | | | | | | | | | | | |
|----|---|----|---|----|----|---|---|---|---|----|----|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 24 | | 32 | | 39 | 27 | | | | | | | 18 |

b) Previous table:

| | | | | | | | | | | | | |
|----|---|----|---|----|----|---|---|---|---|----|----|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 24 | | 32 | | 39 | 27 | | | | | | | 18 |

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$d_6 = 2$, $d_7 = 3$, $d_8 = 0$

insert(0):

$$h_1(0) = 0 \% 13 = 0$$

$$h_2(0) = 1 + (0 \% 12) = 1$$

$$\text{Probing sequence} = (0 + 1) \% 13 = 1 //$$

| | | | | | | | | | | | | |
|----|---|----|---|----|----|---|---|---|---|----|----|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 24 | 0 | 32 | | 39 | 27 | | | | | | | 18 |

insert(3):

$$h_1(3) = 3 \% 13 = 3$$

$$h_2(3) = 1 + (3 \% 12) = 4$$

$$\text{Probing sequence} = (3 + 4) \% 13 = 7 //$$

| | | | | | | | | | | | | |
|----|---|----|---|----|----|---|---|---|---|----|----|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 24 | 0 | 32 | | 39 | 27 | | 3 | | | | | 18 |

insert(2):

$$h_1(2) = 2 \% 13 = 2$$

$$h_2(2) = 1 + (2 \% 12) = 3$$

$$\text{Probing sequence} = (2 + 3) \% 13 = 5 \rightarrow \text{collision}$$

$$\text{probing sequence} = (5 + 3) \% 13 = 8 //$$

| | | | | | | | | | | | | |
|----|---|----|---|----|----|---|---|---|---|----|----|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 24 | 0 | 32 | | 39 | 27 | | 3 | 2 | | | | 18 |

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