Linear Probing: $h(k,i) = (h(k) + i) \bmod m$

Hash function: $h(k) = (5k + 3) \bmod 8$

insert 41 → $h(41) = (205 + 3) \% 8 = 208 \% 8 = 0$ → insert to index 0

insert 30 → $h(30) = (150 + 3) \% 8 = 153 \% 8 = 1$ → insert to index 1

insert 74 → $h(74) = (370 + 3) \% 8 = 373 \% 8 = 5$ → insert to index 5

insert 55 → $h(55) = (275 + 3) \% 8 = 278 \% 8 = 6$ → insert to index 6

insert 68 → $h(68) = (340 + 3) \% 8 = 343 \% 8 = 7$ → insert to index 7

insert 39 → $h(39) = (195 + 3) \% 8 = 198 \% 8 = 6$ (occupied), $+1 = 7$ (occupied), $= 0$ (occupied), $+1 = 1$ (occupied), $+1 = 2$ → insert in index 2

insert 64 → $h(64) = (320 + 3) \% 8 = 323 \% 8 = 3$ → insert to index 3

insert 72 → $h(72) = (360 + 3) \% 8 = 363 \% 8 = 3$ (occupied), $+1 = 4$ → insert in index 4

0	41
1	30
2	39
3	64
4	72
5	74
6	55
7	68

Quadratic Probing: $h(k,i) = (h(k) + i^2) \bmod m$

Hash function: $h(k) = (3k+1) \bmod 8$

insert 19 → $h(19) = 58 \% 8 = 2$ → insert to index 2

insert 29 → $h(29) = 88 \% 8 = 0$ → insert to index 0

insert 16 → $h(16) = 49 \% 8 = 1$ → insert to index 1

insert 26 → $h(26) = 79 \% 8 = 7$ → insert to index 7

insert 14 → $h(14) = 43 \% 8 = 3$ → insert to index 3

insert 24 → $h(24) = 73 \% 8 = 1$ (occupied), $(1 + 0^2) \% 8 = 1 \% 8 = 1$, $(1 + 1^2) \% 8 = 2 \% 8 = 2$, $(1 + 2^2) \% 8 = 5 \% 8 = 5$ → insert to index 5

insert 13 → $h(13) = 40 \% 8 = 0$ (occupied), $(0 + 0^2) \% 8 = 0$, $(0 + 1^2) \% 8 = 1$, $(0 + 2^2) \% 8 = 4 \% 8 = 4$ → insert to index 4

insert 27 → $h(27) = 82 \% 8 = 2$, $(2 + 0^2) \% 8 = 2$, $(2 + 1^2) \% 8 = 3 \% 8 = 3$, $(2 + 2^2) \% 8 = 6 \% 8 = 6$ → insert to index 6

0	29
1	16
2	19
3	14
4	13
5	24
6	27
7	26

Double Hashing: $h(k,i) = (h_1(k) + i \cdot h_2(k)) \bmod m$

Hash functions: $h_1(k) = (3k) \% 8$, $h_2(k) = ((5k+3) \% 7) + 1$

insert 30 → $h(30) = h_1k = 90 \% 8 = 2$, $h_2k = (153 \% 7) + 1 = 7$

$(2 + (0 \cdot 7)) \% 8 = 2$ → insert to index 2

insert 14 → $h(14) = h_1k = 42 \% 8 = 2$, $h_2k = (73 \% 7) + 1 = 4$

$(2 + (0 \cdot 4)) \% 8 = 2$, $(2 + (1 \cdot 4)) \% 8 = 6 \% 8 = 6$ → insert to index 6

insert 40 → $h(40) = 120 \% 8 = 0$, $h_2k = (203 \% 7) + 1 = 1$

$(0 + (0 \cdot 1)) \% 8 = 0$ → insert to index 0

insert 36 → $h(36) \rightarrow h_1k = 108 \% 8 = 4$, $h_2k = (183 \% 7) + 1 = 2$

$(4 + (0 \cdot 2)) \% 8 = 4$ → insert to index 4

insert 56 → $h(56) \rightarrow h_1k = 168 \% 8 = 0$, $h_2k = (283 \% 7) + 1 = 4$

$(0 + (4 \cdot 0)) \% 8 = 0$, $(0 + (1 \cdot 4)) \% 8 = 4$, $(0 + (2 \cdot 4)) \% 8 = 0$, $(0 + (3 \cdot 4)) \% 8 = 4$

→ resize → $(0 + (2 \cdot 4)) \% 16 = 8$ → insert to index 8

insert 75 → $h(75) \rightarrow h_1k = 225 \% 8 = 1$, $h_2k = (378 \% 7) + 1 = 1$

$(1 + (0 \cdot 1)) \% 16 = 1$ → insert to index 1

insert 49 → $h(49) \rightarrow h_1k = 147 \% 8 = 3$, $h_2k = (248 \% 7) + 1 = 4$

$(3 + (0 \cdot 4)) \% 16 = 3$

insert 50 → $h(50) \rightarrow h_1k = 150 \% 8 = 6$, $h_2k = (253 \% 7) + 1 = 2$

$(6 + (0 \cdot 2)) \% 16 = 6$, $(6 + (1 \cdot 2)) \% 16 = 8$, $(6 + (2 \cdot 2)) \% 16 = 10$ → insert to index 10

0	40
1	75
2	30
3	49
4	36
5	
6	14
7	
8	56
9	
10	50
11	
12	
13	
14	
15	

Cuckoo Hashing: $h_1 k \% m$ for table 1, $h_2 k \% m$ for table 2

Hash functions = $(3k+1)$, $h_2 k = \text{floor}(5k/2)+3$

$h_1(10) = 31$, $h_2 k = \text{floor}(25)+3 = 28$ $30\%7=3$, $28\%7=0$

Table 1 → index 3

$h_1(22) = 67$, $h_2 k = 55+3 = 58$ $67\%7=4$ $67\%7=2$

Table 1 → index 4

$h_1(24) = 73$, $h_2 k = 60+3 = 63$ $73\%7=3$, $63\%7=0$

Table 1 → index 3 ... conflict with $h_1(22)$

$h_1(17) = 52$, $h_2(17) = 42+3 = 45$ $52\%7=3$, $45\%7=3$

Table 1 → index 3

$h_1(85) = 256$, $h_2(85) = 212+3 = 215$ $256\%7=4$, $215\%7=5$

Table 1 → index 4

$h_1(23) = 70$, $h_2(23) = 57+3 = 60$ $70\%7=0$, $60\%7=4$

Table 1 → index 0

$h_1(12) = 37$, $h_2(12) = 30+3 = 33$ $37\%7=2$, $33\%7=5$

Table 1 → index 2

$h_1(46) = 139$, $h_2(46) = 115+3 = 118$ $139\%7=6$, $118\%7=6$

Table 1 → index 6

Table 1

0	23
1	
2	12
3	10
4	85
5	
6	46

Table 2

0	24
1	
2	22
3	17
4	
5	
6	