1) linear probing: $h(k,i) = (h(k)+i) \bmod m$

[10, 41, 52, 25, 13, 77, 54, 70], capacity = 8, $h(k) = (3k+2)\%8$

Insert:

$h(10) = 0$ → insert at index 0

$h(41) = 5$ → insert at index 5

$h(52) = 6$ → insert at index 6

$h(25) = 5$ (occupied), +1 (collision) = 6 (occupied), +1 (collision)

= 7 → insert at index 7

$h(13) = 1$ → insert at 1

$h(77) = 1$ (occupied), + 1 (collision) = 2 → insert at 2

$h(54) = 4$ → insert at 4

$h(70) = 4$ (occupied), +1 (collision) = 5 (occupied), +1 (collision) = 6 (occupied), +1 (collision) = 7 (occupied), +1 (collision) = 0 (occupied), +1 (collision) = 1 (occupied), +1 (collision) = 2 (occupied), +1 (collision) = 3

→ insert at 3

index	Element
0	10
1	13
2	77
3	70
4	54
5	41
6	52
7	25

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

[10, 41, 52, 25, 13, 42, 35, 92], $h(k) = (3k+2)\%8$, Capacity = 8

Insert:

$h(10) = 0 \rightarrow$ insert at 0

$h(41) = 5 \rightarrow$ insert at 5

$h(52) = 6 \rightarrow$ insert at 6

$h(25) = 5$ (occupied) $+ 1$ (collision) $= 6$ (occupied), $5 + 4$ (collision) $= 1 \rightarrow$ insert at 1

$h(13) = 1$ (occupied), $+ 1$ (collision) $= 2 \rightarrow$ insert at 2

$h(42) = 0$ (occupied), $+ 1$ (collision) $= 1$ (occupied), $0 + 4$ (collision) $= 4 \rightarrow$ insert at 4

$h(35) = 3 \rightarrow$ insert at 3

$h(92) = 6$ (occupied), $+1$ (collision) $= 7 \rightarrow$ insert at 7

Index	Element
0	10
1	25
2	13
3	35
4	42
5	41
6	52
7	92

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

$[22, 14, 39, 23, 80, 53, 49, 50]$ $h_1(k) = k \% 8$ $h_2(k) = ((5k+3)\%7)+1$

capacity $= 8$

Insert:

$h_1(22) = 6 \rightarrow$ insert at 6

$h_1(14) = (6$ (occupied), $+ (1)(4)$ (collision)$) \% 8 = 2 \rightarrow$ insert at 2

$h_1(39) = 7 \rightarrow$ insert at 7

$h_1(23) = (7$ (occupied), $+ (1)(7)$ (collision)$) \% 8 = 6$ (occupied), $(7 + (2)(7)$ (collision)$) \% 8$

$= 5 \rightarrow$ insert at 5

$h_1(80) = 0 \rightarrow$ insert at 0

$h_1(53) = (5$ (occupied) $+ (1)(3)$ (collision)$) \% 8 = 0$ (occupied), $(5 + (2)(3)$ (collision)$) \% 8$

$= 3 \rightarrow$ insert at 3

$h_1(49) = 1 \rightarrow$ insert at 1

$h_1(50) = (2$ (Occupied), $+ (1)(2)$ (collision)$) \% 8 = 4 \rightarrow$ insert at 4

Index	Element
0	80
1	49
2	14
3	53
4	50
5	23
6	22
7	39

4) Cuckoo hashing: $h_1(k)$ for table 1, $h_2(k)$ for table 2

[9, 23, 24, 15, 87, 20, 12, 47] $h_1(k) = (3k+1) \% 7$ $h_2(k) = (\lfloor \frac{5k}{2} \rfloor + 3) \% 7$

Capacity = 14 (7 for each table)

Insert:

$h_1(9) = 0$ → insert Tree 1 at 0

$h_1(23) = 0$ (Occupied) → insert 23 at Tree 1 0, (Collision) $h_2(9) = 4$

→ insert 9 at Tree 2, 4

$h_1(24) = 3$ → insert 24 at Tree 1, 3

$h_1(15) = 4$ → insert 15 at Tree 1, 4

$h_1(87) = 3$ (Occupied) → insert 87 at Tree 1, 3, (Collision) $h_2(24) = 0$ → insert 24 at Tree 2, 0

$h_1(20) = 5$ → insert 20 at Tree 1, 5

$h_1(12) = 2$ → insert 12 at Tree 1, 2

$h_1(47) = 2$ (Occupied) → insert 47 at Tree 2, (Collision) $h_2(12) = 5$ → insert 12 at Tree 2, 5

Tree 1:

Index	Element
0	23
1	
2	47
3	87
4	15
5	20
6	

Tree 2:

Index	Element
0	24
1	
2	
3	
4	9
5	12
6	