Homework

1. Calculate hash values of keys: 1892, 1921, 2007, 3456 using different methods of hasing

2. Consider a hash table with size = 11, insert the keys 27, 72, 63, 42, 36, 18, 29 and 101 into the table.

a) Using linear probing

b) Using quadratic probing, . Take c1 = 2 and c2 = 4.

c) Using double hashing Take h1 = k mod 11 and h2 = k mod 7

d) Using chaining method.

(i) division method

m = 11

h(1892) = 1892 % 11 = 0

h(1921) = 1921 % 11 = 7

h(2007) = 2007 % 11 = 5

h(3456) = 3456 % 11 = 2

Multiplication method

m = 11 $h(k) = \lfloor m(kA \bmod 1) \rfloor$

A = 0.618033

$h(1892) = \lfloor 11(1892 \times 0.618033 \bmod 1) \rfloor$

$= \lfloor 11(0.31844) \rfloor$

$= 3$

$h(1921) = \lfloor 11(1921 \times 0.618033 \bmod 1) \rfloor$

$= 11 \times 0.27139$

$= 2$

$h(2007) = \lfloor 11 (200 \times 0.618033 \bmod 1) \rfloor$

$= 11 \times 0.39223$

$= 4$

$h(3456) = \lfloor 11 (3456 \times 0.618033 \bmod 1) \rfloor$

$= 11 \times 0.92205$

$= 10$

Mid-square method

$k = 1892$, $k^2 = 3579664$, 96

$k = 1921$, $k^2 = 3690241$, 02

$k = 2007$, $k^2 = 4028049$, 80

$k = 3456$, $k^2 = 11943936$, 43

Folding method

~~$k = 1892$~~

Key	1892	1921	2007	3456
Parts	18 92	19 21	20 07	34 56
Sum	110	40	27	90
Hash value	10	40	27	90

2.

(i) Linear probing

$h(k, i) = [h'(k) + i] \bmod m$

$h(27, 0) = [27 \bmod 11 + 0] \bmod 11$

$= 5 \bmod 11$

$= 5$

$h(72, 0) = (72 \bmod 11 + 0) \bmod 11$

$= 6 \bmod 11$

$= 6$

$h(63,0) = [63 \bmod 11 + 0] \bmod 11$

$= 8 \bmod 11$

$= 8$

$h(42,0) = [42 \bmod 11 + 0] \bmod 11$

$= 9 \bmod 11$

$= 9$

$h(36,0) = [36 \bmod 11 + 0] \bmod 11$

$= 3 \bmod 11$

$= 3$

$h(18,0) = [18 \bmod 11 + 0] \bmod 11$

$= 7 \bmod 11$

$= 7$

$h(29,0) = [29 \bmod 11 + 0] \bmod 11$

$= 7$ collision

$i=1 = 8$ collision

$i=2 = 9$ collision

$i=3 = [29 \bmod 11 + 3] \bmod 11$

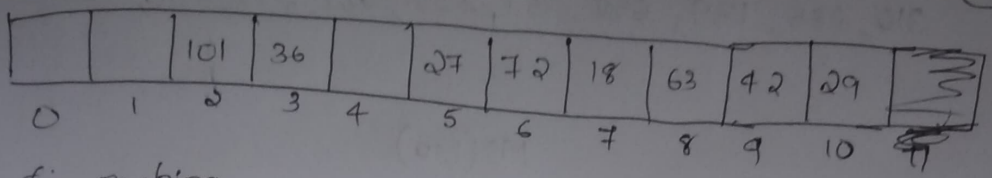
$= 10 \bmod 11$

$= 10$

$h(101,0) = [101 \bmod 11 + 3] \bmod 11$

$= 2 \bmod 11$

$= 2$



Quadratic probing

$c_1 = 2 \quad c_2 = 4$

$$h(k,i) = [h'(k) + c_1 i + c_2 i^2] \bmod m$$

$h(27,0) = [27 \bmod 11 + 2\times0 + 4\times0] \bmod 11$

$= 5 \bmod 11$

$= 5$

$h(72,0) = [72 \bmod 11 + 2\times0 + 4\times0] \bmod 11$

$= 6 \bmod 11$

$= 6$

$h(63,0) = [63 \bmod 11 + 2\times0 + 4\times0] \bmod 11$

$= 8 \bmod 11$

$= 8$

$h(42,0) = [42 \bmod 11 + 2\times0 + 4\times0] \bmod 11$

$= 9 \bmod 11$

$= 9$

$h(36,0) = [36 \bmod 11 + 2\times0 + 4\times0] \bmod 11$

$= 3 \bmod 11$

$= 3$

$h(18,0) = [18 \bmod 11 + 2\times0 + 4\times0] \bmod 11$

$= 7 \bmod 11$

$= 7$

$h(29,0) = 7$ collision

$i=1 = [18 \bmod 11 + 2 + 4] \bmod 11$

$= 13 \bmod 11$

$= 2$

$h(101,0) = 2$ collision

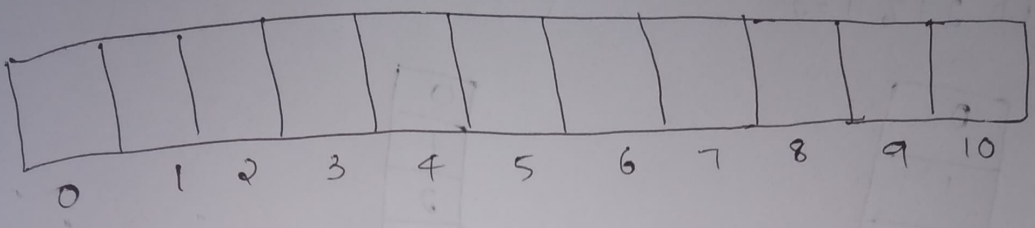
$i=1 \quad [101 \bmod 11 + 2 + 4] \bmod 11$

$= 8 \bmod 11$ collision

$i=2 \quad [2+4+16] \bmod 11$

$= 22 \bmod 11$

$= 0$



double hashing

$h_1 = k \bmod 11$ and $h_2 = k \bmod 7$

$$h(k,i) = [h_1(k) + i\,h_2(k)] \bmod m$$

$h(27,0) = [27 \bmod 11 + (0 \times 27 \bmod 7)] \bmod 11 = 5$

$h(72,0) = [72 \bmod 11 + 0] \bmod 11 = 6$

$h(63,0) = [63 \bmod 11 + 0] \bmod 11 = 8$

$h(42,0) = [42 \bmod 11 + 0] \bmod 11 = 9$

$h(36,0) = [36 \bmod 11 + 0] \bmod 11 = 3$

$h(18,0) = [18 \bmod 11 + 0] \bmod 11 = 7$

$h(29,0) = 7$ collision

$h(29,1) = [7+1] \bmod 11 = 8$ collision

$h(29,2) = [7+2] \bmod 11 = 9$ collision

$h(29,3) = [7+3\times1] \bmod 11 = 10$

$h(101,0) = [101 \bmod 11 + 0] \bmod 11$

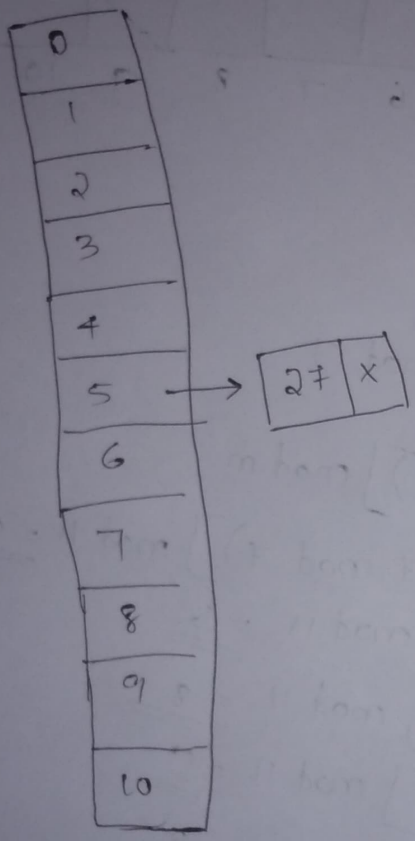
$= 2$

		101	36		27	72	18	63	42	29
0	1	2	3	4	5	6	7	8	9	10

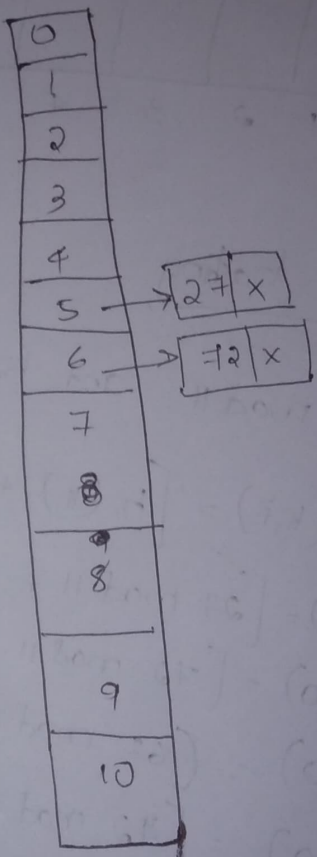
Chaining method

$m = 11$

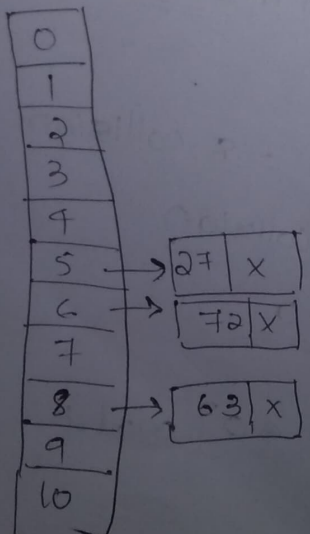
(i) $27 \% 11 = 5$



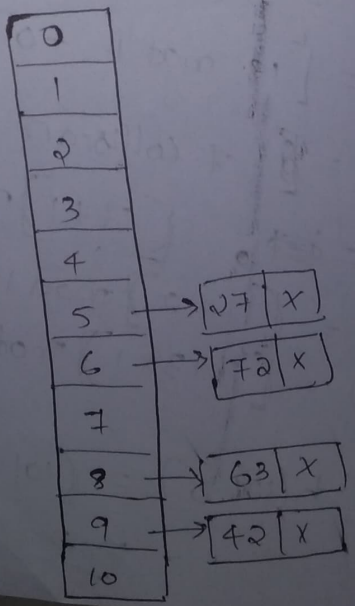
(ii) $72 \% 11 = 6$



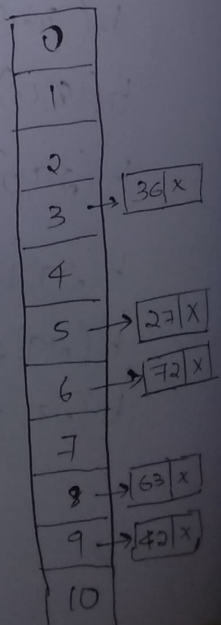
(iii) $63 \% 11 = 8$



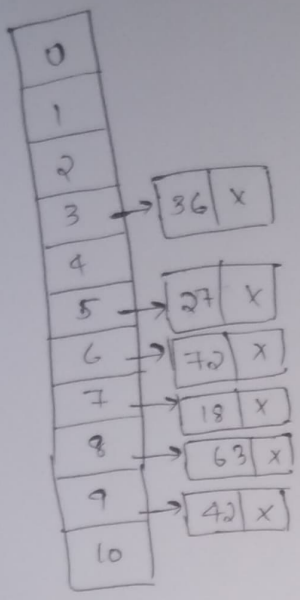
(iv) $42 \% 11 = 9$



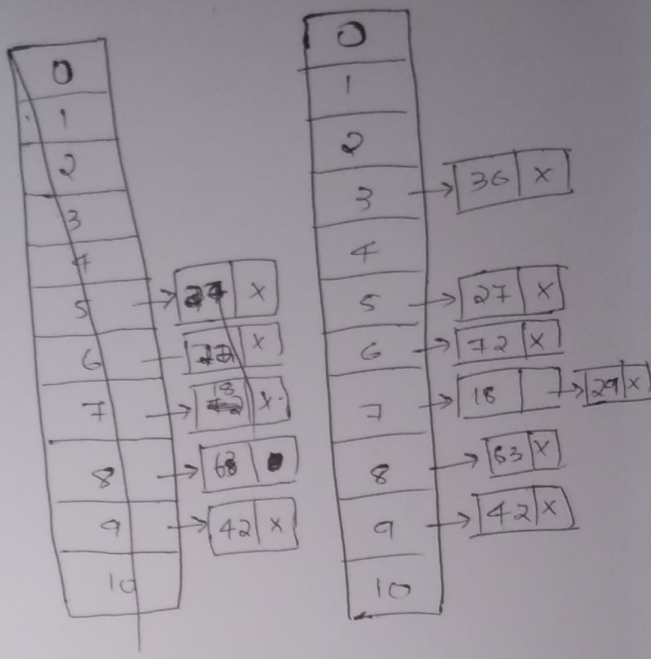
(v) $36 \% 11 = 3$



(vi) 18 % 11 = 7



(vii) 29 % 11 = 7



(viii) 101 % 11 = 2