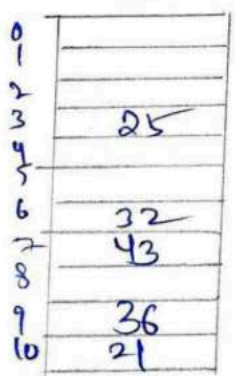
3. (6 marks) You are given a hash table with 11 slots, initialized to be empty. The hash functions used for this hash table are: $h_1(x) = x \bmod 11$, $h_2(x) = 1 + (x \bmod 10)$. The collision resolution strategy is the following: for the i-th probe for the key k the formula followed is: $p(i,k) = (h_1(k) + c_1.i + c_2.i^2 + h_2(k).i) \bmod 11$. Here $c_1 = 1$ and $c_2 = 3$. Show the insertion of the following keys in to the hashtable:[21, 32, 43, 25, 36]

$(h_1(k) + i + 3i^2 + ih_2(k)) \bmod 11$



initial hash table is empty.

a 11-slot HT has 10 keys.

first value ⇒ 21. 0th probe ∴ i=0
hash key = $h_1(k)$ = 21 mod 11 = 10
insert 21 in HT with key 10 (as shown)

2nd value = 32^3. probe = 0
hash key = $h_1(k)$ = 32 mod 11 = 10
but 10 is already filled i.e collision key
Thus probe is increased by 1. (i=1)
new hash key = $[32 \bmod 11 + 1 + 3 + (1 + 32 \bmod 10)] \bmod 11$
= $[10 + 4 + 3] \bmod 11 = 6$. ∴ key = 6
insert 32 at key 6 as shown.

next value = 43.

hash key for probe 0 (i=0) ⇒ 43 mod 11 = 10

But 10 is filled so i=1; new hash key =

$[43 \bmod 11 + 1 + 3 + (1 + 43 \bmod 10)] \bmod 11$

$[10 + 4 + 1 + 3] \bmod 11 = 7 =$ new hash key

insert 43 at key = 7

next value = 25

hash key for i=0 (initial) ⇒ 25 mod 11 = 3

∴ insert 25 at key 3 in the HT.

(3) next value = 36

hash key for i=0 (initial) ⇒ 36 mod 11 = 3 but 3 is filled.

so increase i, i=1.

new hash key ⇒ $[36 \bmod 11 + 1 + 3 + (1 + 36 \bmod 10)] \bmod 11$

$[3 + 5 + 6] \bmod 11 = 3$ ⇒ again collision

change i, i = 2

new hash key ⇒ $[36 \bmod 11 + 2 + 3(2)^2 + 2(1 + 36 \bmod 10)] \bmod 11$

$[3 + 14 + 14] \bmod 11 = 31 \bmod 11 = 9$

Thus insert 36 at key = 9. The final HT is on the previous page

25 ⇒ key 3 32 ⇒ key 6 43 ⇒ key 7

36 ⇒ key 9 21 ⇒ key 10

Problem 3: [24 marks]

1. [8 marks] For the given pair of functions, mark all the correct statements regarding their