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Assignment 7

R-2.19 Draw the 11-item hash table resulting from hashing the keys 12, 44, 13, 88, 23, 94, 11, 39, 20, 16, and 5, using the hash function h(i) = (2i + 5) mod 11 and assuming collisions are handled by chaining.

Answer:

Key	**H(K)**
12	7
44	5
13	9
88	5
23	7
94	6
11	5
39	6
20	1
16	4
5	4

Index	**Key**
0	∅
1	20
2	∅
3	∅
4	16, 5
5	44, 88, 11
6	94, 83
7	12, 13
8	∅
9	13
10	∅

R-2.20 What is the result of the previous exercise, assuming collisions are handled by linear probing?

Answer:

Key	**H(K)**	**Probes**
12	7	7
44	5	5
13	9	9
88	5	5->6
23	7	7->8
94	6	6->10
11	5	5->0
39	6	6->1
20	1	1->2
16	4	4
5	4	4->3

Key	11	39	20	5	16	44	88	12	23	13	94
Index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]

R-2.21 Show the result of Exercise R-2.19, assuming collisions are handled by quadratic probing, up to the point where the method fails because no empty slot is found.

Answer:

Quadratic probing formula: A [(i + j^2) mod N]

12	7	7
44	5	5
13	9	9
88	5	5->6
23	7	7->8
94	6	6->10
11	5	5->3
39	6	6->1
20	1	1->2
16	4	4->2
5	4	4->???

Quadratic probing can't find empty slot for 5 because after j=11 it repeats as the first 11 initial value.

Key		20	16	11	39	44	88	12	23	13	94
Index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]

R-2.22 What is the result of Exercise R-2.19 assuming collisions are handled by double hashing using a secondary hash function h'(k) = 7 – (k mod 7) ?

Answer:

1.) h(i) = (2i + 5) mod 11
2.) h'(k) = 7 – (k mod 7)

Key	**h(i)**	**H'(k)**	**Probes**
12	7		7
44	5		5
13	9		9
88	5	3	3
23	7	5	1
94	6		6
11	5	3	8
39	6	3	4
20	1	1	2
16	4	5	0
5	4	2	10

```
Algorithm removalLinearProbing(key)
    Input: key to remove from
    Output: remove and return the element

    key, element) <- findElement(key)
    If key != NO_SUCH_KEY then
        key <- AVAILABLE
        return element
    return NO_KEY_FOUND
```

Linear probing handles collision by putting the item in the next empty or available block. So, It is necessary to use a special marker to represent the deleted elements. If we remove it then we will not find the value that might be put in the next block after that because the search will end when it finds an empty and not available block.

Give the pseudo-code description for performing a removal from a hash table that uses linear probing to resolve collisions. Why is it necessary to use a special marker to represent deleted elements?