

Using a hash table T of size $m = 11$ (i.e., $T[0...10]$) with hash function $\text{hash}(x) = x \% m$, show the hash table results after performing the following operations:

- Insert the following keys in the given order: 26 42 5 44 92 59 40 36 12.
- Delete the following keys in the given order: 38 12
- Search for the following keys: 44 50
- Insert key 29. (If the number of probes reaches m and it still cannot find an available slot to put the new item, you can stop and indicate that the hash table is too full to search for an available slot)

a) Linear probing, i.e., $h_i(x) = (\text{hash}(x) + i) \% m$, for $i = 0, 1, 2, \dots, m-1$.

$\text{hash}(x) = x \% 11$

Insert the following keys in the given order: 26 42 5 44 92 59 40 36 12.

When inserting 26, the 1st probing location is 4 : status=0.

When inserting 42, the 1st probing location is 9 : status=0.

When inserting 5, the 1st probing location is 5 : status=0.

When inserting 44, the 1st probing location is 0 : status=0.

When inserting 92, the 1st probing location is 4 : status=1, 2nd probing location is 5 : status=1, 3rd probing location is 6: status=0.

When inserting 59, the 1st probing location is 4 : status=1, 2nd probing location is 5 : status=1, 3rd probing location is 6: status=1, 4th probing location is 7: status=0.

When inserting 40, the 1st probing location is 7: status=1, 2nd probing location is 8 : status=0

When inserting 36, the 1st probing location is 3: status=0

When inserting 12, the 1st probing location is 1: status=0

0	1	2	3	4	5	6	7	8	9	10
44	12		36	26	5	92	59	40	42	
1	1	0	1	1	1	1	1	1	1	0

Delete 38, 12

0	1	2	3	4	5	6	7	8	9	10
44	12		36	26	5	92	59	40	42	
1	2	0	1	1	1	1	1	1	1	0

Delete 38, $\text{hash}(38)=5$

When deleting 38, the 1st probing location is 5 : status=1, the 2nd probing location is 6:status=1, the 3rd probing location is 7:status=1, the 4th probing location is 8 : status=1, the 5th probing location is 9 : status=1, the 6th probing location is 10 : status =0.

When deleting 12, the 1st probing location is 1 : status =1. Change status=2.

Search for 44, 50

When searching for 44, the 1st probing location is 0 : status=1. Return true.

When searching for 50, the 1st probing location is 6 : status=1, the 2nd probing location is 7 : status=1, the 3rd probing location is 8 : status=1, the 4th probing location is 8 : status=1, the 5th probing location is 9 : status=1, the 6th probing location is 10 : status =0. Return false.

When inserting 29, the 1st probing location is 7 : status=1, the 2nd probing location is 8 : status=1, the 3rd probing location is 8 : status=1, the 4th probing location is 9 : status=1, the 5th probing location is 10 : status =0.

0	1	2	3	4	5	6	7	8	9	10
44	12		36	26	5	92	59	40	42	29
1	2	0	1	1	1	1	1	1	1	1

b) Quadratic probing, i.e., $hi(x) = (\text{hash}(x) + i^2) \% m$, for $i = 0, 1, 2, \dots, m-1$

Insert the following keys in the given order: 26 42 5 44 92 59 40 36 12.

0	1	2	3	4	5	6	7	8	9	10
44	12	59	36	26	5		40	92	42	29
1	2	1	1	1	1	0	1	1	1	1

When inserting 26, the 1st probing location is 4: status 0.

When inserting 42, the 1st probing location is 9: status 0.

When inserting 5, the 1st probing location is 5: status 0.

When inserting 44, the 1st probing location is 0: status 0.

When inserting 92, the 1st probing location is 4: status 1, the 2nd probing location is 5: status 1, the 3rd probing location is 8: status 0.

When inserting 59, the 1st probing location is 4: status 1, the 2nd probing location is 5: status 1, the 3rd probing location is 8: status 1, the 4th probing location is 2: status 0.

When inserting 40, the 1st probing location is 7: status 0.

When inserting 36, the 1st probing location is 3: status 0.

When inserting 12, the 1st probing location is 1: status 0.

When deleting 38, the 1st probing location is 5: status 1, the second probing location is 6: status 0.

When deleting 12, the 1st probing location is 1: status 1, set location to status 2.

When searching for 44, the 1st probing location is 0: status 1.

When searching for 50, the 1st probing location is 6: status 0.

When inserting 29, the 1st probing location is 7: status 1, the 2nd probing location is 8: status 1, the 3rd probing location is 5: status 1, the 4th probing location is 1: status 1, the 5th probing location is 10: status 0.

c) Double Hashing, Secondary hash function $\text{hash2}(x) = x \% 9 + 1$. $h(x) = (\text{hash}(x) + i(\text{hash2}(x))) \% m$

Insert the following keys in the given order: 26 42 5 44 92 59 40 36 12.

0	1	2	3	4	5	6	7	8	9	10
44	40	12	36	26	5		92		42	59
1	1	0	1	1	1	0	0	0	1	0

When inserting 26, the 1st probing location is 4: status 0.

When inserting 42, the 1st probing location is 9: status 0.

When inserting 5, the 1st probing location is 5: status 0.

When inserting 44, the 1st probing location is 0: status 0.

When inserting 92, the 1st probing location is 4: status 1, the 2nd probing location is 7: status 0.

When inserting 59, the 1st probing location is 4: status 1, the 2nd probing location is 10: status 0.

When inserting 40, the 1st probing location is 7: status 1, the 2nd probing location is 1: status 0.

When inserting 36, the 1st probing location is 3: status 0.

When inserting 12, the 1st probing location is 1: status 1, the 2nd probing location is 5: status 1, the 3rd probing location is 9: status 1, the 4th probing location is 2: status 0

