#ASLI ENGINEERING

Quadratic Probing in Hash Tables

SWIPE

BY

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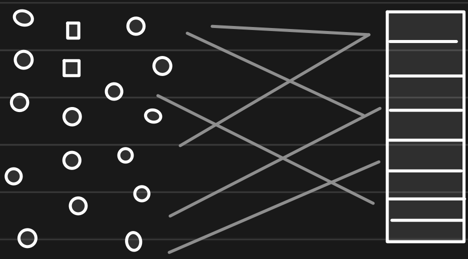
Conflict Resolution with Quadratic Probing

Conflicts are inevitable!



With Open Addressing, we use a probing function to find the slot where the key should be placed

One such method is Quadratic Probing

Probing Function

Probing Function is defined as $p(k, i) = j$ ← index

key → k, attempt → i

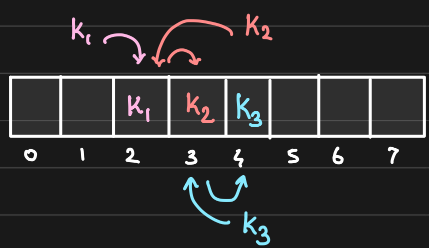
we use the probing function to find the first available slot

the same function is used during lookups

Challenges with Linear Probing

Linear probing suffers from cascading collisions

if k_1 hashes to 2
k_2 hashes to 2
k_3 hashes to 3



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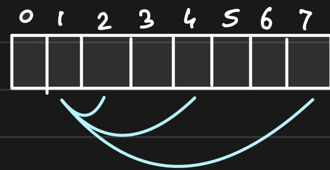
Quadratic Probing

Instead of placing the collided key in the neighbouring slot, quadratic probing adds successive value of an arbitrary quadratic polynomial.



$$p(k, i) = h(k) + i$$

Linear Probing

$$p(k, i) = h(k) + c_1 i + c_2 i^2$$

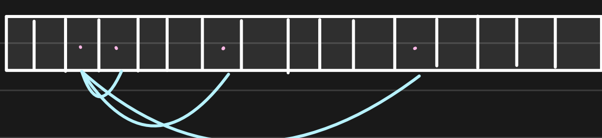
Quadratic Probing

Sample sequence:

$$h(k), \quad h(k) + 1^2, \quad h(k) + 2^2, \quad h(k) + 3^2, \ \ldots$$

How is it better than linear probing?

It reduces clustering and cascaded collisions as collided keys are placed further away from each other



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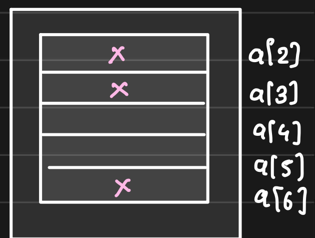
Properties of Quadratic Probing

1. It reduces clustered collisions by distributing it quadratically

   * It is not immune to it, but still it reduces it to a good extent

2. It has a good locality of reference but not as great as linear probing

   * leverages CPU cache well



Two slots are already cached on CPU

$h(k) = 2, \quad h(k) + 1^2 = 3, \quad h(k) + 2^2 = 6$

Unless there are large collisions on same key, at least a couple of subsequent slots will be in CPU cache.

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