
# DATA STRUCTURES AND ITS APPLICATIONS UE21CS252A

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## Hashing: Collision Resolution
## Quadratic Probing, Double Hashing

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## Hashing: Quadratic Probing

Quadratic Probing (Open addressing, closed hashing) resolves collision by using the below formula:

h(key) = ( h(key) + i^2 ) % tableSize

where i = 1, 2, 3, …

## Hashing: Quadratic Probing

Insert 7, 20, 41, 31, 18, 8, 9 into a hash table of size 7. Use key%tableSize as the hash function & quadratic probing to resolve collision.

h(7) = 7 % 7 = 0

h(20) = 20 % 7 = 6

h(41) = 41 % 7 = 6 collision

Resolving collision: h(41)=((6+1^2)%7)=0, h(41)=((6+2^2)%7)=3

h(31) = 31 % 7 = 3 collision

Resolving collision: h(31)=((3+1^2)%7)=4

h(18) = 18 % 7 = 4 collision

Resolving collision: h(18)=((4+1^2)%7)=5

h(8) = 8 % 7 = 1

h(9) = 9 % 7 = 2

| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 7 | 8 | 9 | 41 | 31 | 18 | 20 |

## Hashing: Double Hashing

Double Hashing (Open addressing, closed hashing) resolves collision by using a second hash function whenever there results a collision. The below formula is used:

hash(key) = (hash1(key) + i * hash2(key)) % tableSize

Here hash1() and hash2() are hash functions and tableSize is the size of hash table, i = 1, 2, …

## Hashing: Double Hashing

Insert 7, 20, 41, 31, 18, 8, 9 into a hash table of size 7.

Use **key%tableSize** as the **first hash function** & double hashing (closed hashing) to resolve collision. Use **key%5** as the **second hash function**.

| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 7 | 41 | | 31 | 18 | | 20 |

h(7) = 7 % 7 = 0

h(20) = 20 % 7 = 6

h(41) = 41 % 7 = 6 collision

Resolving collision: 2nd hash function: h(41) = 41 % 5 = 1

Therefore, h(41) = (6 + 1*1) % 7 = 0, h(41) = (6 + 2*1) % 7 = 1

h(31) = 31 % 7 = 3

h(18) = 18 % 7 = 4

## Hashing: Double Hashing

Insert 7, 20, 41, 31, 18, 8, 9 into a hash table of size 7.

Use **key%tableSize** as the **first hash function** & double hashing (closed hashing)to resolve collision. Use **key%5** as the **second hash function**.

**contd..,**

| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 7 | 41 | 8 | 31 | 18 | 9 | 20 |

h(8) = 8 % 7 = 1 collision

Resolving collision: 2nd hash function: h(8) = 8 % 5 = 3

Therefore, h(8) = (1 + 1*3) % 7 = 4, h(8) = (1 + 2*3) % 7 = 0, h(8) = (1 + 3*3) % 7 = 3

h(8) = (1 + 4*3) % 7 = 6, h(8) = (1 + 5*3) % 7 = 2

h(9) = 9 % 7 = 2 collision

Resolving collision: 2nd hash function: h(9) = 9 % 5 = 4

Therefore, h(9) = (2 + 1*4) % 7 = 6, h(9) = (2 + 2*4) % 7 = 3, h(9) = (2 + 3*4) % 7 = 0

h(9) = (2 + 4*4) % 7 = 4, h(9) = (2 + 5*4) % 7 = 1, h(9) = (2 + 6*4) % 7 = 5


# THANK YOU

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