

# Data Structures

# Hashing – Introduction

Team Emertxe



# Hashing -Introduction (Part 2)



# Data Structure –Hashing

## Concept

```
.int arr[SIZE]
```

SIZE =10

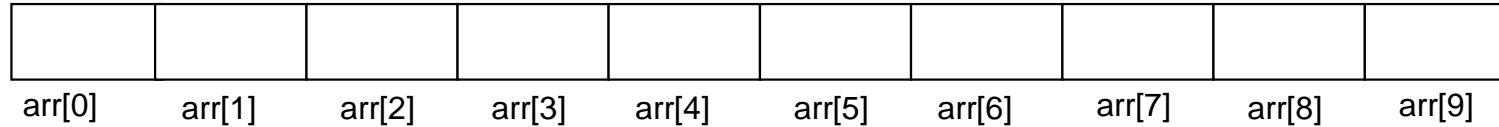
# Data Structure –Hashing

## Concept



```
.int arr[SIZE]
```

SIZE =10



# Data Structure –Hashing

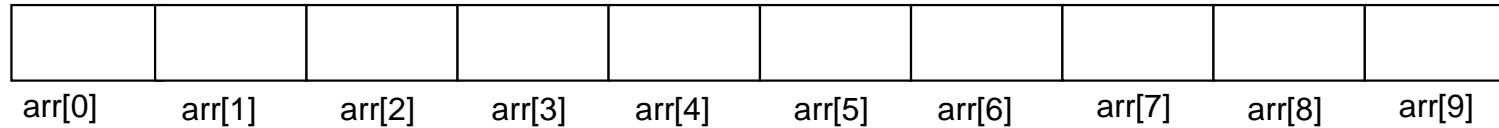
## Concept



```
.int arr[SIZE]
```

SIZE =10

8, 5 , 3 , 7, 2



# Data Structure –Hashing

## Concept



```
.int arr[SIZE]
```

SIZE =10

8, 5 , 3 , 7, 2

		2	3		5		7	8	
arr[0]	arr[1]	arr[2]	arr[3]	arr[4]	arr[5]	arr[6]	arr[7]	arr[8]	arr[9]

# Data Structure –Hashing

## Concept



.int arr[SIZE]

SIZE =10

8, 5 , 3 , 7, 2

Key = 3

		2	3		5		7	8	
arr[0]	arr[1]	arr[2]	arr[3]	arr[4]	arr[5]	arr[6]	arr[7]	arr[8]	arr[9]

# Data Structure –Hashing

## Concept



.int arr[SIZE]

SIZE =10

8, 5 , 3 , 7, 2

Key = 3

Key = 6

		2	3		5		7	8	
arr[0]	arr[1]	arr[2]	arr[3]	arr[4]	arr[5]	arr[6]	arr[7]	arr[8]	arr[9]



# Data Structure –Hashing

## Concept



.int arr[SIZE]

SIZE =10

8, 5 , 3 , 7, 2

Key = 3

Time Complexity =  $O(1)$

Key = 6

		2	3		5		7	8	
arr[0]	arr[1]	arr[2]	arr[3]	arr[4]	arr[5]	arr[6]	arr[7]	arr[8]	arr[9]

# Data Structure –Hashing

## Concept



.int arr[SIZE]

SIZE =10

8, 5 , 3 , 7, 2 ,50

Time Complexity =  $O(1)$

		2	3		5		7	8	
arr[0]	arr[1]	arr[2]	arr[3]	arr[4]	arr[5]	arr[6]	arr[7]	arr[8]	arr[9]

# Data Structure –Hashing

## Concept

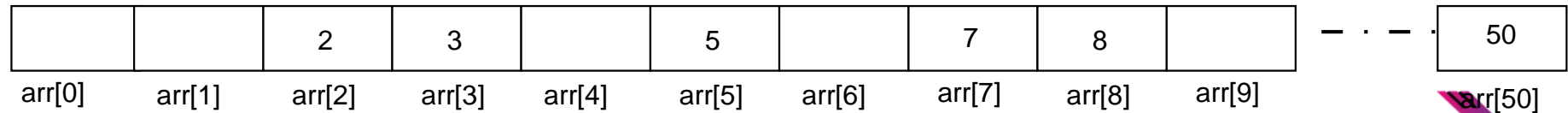


```
.int arr[SIZE]
```

SIZE =10

8, 5 , 3 , 7, 2 ,50

Time Complexity =  $O(1)$



# Data Structure –Hashing

## Concept



# Data Structure –Hashing

## Concept



SIZE =10

Data Pool

8, 5, 3, 7, 2

# Data Structure –Hashing

## Concept



SIZE =10

Data Pool

8, 5, 3, 7, 2

$$.h(x) = x$$

Hash Table

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

# Data Structure –Hashing

## Concept



SIZE =10

Data Pool

8, 5, 3, 7, 2

$$.h(x) = x$$

Hash Table

		2	3		5		7	8	
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

# Data Structure –Hashing

## Concept



SIZE =10

Data Pool

8, 5, 3, 7, 2, 50

$$.h(x) = x$$

Hash Table

		2	3		5		7	8		50
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[50]



# Data Structure –Hashing

## Concept



SIZE =10

Data Pool

8, 5, 3, 7, 2

Hash Function

$h(x) = x \% \text{ SIZE}$

$h(x) = x$

Hash Table

		2	3		5		7	8	
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

# Concept



SIZE =10

Data Pool

8, 5, 3, 7, 2

Hash Function

$$h(x) = \text{data} \% \text{SIZE}$$

Hash Table

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

# Data Structure –Hashing

## Concept



SIZE =10

Data Pool

8, 5, 3, 7, 2

**Hash Function**

$h(x) = \text{data} \% \text{SIZE}$

$h(x) = 8 \% 10 = 8$

**Hash Table**

								8	
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

# Data Structure –Hashing

## Concept



SIZE =10

Data Pool

8, 5, 3, 7, 2

**Hash Function**

$h(x) = \text{data} \% \text{SIZE}$

$h(x) = 8 \% 10 = 8$

$h(x) = 5 \% 10 = 5$

**Hash Table**

					5			8	
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

# Data Structure –Hashing

## Concept



SIZE =10

Data Pool

8, 5, 3, 7, 2

Hash Function

$h(x) = \text{data} \% \text{SIZE}$

$$h(x) = 8 \% 10 = 8$$

$$h(x) = 5 \% 10 = 5$$

$$h(x) = 3 \% 10 = 3$$

$$h(x) = 7 \% 10 = 7$$

Hash Table

			3		5		7	8	
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

# Data Structure –Hashing

## Concept



SIZE =10

Data Pool

8, 5, 3, 7, 2

Hash Function

$h(x) = \text{data} \% \text{SIZE}$

$$h(x) = 8 \% 10 = 8$$

$$h(x) = 5 \% 10 = 5$$

$$h(x) = 3 \% 10 = 3$$

$$h(x) = 7 \% 10 = 7$$

$$h(x) = 2 \% 10 = 2$$

Hash Table

		2	3		5		7	8	
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

# Data Structure –Hashing

## Concept



SIZE =10

Data Pool

8, 5, 3, 7, 2, 50

Hash Function

$h(x) = \text{data} \% \text{SIZE}$

$$h(x) = 8 \% 10 = 8$$

$$h(x) = 5 \% 10 = 5$$

$$h(x) = 3 \% 10 = 3$$

$$h(x) = 7 \% 10 = 7$$

$$h(x) = 2 \% 10 = 2$$

$$h(x) = 50 \% 10 = 0$$

Hash Table

50		2	3		5		7	8	
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

# Data Structure –Hashing

## Concept



SIZE =10

Data Pool

8, 5, 3, 7, 2, 50  
22

Hash Function

$h(x) = \text{data} \% \text{SIZE}$

$$h(x) = 8 \% 10 = 8$$

$$h(x) = 5 \% 10 = 5$$

$$h(x) = 3 \% 10 = 3$$

$$h(x) = 7 \% 10 = 7$$

$$h(x) = 2 \% 10 = 2$$

$$h(x) = 50 \% 10 = 0$$

$$h(x) = 22 \% 10 = 2$$

Hash Table

50		2	3		5		7	8	
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]



# Data Structure –Hashing

## Concept



SIZE =10

Data Pool

8, 5, 3, 7, 2, 50  
22

Hash Function

$h(x) = \text{data} \% \text{SIZE}$

$$h(x) = 8 \% 10 = 8$$

$$h(x) = 5 \% 10 = 5$$

$$h(x) = 3 \% 10 = 3$$

$$h(x) = 7 \% 10 = 7$$

$$h(x) = 2 \% 10 = 2$$

$$h(x) = 50 \% 10 = 0$$

$$h(x) = 22 \% 10 = 2$$

**Collision**

Hash Table

50		2	3		5		7	8	
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

# Data Structure –Hashing

# Components



## **.Hash Table:**

Hash Table is a data structure which stores data in an associative manner.

## **.Hash Function:**

It is function used to map a data sets of an arbitrary size to a data set of fixed size which falls into the hash table

## **.Collision:**

It is a state that occurs when pair of elements are mapped to same hash value.

## **.Collision Resolution Technique:**

- .Open Addressing
- .Direct Chaining

# Hashing -Collision Resolution Technique

