

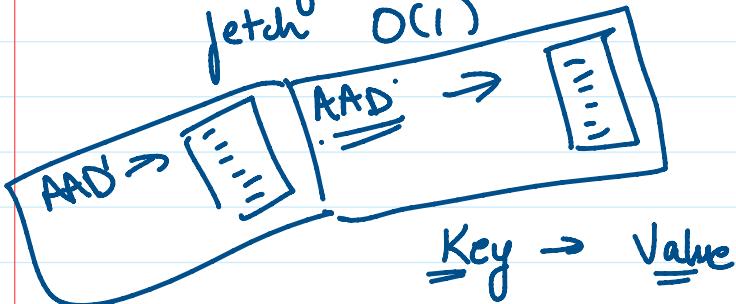
# HASH MAP

01 April 2023 09:00

↳ Pair

↳ Key: Value

fetch  $O(1)$



AADHAR → DETAILS

DICTIONARY →

WORD → MEANING

CONTACT

NAME → PHONE

DL →

$O(1)$

Arrays

$arr[i] = \underline{\underline{O}}$

key

value

$\underline{\underline{=}}$

Array

$O(1)$

$O(1)$

get  
put

$(0 - n-1)$

H.M

$O(1)$

$O(1)$

1) Key, Value  
↳ generic

2) Range of Key

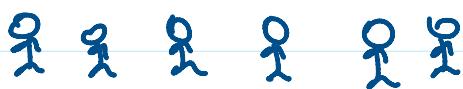
$\xrightarrow{2} 0$

1000000000

Student  
(String) vs Marks  
(Integer)

A B C D E

10 20 15 25 5



$\subseteq \rightarrow O(n) \underline{=} O(1)$

Hashmap

1) put

3) containsKey

5) keySet

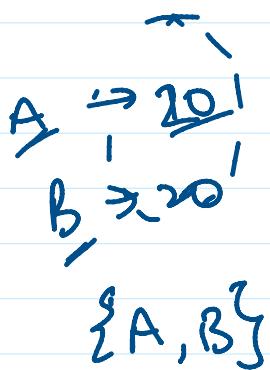
2) get

4) remove

6) size

$\{A, B, C\}$

$\{A, B, A\} \times \{A, B\} \xrightarrow{\checkmark} \{A, B\}$



1) Intersection of 2 unsorted arrays

a1: { 30, 40, 20, 50, 70, 30, 20, 20, 50, 50 }

$\begin{matrix} 30 & -2 \\ 40 & -1 \\ 20 & -3 \end{matrix}$        $\begin{matrix} 50 & -3 \\ 70 & -1 \end{matrix}$

a2: { 50, 80, 30, 20, 20, 20, 90, 50, 20 }

$\begin{matrix} 50 & -2 \\ 80 & -1 \\ 30 & -1 \\ 20 & -4 \\ 90 & -1 \end{matrix}$

1) Using 2 loops  $\rightarrow O(N^2)$

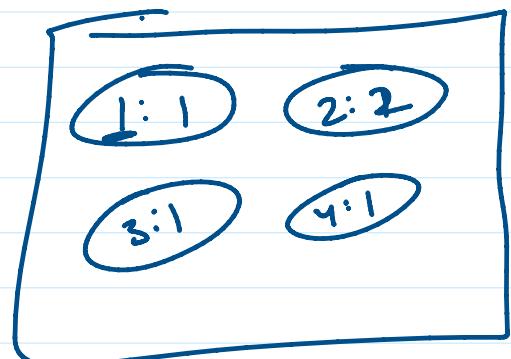
2) Sort both arrays & find intersection  $\rightarrow O(N \log N)$

3) Hash Map  $\rightarrow \langle \text{integer}, \text{integer} \rangle$

$\underline{O(N)}$

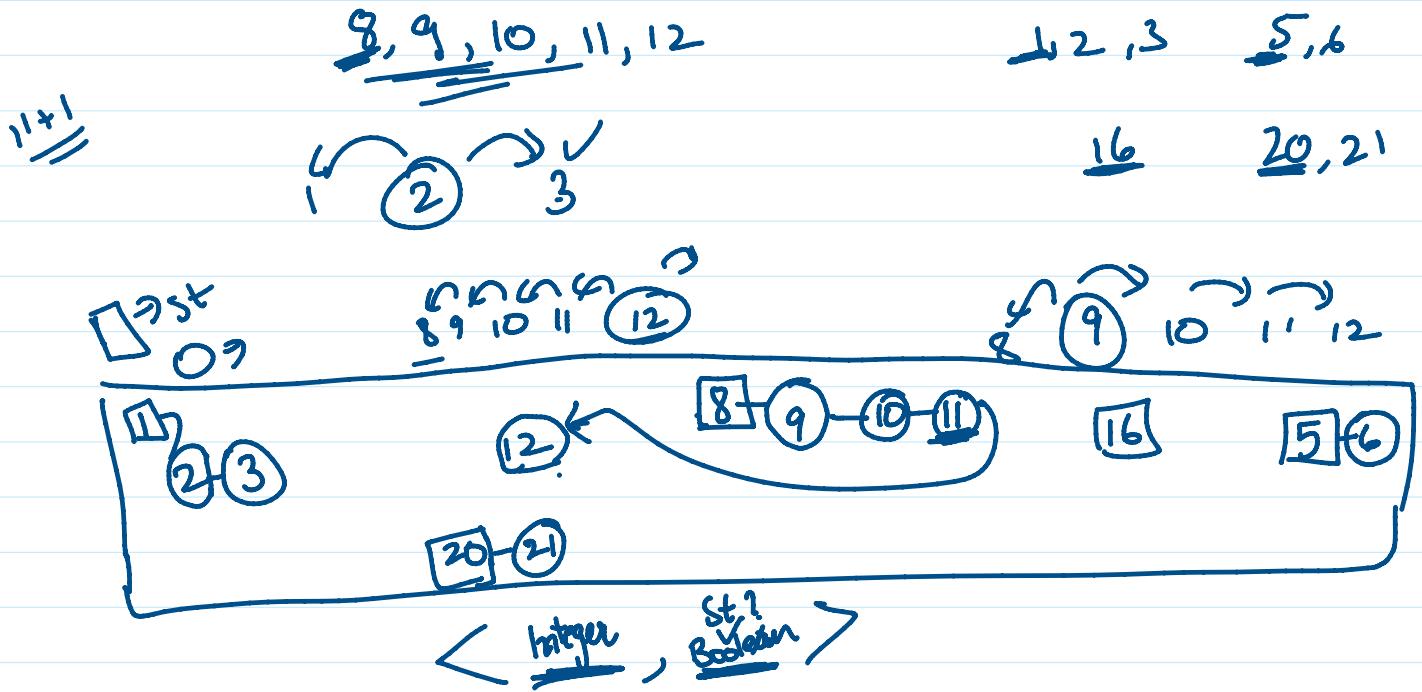
1, 2, 3, 4, 2, 3

$$\begin{array}{l} v = 1 + 1 \\ \quad \quad \quad = 2 \end{array}$$



$\{ \underline{2}, 12, 9, 16, 10, \underline{5}, 3, 20, 21, 11, 1, 8, 6 \}$

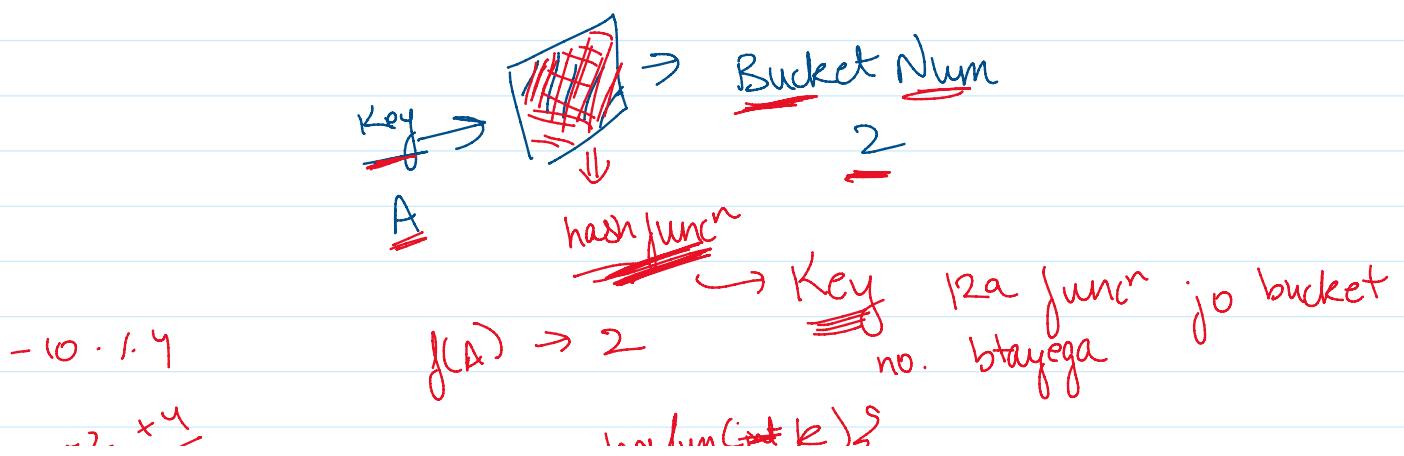
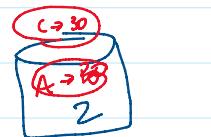
↳ Largest possible sequence of consecutive numbers.



HashMap Implementation

n pair  
 $A \rightarrow 10$ ,  $B \rightarrow 20$ ,  $C \rightarrow 30$ ,  $D \rightarrow 50$ ,  $E \rightarrow 60$

buckets



$$\begin{array}{r} -w \\ -2 \times 4 \\ \times 2 \end{array}$$

$f(x)$

no. of ways

$\text{hasfun}(k) \}$   
return 0;



$O(1) \checkmark$

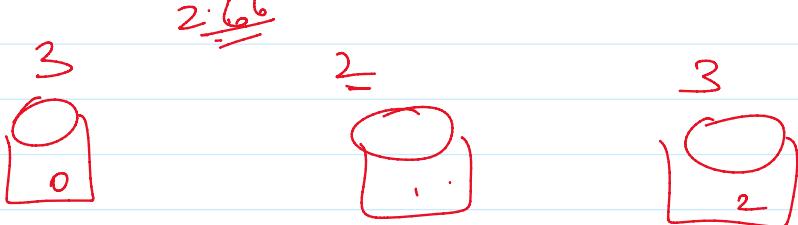
$O(n) ?$

hash func  
choose

Balanced  
Tarika ??

Load Factor

$$LF = \frac{\text{Number of pairs in each bucket / size of each bucket}}{b} = \frac{n}{b} \Rightarrow \text{no. of pairs/buckets}$$

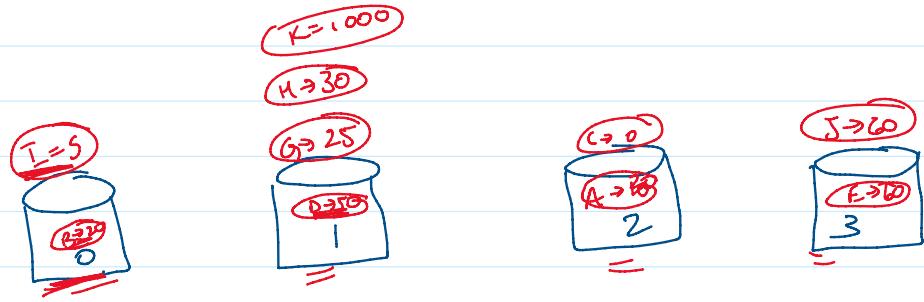


Put, Get, Remove : We need to visit avg size of each bucket if the pairs

$O(LF)$

$\xrightarrow{n}$  n keeps on increasing, avg size of each buck will also increase

So in order to improve this, we will increase the number of buckets so that the average size of each bucket remains constant.



$D \Rightarrow 1$

$D \Rightarrow 5$

