

# Today's announcements:

MP6 available, due , 11:59p. EC due , 11:59p

Hashing Table consists of the following:

- 1.
- 2.
- 3.

Two different kinds of item 3:

A problem with the second...

# Probe based hashing – a problem...

## Primary clustering:



Description:

Remedy:

## Probe based hashing: (double hashing)

$$S = \{16, 8, 4, 13, 29, 11, 22\} \quad |S| = n \quad H(k,i) = h_1(k) + ih_2(k)$$

0	
1	
2	
3	
4	
5	
6	

Try  $h(k) = (k + 0 \cdot h_2(k)) \% 7$ . If full...  
try  $h(k) = (k + 1 \cdot h_2(k)) \% 7$ . If full...  
try  $h(k) = (k + 2 \cdot h_2(k)) \% 7$ . If full...  
try...



# Hash table performance: expected # of probes for Find(key) under SUHA

Linear probing -

successful:  $\frac{1}{2} (1 + 1/(1-\alpha))$

unsuccessful:  $\frac{1}{2} (1 + 1/(1-\alpha))^2$

Double hashing -

successful:  $1/\alpha \ln 1/(1-\alpha)$

unsuccessful:  $1/(1-\alpha)$

Separate chaining -

successful:  $1 + \alpha/2$

unsuccessful:  $1 + \alpha$

Do not memorize these!

Observe:

- As  $\alpha$  increases, running times increase...
- If  $\alpha$  is held constant then running times are constant...

Which is better?

- Big records –
- Structure speed –

What structures do hash tables replace for us?

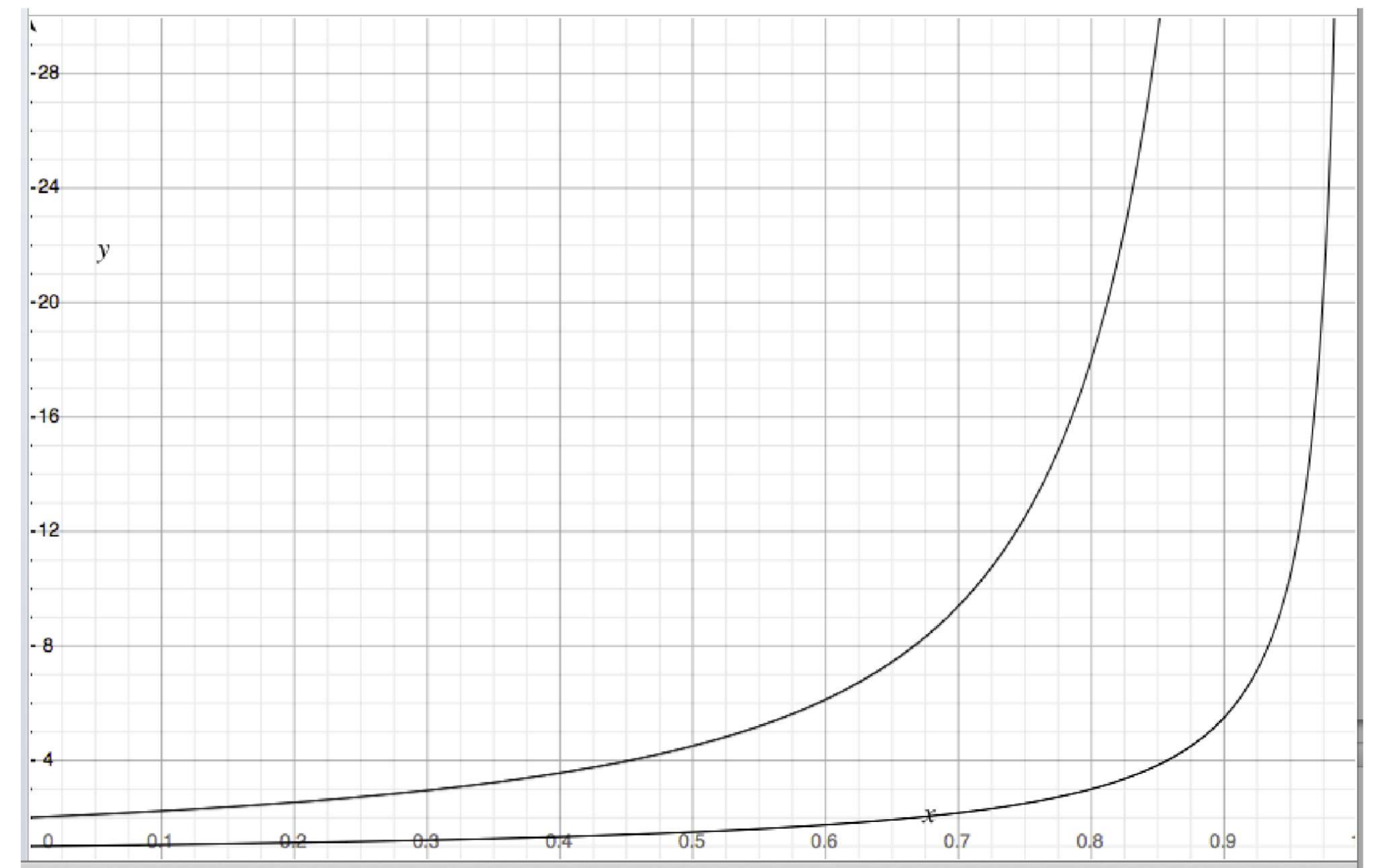


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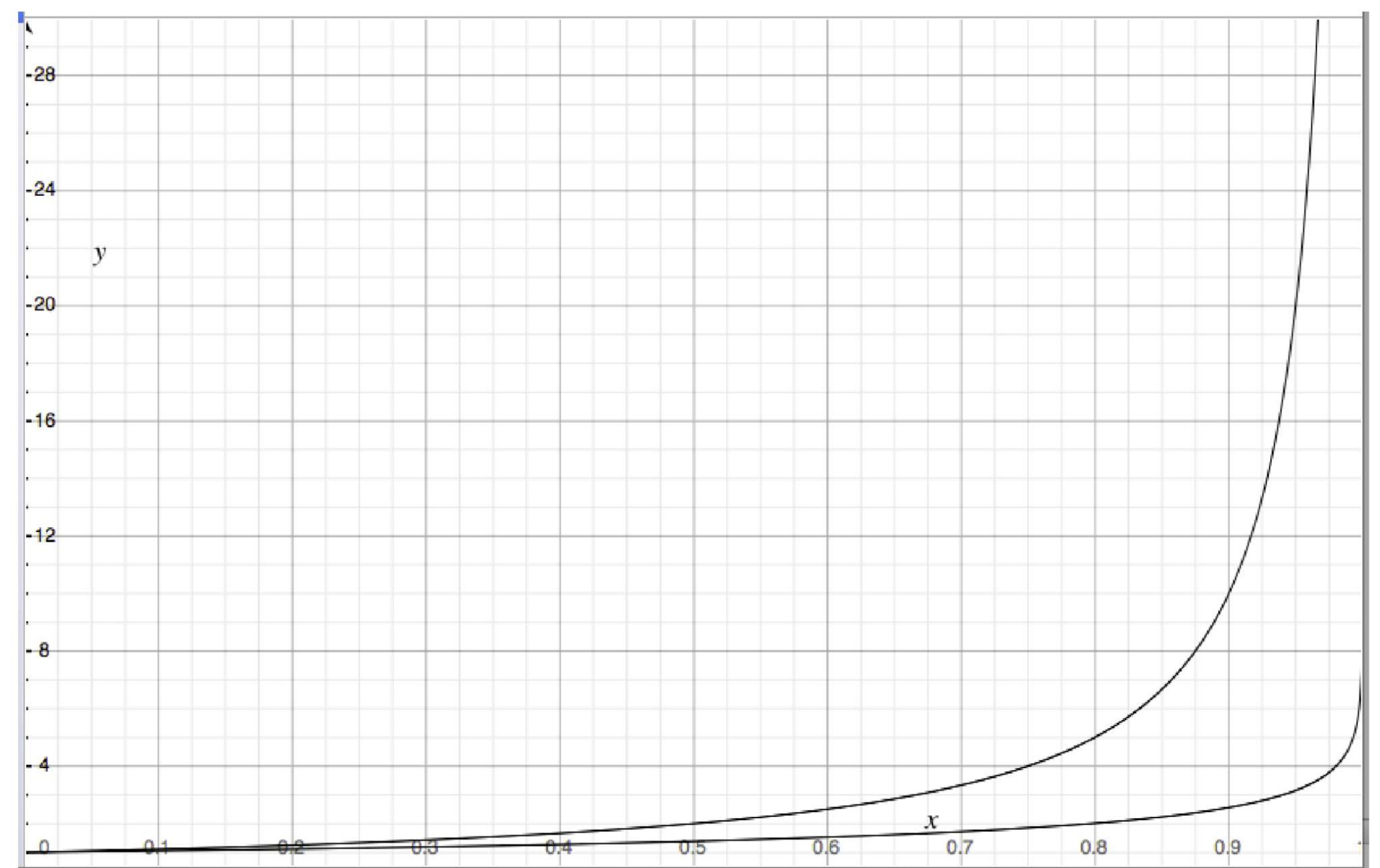
unsuccessful:  $\frac{1}{2} (1 + 1/(1-\alpha))^2$



Double hashing -

successful:  $1/\alpha \ln 1/(1-\alpha)$

unsuccessful:  $1/(1-\alpha)$





# ReHashing:

## What if the array fills?



# Hashing Miscellaneous Discussion –

Which collision resolution strategy is better?

- Big records –
- Structure speed –

What structures do hash tables replace for us?

There is a constraint on Keyspaces for BST that does not affect hashing...

Why do we talk about balanced BST if hashing is so great?

Applications of hashing?

Area of active research in mathematics to develop general purpose hash functions.

Secret mystery data structure

YES

NO

ADT - \_\_\_\_\_

insert

remove

getSize