

I ILLINOIS

Hash Table

Learning Objectives

1. Understand how collisions are handled with double hashing
2. Understand how insert, remove, and find are implemented for dictionaries with double hashing



Collision Handling: Linear Probing

$S = \{ 16, 8, 4, 13, 29, 11, 22 \}$

$|S| = n$

$h(k) = k \% 7$

$|\text{Array}| = m$

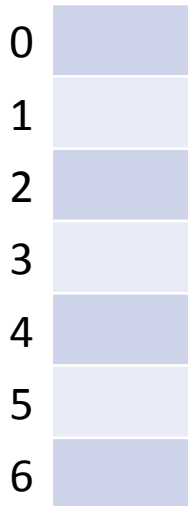
$h(k, i) = (k + i) \% 7$

Try $h(k) = (k + 0) \% 7$, if full...

Try $h(k) = (k + 1) \% 7$, if full...

Try $h(k) = (k + 2) \% 7$, if full...

Try ...



A Problem w/ Linear Probing

Primary clustering:

0	
1	1_1
2	1_2
3	3_1
4	1_3
5	3_2
6	
7	
8	
9	



Collision Handling: Double Hashing

$S = \{ 16, 8, 4, 13, 29, 11, 22 \}$

$|S| = n$

$h_1(k) = k \% 7$

$|\text{Array}| = m$

$h_2(k) = 1$

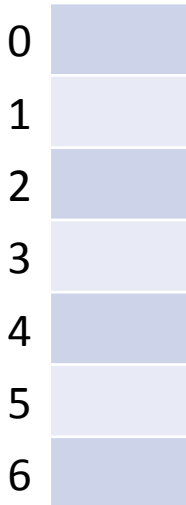
$h(k, i) = (k + i) \% 7$

Try $h(k) = (k + 0) \% 7$, if full...

Try $h(k) = (k + 1) \% 7$, if full...

Try $h(k) = (k + 2) \% 7$, if full...

Try ...



Collision Handling: Double Hashing

$S = \{ 16, 8, 4, 13, 29, 11, 22 \}$

$|S| = n$

$$h_1(k) = k \% 7$$

$|\text{Array}| = m$

$$h_2(k) = 5 - (k \% 5)$$

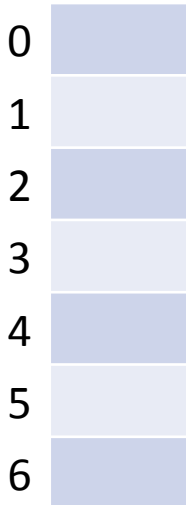
$$h(k, i) = (k + i * h_2(k)) \% 7$$

Try $h(k) = (k + 0 * h_2(k)) \% 7$, if full...

Try $h(k) = (k + 1 * h_2(k)) \% 7$, if full...

Try $h(k) = (k + 2 * h_2(k)) \% 7$, if full...

Try ...



What to do when the table is full?

$S = \{ 16, 8, 4, 13, 29, 11, 22, 42 \}$

42



0	22
1	8
2	16
3	29
4	4
5	11
6	13

Resizing a hash table

0	22
1	8
2	16
3	29
4	4
5	11
6	13

0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	

