

# Algorithms and Data Structures for Data Science

## lab\_hash

CS 277

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**ILLINOIS**  
URBANA - CHAMPAIGN

Department of Computer Science

# Mini-Project 1 Graded

Average Score: 74% overall

Autograded - 97%

Proposal - 81%

Visualization - 60%

# Exam 1 Retake next week!

March 1 — March 3

No make-up retakes. No extensions.

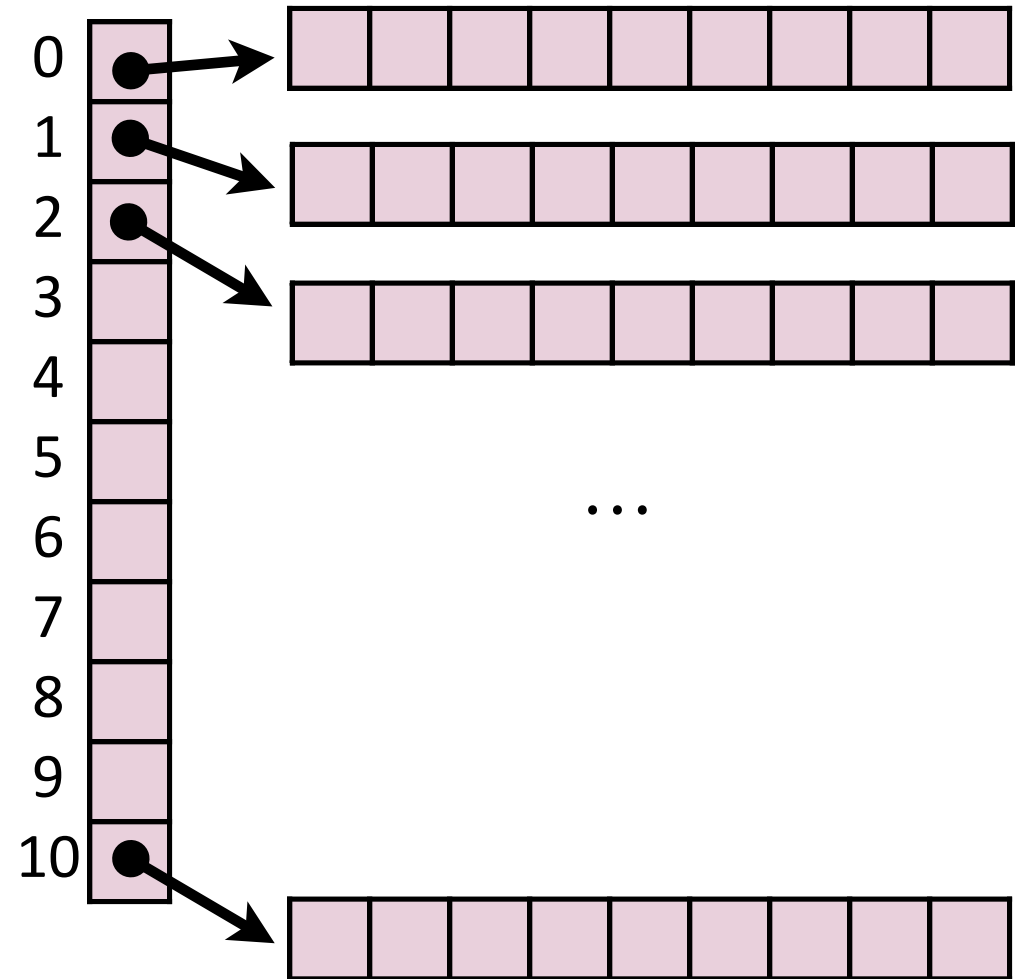
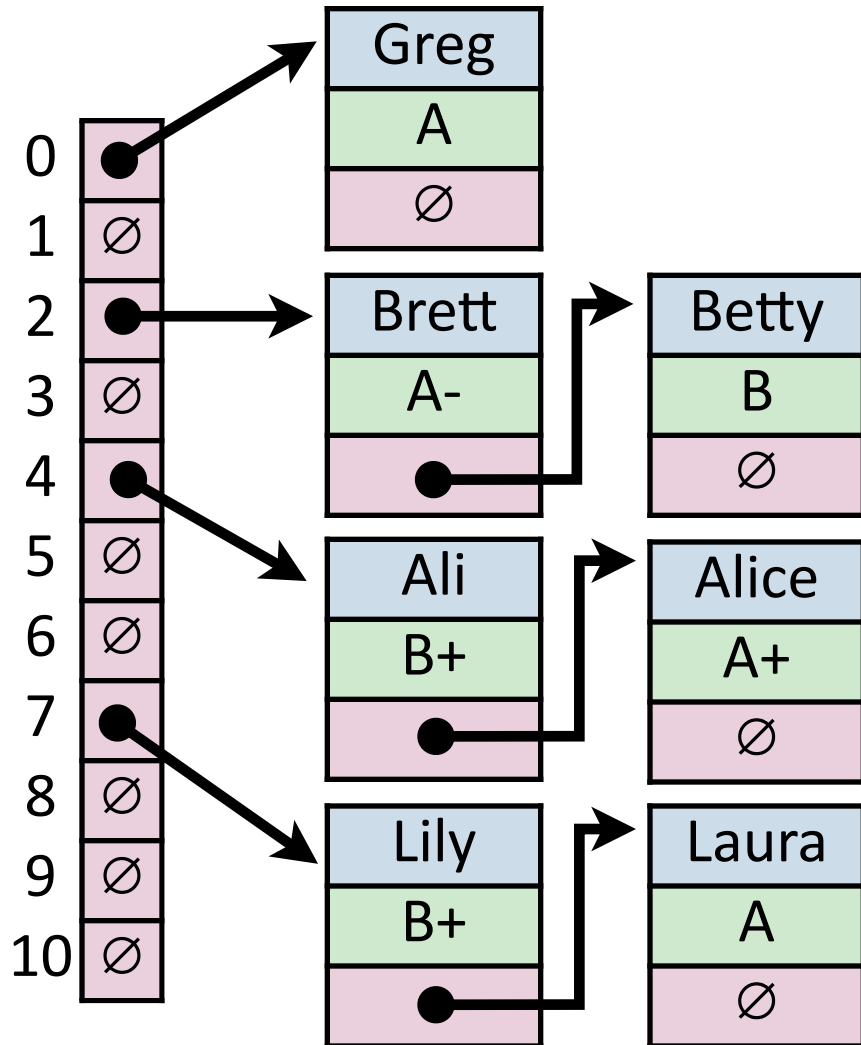
There will be a programming question. It will **not** be hand graded

# Learning Objectives

Implement multiple forms of hashing

Determine collision frequency and run-time differences in hashing

# Separate Chaining

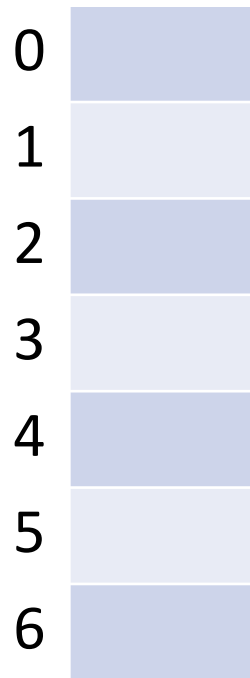


# Collision Handling: Linear Probing

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

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

$$|\text{Array}| = m$$



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

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 ...

# Collision Handling: Double Hashing

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

$h_1(k) = k \% 7$

$|Array| = m$

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

0	
1	8
2	16
3	
4	4
5	
6	13

$h(k, i) = (h_1(k) + i * h_2(k)) \% 7$

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 ...

# Coding the lab

- 1) Make sure you understand how to use each hash function
- 2) Work out how to code each of the collision strategies
- 3) After you figure out how to build the hash table, work out find.

Tip: Make sure you don't go out of bounds!

Tip: Read the instructions for double hash carefully!