

Lecture 9: Data Structures - Selection and Augmentation

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- ① Data Structure: Tradeoffs
- ② Data Structure Augmentation
- ③ Data Structure Selection

- **URL:** `http://m.socrative.com/`
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ADTs and Data Structure

ADT	Operations	Data Structures
Dynamic Set	Insert, Search, Delete, Min, Max	BST, RBT etc
Priority Queue	Insert, FindMin, DeleteMin	Binary Heap
Disjoint Set	MakeSet, Union, Find	Union-Find
Dictionary	Insert, Delete, Search	DAT, Hash Tables

Data Structure: Tradeoffs

Data Structure	Constraint	Tradeoff
BST, RBT, Heap etc	$O(n)$ space	Time
DAT, Hash Tables	$O(1)$ time	Space
Bloom filter	Space and $O(1)$ time	Correctness

- Solve the problem with a text-book data structure
- Solve the problem with some advanced data structure
- Design a brand new data structure
- Augment a data structure
 - add new information and operations to existing DS

Steps for Augmentation:

- What is the underlying DS?
- What is the additional information to store?
- How does additional information affect existing operations?
- How to maintain additional information?
- What additional or extended operations can be supported?

Typical Augmentations

- Sum, Min, Max
- Works very well when augmented data is orthogonal to original DS
- Simplifying computations - store partial computations

Major Concepts:

- ADTs and Data Structures
- Tradeoffs in Data Structure Selection
- Data Structure Augmentation