Data structures are fundamental!

- All fields of CS involve storing, retrieving, and processing data
- Information retrieval
- Geographic Inf. Systems
- Machine Learning
- Text/String processing
- Computer Graphics

Basic Elements in Study of Data Structures

- Modeling: How real world objects are encoded
- Operations: Allowed functions to access and modify structure
- Representation: Mapping to memory
- Algorithms: How are operations performed?

Course Overview:

- Fundamental data structures + algorithms
- Mathematical techniques for analyzing them
- Implementation

Common:

- $O(1)$: constant time
- $O(1)$ (Hash Map)
- $O(\log n)$: log-time (good)
- $O(\log n)$ (Binary search)
- $O(n^p)$: $p=constant$: poly time
- $O(n\log n)$

Asymptotic: "Big-o"

- Ignore constants
- Focus on large $n$

$T(n) = 34n^2 + 15n\log n + 143$
$T(n) = \Theta(n^2)$

Asymptotic Analysis:

- Run time as function of $n$: no. of items
- Worst-case, average case, randomized...
- Amortized: average over series of ops.