

# Welcome

CSCI 345  
Data Structures and Algorithms  
Wheaton College  
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Fall 2025

1. The correctness of an algorithm can be verified formally using loop invariants and other proof techniques and empirically using unit tests.
2. The efficiency of an algorithm can be measured formally using algorithmic analysis, big-oh categories, etc, and empirically by running experiments.
3. Abstract data types, especially list, stack, queue, set, bag, and map, are specified by how they are used; data structures, such as arrays, linked lists, binary trees, and hash tables, are implementation strategies, each with trade-offs.
4. Searching in an unordered data structure such as a map can be done in logarithmic time using a balanced binary search tree .
5. Searching in an unordered data structure can be done in constant time using a hash table.
6. Problems with overlapping subproblems and optimal substructure can be solved efficiently using dynamic programming.

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	<b>formally</b>		<b>empirically</b>
<b>Correctness</b> , verified	by invariants and correctness proofs	<i>and</i>	by unit tests
<b>Efficiency</b> , measured	by big-oh categories and related notation	<i>and</i>	by experiments

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## **ADTs**

List

Set

Map

Stack

Queue

Bag

## **Data structures**

Array

Linked list and other linked structures

Binary search tree

Hash table

## The quest for the more efficient map

4. Searching in an unordered data structure such as a map can be done in logarithmic time using a balanced binary search tree .
5. Searching in an unordered data structure can be done in constant time using a hash table.

6. Problems with overlapping subproblems and optimal substructure can be solved efficiently using dynamic programming.

Other smaller topics: Sorting algorithms, graph algorithms, string algorithms, regular expressions, ...

## How to succeed in CSCI 345:

- ▶ Know your DMFP and Programming II stuff.
- ▶ Read the textbook.
- ▶ Do the practice problems.
- ▶ Figure out the quiz questions.
- ▶ Learn in the labs.
- ▶ Do the projects on time.
- ▶ Use the projects to understand the data structures and algorithms—don't just fiddle with the code until the tests pass.
- ▶ Keep electronic devices away during class.

## Coming up:

**Send me** *your github userid (if you haven't already)*

*Due* **Today, Wednesday, Aug 27** *(end of day)*

*Read Section 1.1*

*Take quiz, "Course introduction"*

*Due* **Tues, Sept 2** *(end of day)*

*Finish "Pretest" Project (if not finished during lab Aug 28)*

*Read Section 1.2 (long section—spread it out)*

*Do Exercises 1.6*

*Take quiz, "Algorithms and correctness"*