Goals

Understand some of the uses for trees:

• To model hierarchical data.

• To implement abstract data types.
Trees in computer science

Why do we need these?
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1. to represent **hierarchical structure**.
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* Reports functionally to the Board of Trustees, Audit Committee, and administratively to the Vice President for Business and Financial Affairs.
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**Syntax Trees:**

- In textual representation, **parentheses** show hierarchical structure.
- In tree representation, hierarchy is explicit in the tree’s **structure**.

Also used for **natural languages** and **programming languages**!
Why do we need these?

1. to represent **hierarchical structure**.

Quadtrees for **collision detection** in graphics and simulation
Why do we need these?

2. to implement various ADTs **efficiently**.

Tree**Set**, Tree**Map**

The height of a balanced binary tree is $O(\log n)$

Consequence: Many operations (find, insert, ...) can be done in $O(\log n)$ in *carefully-designed* trees.

![Diagram of a balanced binary tree with nodes labeled 2, 9, 0, 8, 3, 5, 7]