

Trees

1320-Intermediate Programming
University of Texas at Arlington

Lecture Overview

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 - Recursion
 - Traversing a Binary Tree
- Sample Programs

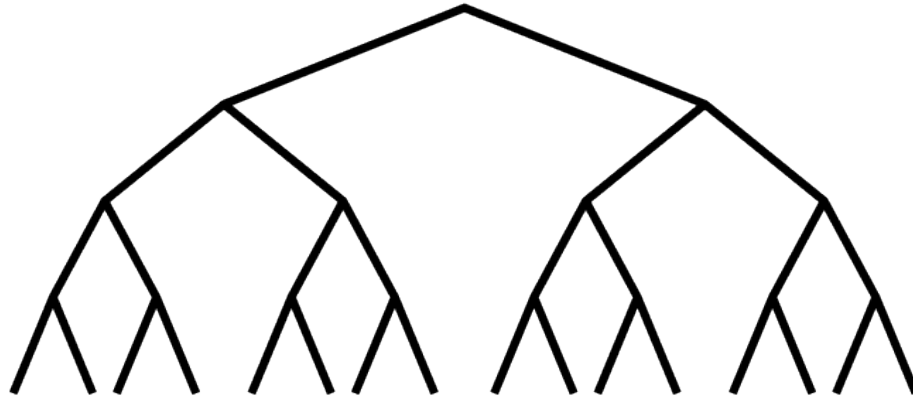
LECTURE

Trees

- What is a tree?
 - A tree is a mathematical abstraction
- In computer science, we actually create concrete representations of trees to use as data structures
 - Usually used when we want to represent data with hierarchical aspects
- We then implement the tree in our code
 - Remember, computer scientists are always trying to represent concepts in code



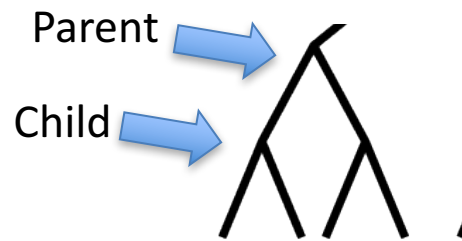
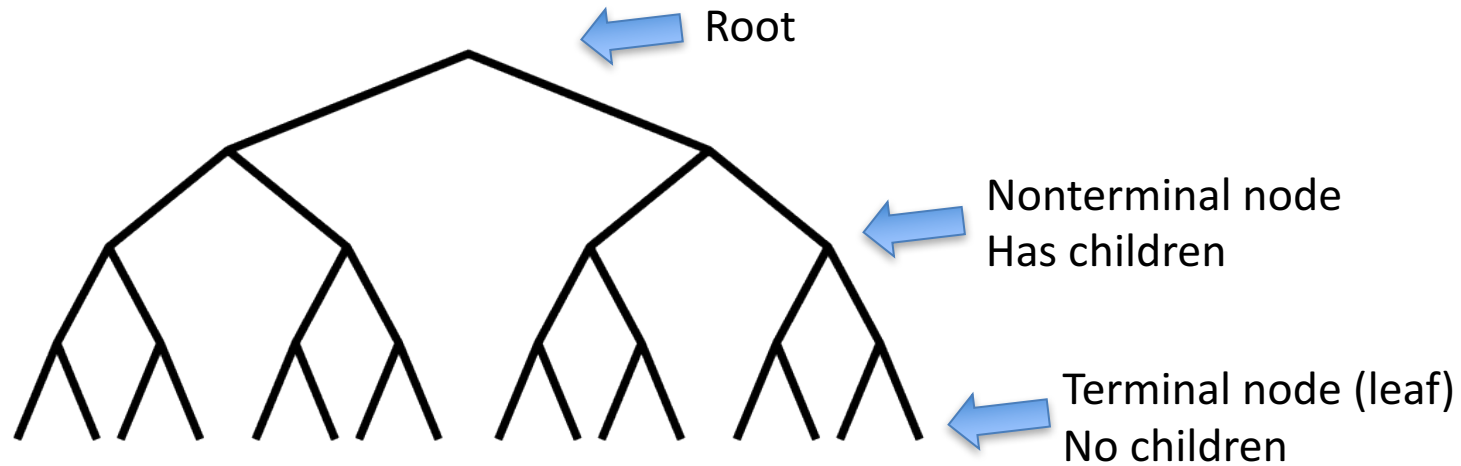
Trees



Our mathematical abstraction closely resembles an actual tree

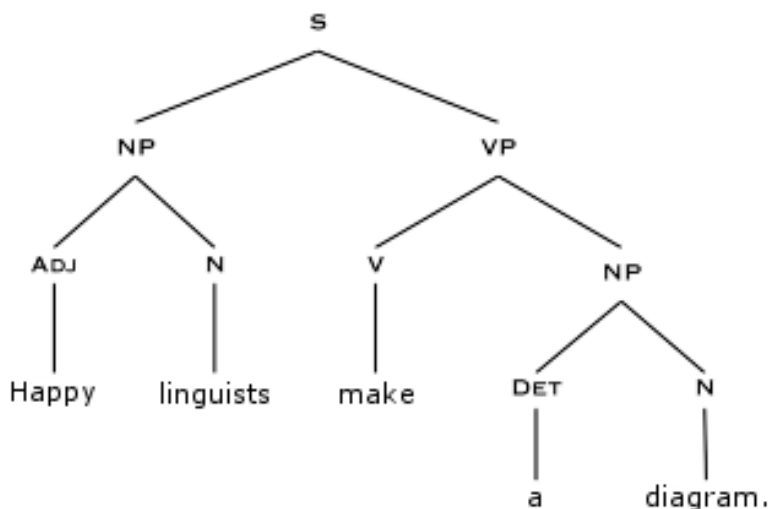


Trees



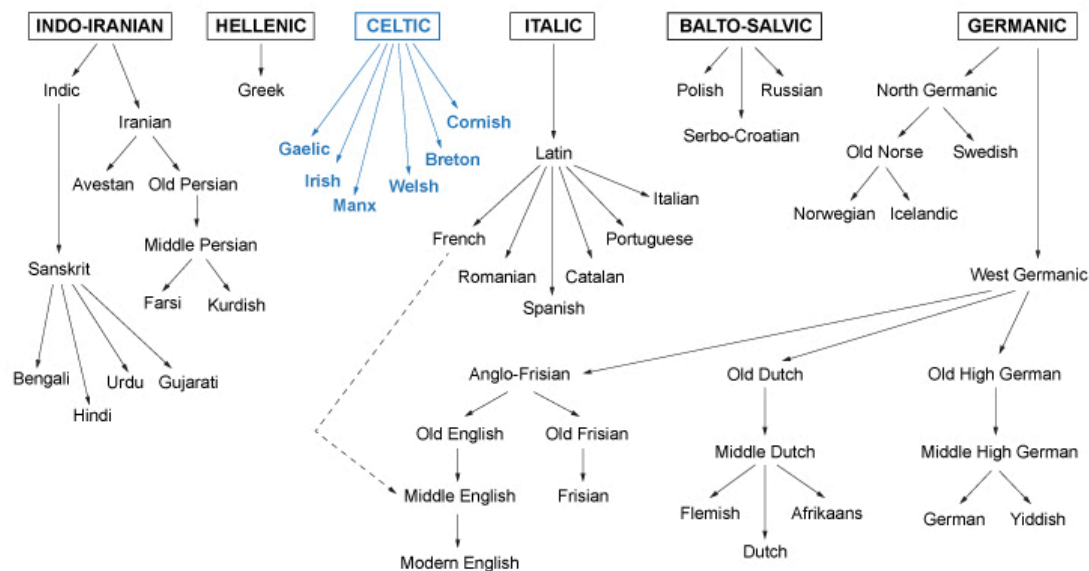
Trees

- Up until now, we have been holding data in a linear fashion
 - Physically linear (arrays)
 - Conceptually linear (linked lists)
- Trees allow us to encode data in a hierarchy
 - We can represent dependencies
 - We can represent decisions
 - Etc.
- On the following slides, I show examples of trees used to hold different types of information



Syntax tree

In linguistics, we can hold a sentence structure in a syntax tree. **Sample program:** break down meaning of a sentence (language processing).

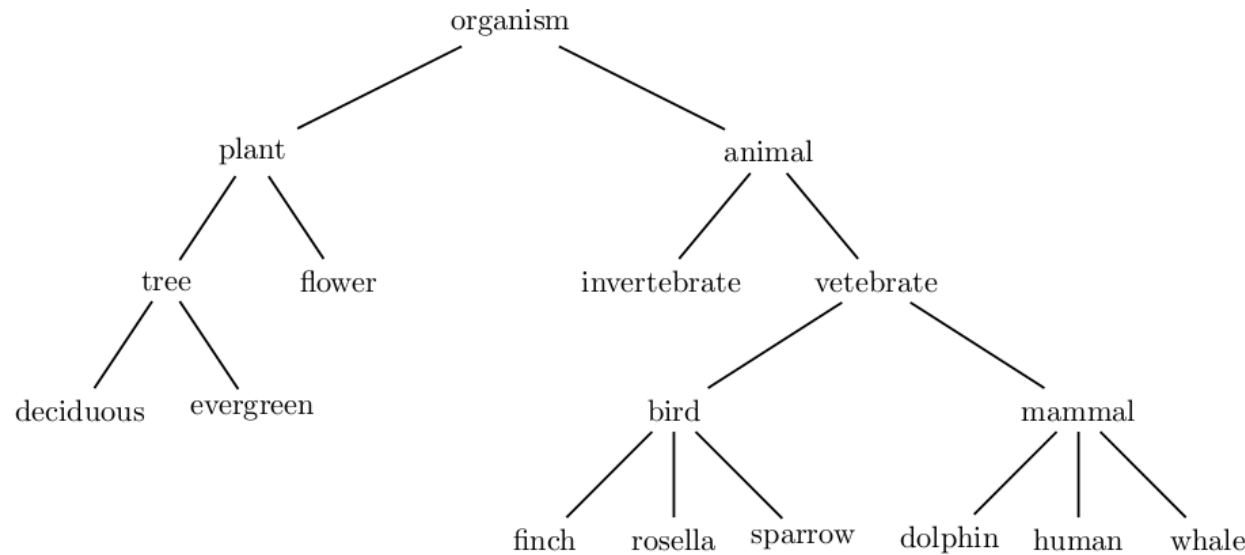


Language Family Tree

We could also hold a whole language family in a language tree. **Sample program:** a linguist keeping track of all languages in the Indo European language family.

Classification tree

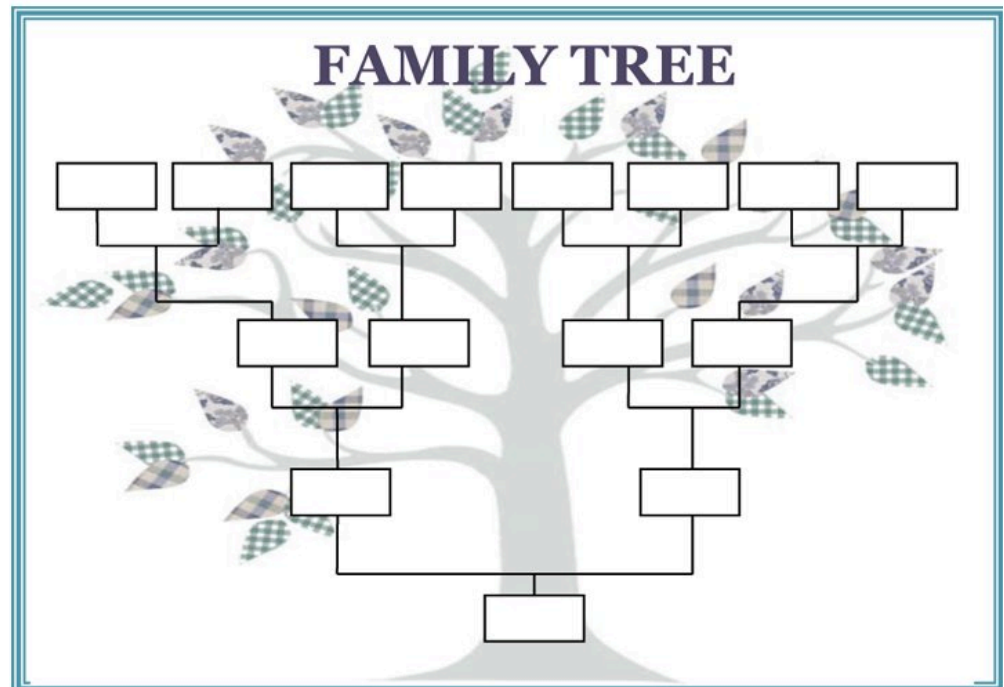
In biology, we can have a type of decision tree used to classify things. **Sample program:** enter characteristics of an object and the program will tell you what it is

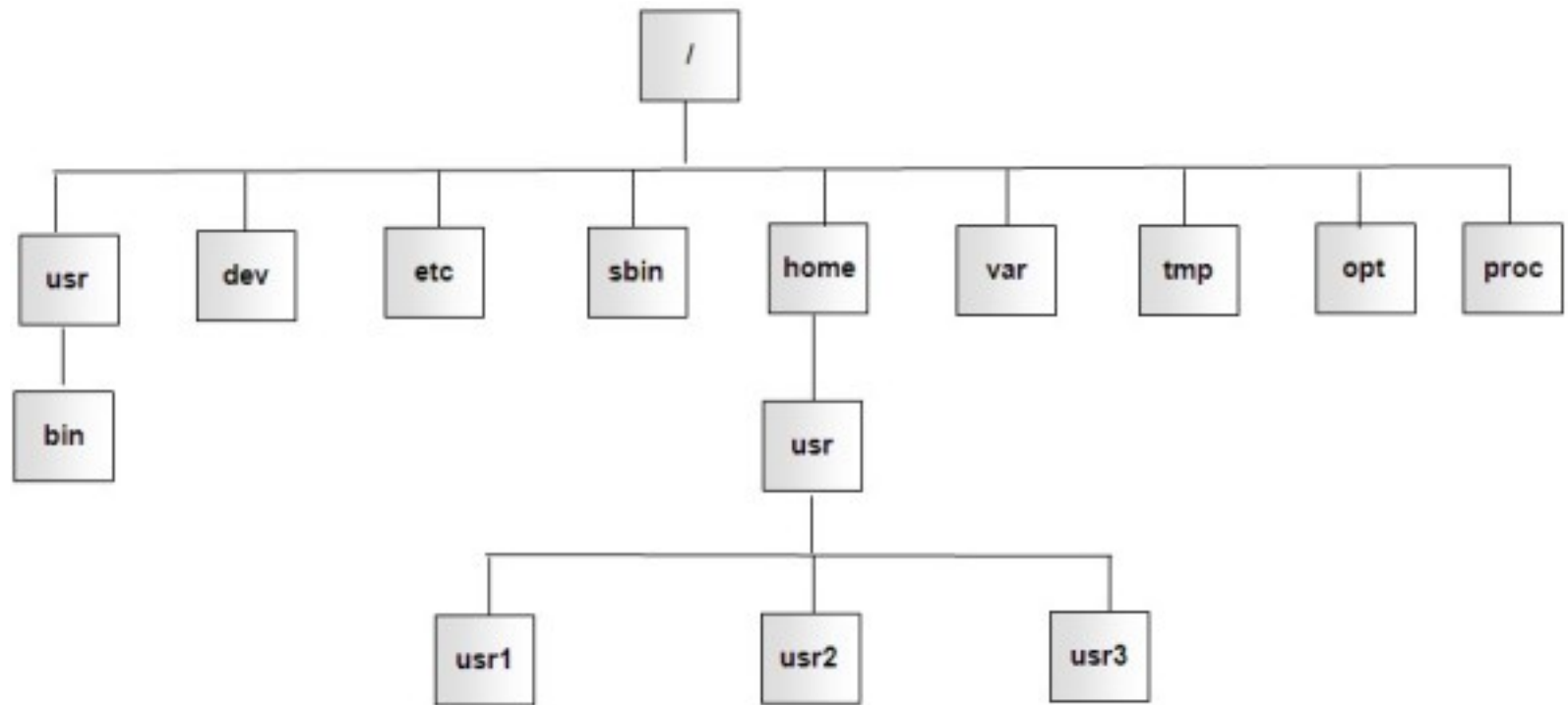


Family tree

We can use a tree to trace our family history.

Sample program: you could build a website like ancestry.com to hold family information



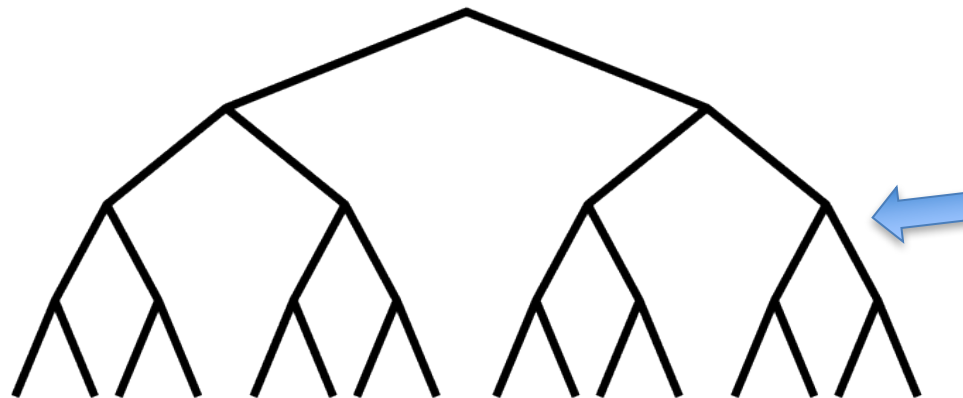


Computer Directories/File Structures

The internal workings of your computer directories can be represented by a tree. **Actual**: when you type `cd`, you are changing directories (`cd usr` moves you from the *home* directory to the *usr* directory-assuming you're currently in the home directory)

Binary Trees

- A binary tree is simply a tree where every non-terminal node has two children



Every nonterminal
node has 2 children

Notice we branch off into two every time

BEFORE WE CODE

Before We Code

- Representing binary trees in code
- Recursion
- Traversing your tree (going through the tree)
 - Pre-order
 - In-order
 - Post-order

SAMPLE PROGRAMS

Sample Programs

1. Go over binary tree (and traversing)