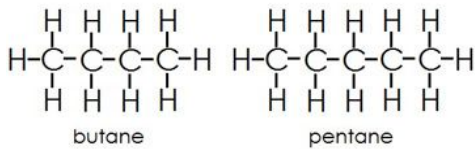
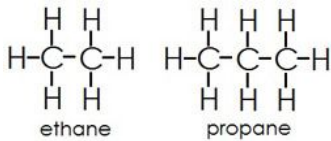


In nature, a **tree** is a plant with a single woody trunk, considerable height, and lateral branches suspended above the ground.

In math, a **tree** is an undirected graph in which any two vertices are connected by exactly one path.



Fun Fact

In chemistry, *alkanes* are trees of carbon and hydrogen atoms.

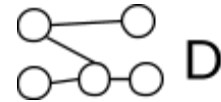
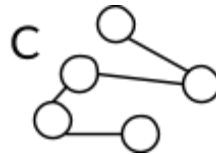
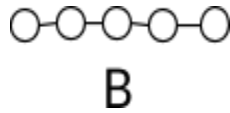
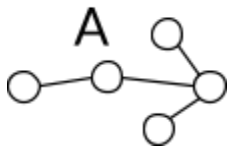
Can you draw methane, the alkane with 1 carbon atom?

	Is it a tree?	# Vertices	# Edges	Degrees
<p>(this one is <i>labeled</i>)</p>				

Counting Trees

Two trees are **isomorphic** if one can be rearranged to match the other without cutting any lines.

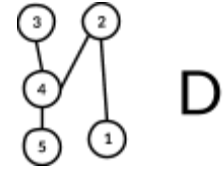
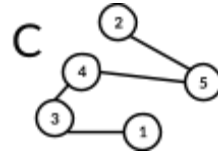
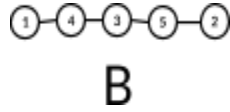
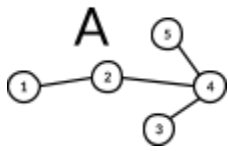
Which of these trees are isomorphic?



# Vertices	Drawings of Non-isomorphic Trees	# Non-isomorphic Trees
2		
3		
4		
5		
6		

Counting Labeled Trees

Which of these labeled trees are isomorphic?




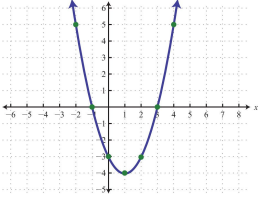
# Vertices	Drawings of Non-isomorphic Labeled Trees	# Non-isomorphic Labeled Trees
2		
3		
4		
5		
6		

Tree Codes

In math, a **code** is an efficient way to describe an object using symbols.

In programming, code is (hopefully) an efficient way to describe instructions for a computer processor.

Examples of Objects and Codes

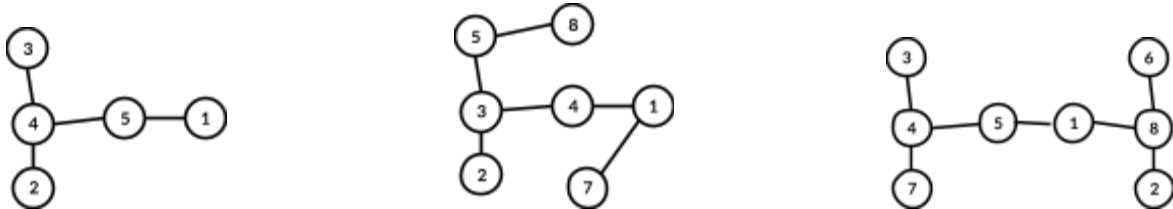
<p>.000000000000 0000000001</p> <p style="text-align: center;">↓</p> <p style="text-align: center;">10^{-21}</p>	<p>The Color "Salmon"</p> <p style="text-align: center;">↓</p> <p>#FA8072 (hex code)</p>	<p>Musical composition</p> <p style="text-align: center;">↓</p> 	 <p style="text-align: center;">↓</p> <p>$y = x^2 - 2x - 3$</p>
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Prüfer Codes

To write down a Prüfer code for any labeled tree, do the following:

- write down the smallest leaf (vertex with only one edge), then cross out that leaf
- repeat

Write down the Prüfer codes for the following:



Can you think of a way to turn a Prüfer code into its graph?