BTree Motivation
Big-O assumes uniform time for all operations, but this isn’t always true.

However, seeking data from the cloud may take 100ms+. 
...an O(lg(n)) AVL tree no longer looks great:

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Consider Instagram profile data:

<table>
<thead>
<tr>
<th>How many profiles?</th>
<th>How much data /profile?</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVL Tree</td>
<td>BTree</td>
</tr>
<tr>
<td>Tree Height</td>
<td></td>
</tr>
</tbody>
</table>

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BTree Motivations
Knowing that we have long seek times for data, we want to build a data structure with two (related) properties:

1. 
2. 

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Great interactive visualization of BTrees:
https://www.cs.usfca.edu/~galles/visualization/BTree.html
BTree Properties
For a BTree of order \( m \):
1. All keys within a node are ordered.
2. All leaves contain no more than \( m-1 \) nodes.
3. All internal nodes have exactly **one more key than children**.
4. Root nodes can be a leaf or have \([2, m]\) children.
5. All non-root, internal nodes have \([\lceil m/2 \rceil, m]\) children.
6. All leaves are on the same level.

Example BTree

![BTree Diagram]

What properties do we know about this BTree?

BTree Analysis
The height of the BTree determines maximum number of ______________ possible in search data.

...and the height of our structure:

Therefore, the number of seeks is no more than: ______________.

...suppose we want to prove this!

BTree Analysis
In our AVL Analysis, we saw finding an upper bound on the height (given \( n \)) is the same as finding a lower bound on the nodes (given \( h \)).

Goal: We want to find a relationship for BTrees between the number of keys (\( n \)) and the height (\( h \)).

CS 225 – Things To Be Doing:

1. Programming Exam B starts next Thursday
2. MP4 due next Monday (Oct. 22)
3. lab_avl due Sunday
4. Daily POTDs are ongoing!