Range-based Searches:
Q: Consider points in 1D: \( p = \{p_1, p_2, \ldots, p_n\} \).
   ...what points fall in \([11, 42]\)?

Tree Construction:

Extending to k-dimensions:
Consider points in 2D: \( p = \{p_1, p_2, \ldots, p_n\} \):
   ...what points are inside a range (rectangle)?
   ...what is the nearest point to a query point \( q \)?
**BTree**

-3 8 23 25 31 42 43 55

**m=9**

**Goal:** Build a tree that uses _______________/node!
...optimize the algorithm for your platform!

A **BTree of order m** is an m-way tree where:

1. All keys within a node are ordered.

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**BTree Insert, using m=5**

...when a BTree node reaches m keys:

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**BTree Insert, m=3:**

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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.

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**Example BTree**

What properties do we know about this BTree?

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**CS 225 – Things To Be Doing:**

1. mp_traversal final deadline Today
2. Daily POTDs are ongoing!