B+Tree

• Most widely used database index
• B stands for balanced (not binary)
  – All leaves are the same distance from the root
  – Trees grow and shrink at the root

B+Tree Order

• If the tree has order M then
  – The maximum number of children a node can have is M
  – The maximum number of keys in a node is M-1
  – The minimum number of children a non-leaf node (except the root) can have is ceiling(M/2)
  – The minimum number of keys in a node (except the root) is ceiling(M/2)-1
  – The root can have between 1 and M-1 keys
  – A node with x children contains x-1 keys
B+Tree

• Good for equality and range searches
• Cost of the search depends on height of the tree
• B+Trees are very short and wide
• Keys in the leaves of an order M, height n B+tree?
  – Maximum number of keys in leaves: $M^n(M-1)$
  – Minimum number of keys in leaves: $2(\lceil M/2 \rceil)^n(n-1)$

• For example a height 3, order 201 B+tree has between 2,040,200 and 1,624,120,200 keys in the leaves