Binary tree properties

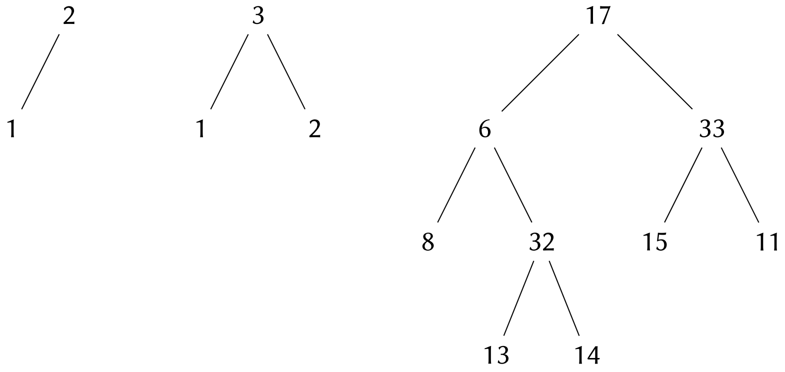
Goldsmiths Computing

Height-balanced property

In a height-balanced tree:

- the heights of left- and right-subtrees of every node differ by at most 1

Example height-balanced trees



Height-balanced property

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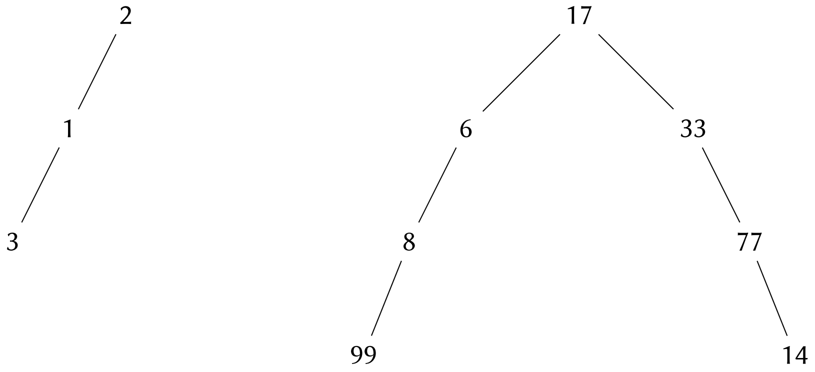
Example non-height-balanced trees



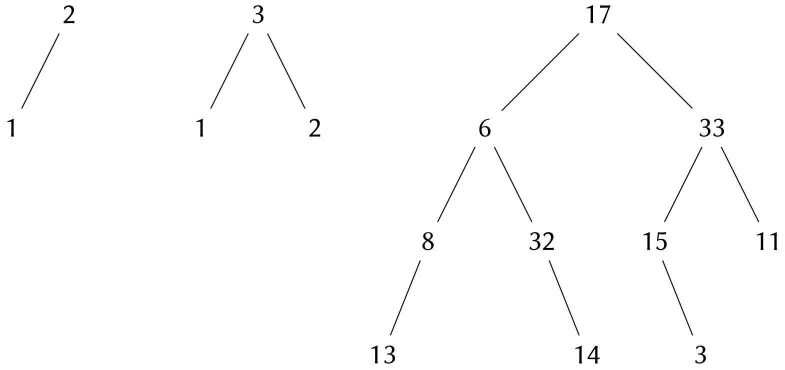
Weight-balanced property

In a weight-balanced tree:

- the number of nodes of left- and right-subtrees of every node differ by at most 1

Weight-balanced trees are automatically height-balanced.

Example weight-balanced trees



Weight-balanced property

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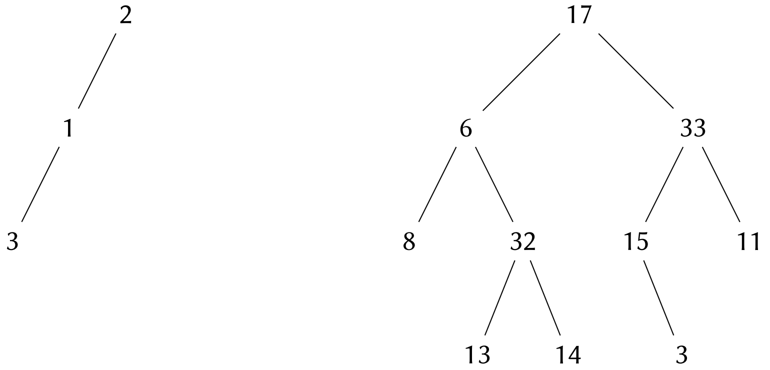
Example non-weight-balanced trees



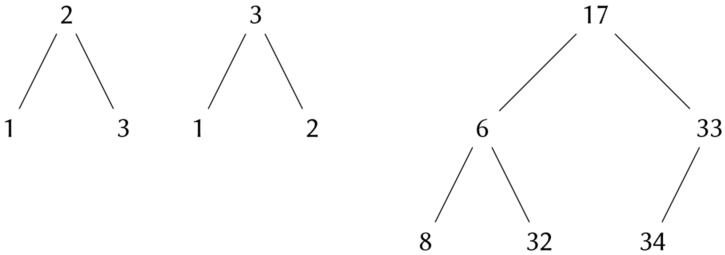
Nearly-complete property

In a nearly-complete tree:

- all levels except *possibly* the lowest level are completely filled;
- the lowest level is filled from the left;
- a complete tree (lowest level filled) is by convention also a nearly-complete tree.

Nearly-complete trees are automatically height-balanced (but not necessarily weight-balanced)

Example nearly complete trees



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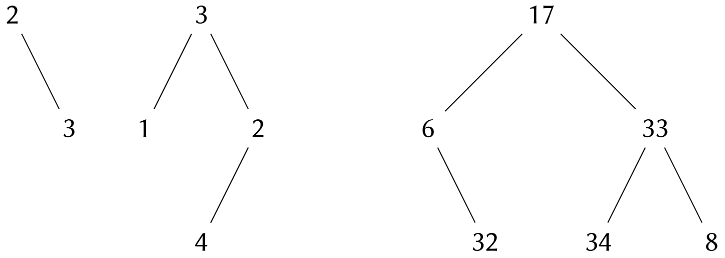
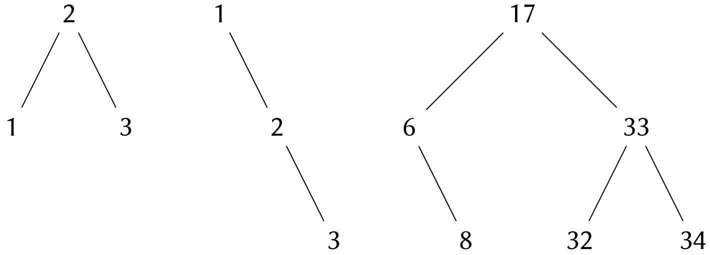
Example non-nearly complete trees



Binary search tree property

Let x be a node in a binary search tree. If y is a node in the left subtree of x, then y.key < x.key. If z is a node in the right subtree of x, then z.key ≥ x.key.

Example binary search trees



Heap property

Let x be a node in a max-heap. If y is a (generalised) parent of x, then y.key ≥ x.key.