# CO225 Lab 10

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1. The *depth* of a node is the distance to it from the root (which is at depth 0.) Define a function `max_depth` that returns the maximum depth of all leaves in a binary tree.
2. An HTML document can be represented as tree known as the document object model tree. Each node in the tree represents an HTML element such as `<head>`, `<body>`, and `<h1>`. A node's children correspond to elements contained within another it. For example, the `<body>` tag may contain multiple `<h1>` elements as children.
   (a) Define a type `domtree`, where each node contains
      - a *tag* such as `<h1>` and optionally some text. The tags `<head>`, `<title>`, `<body>`, `<h1>` and `<p>` should be supported.
      - zero or more children (the DOM is a *multiway* tree.)

   (b) Define the operation `count_tag t` which counts the number of occurrences of tag `t` in the tree.

   (c) Define the operation `dom_tostring` that takes a `domtree` and returns its string representation.
3. An order statistics tree is a BST that supports two additional operations
   1. `rank x` returns the number of keys that are less than or equal to `x`.
   2. `select k` find the k-th smallest element in the tree.

   To implement these operations we keep a count of the number of nodes in each subtree at each node. The count at leaves will be 1 and the count at the root will be the total number of nodes in the tree.

   (a) Define a type `ostree` by adding a count to binary tree nodes.

   (b) Define the operations `insert`, `rank` and, `select` for the `ostree` type.