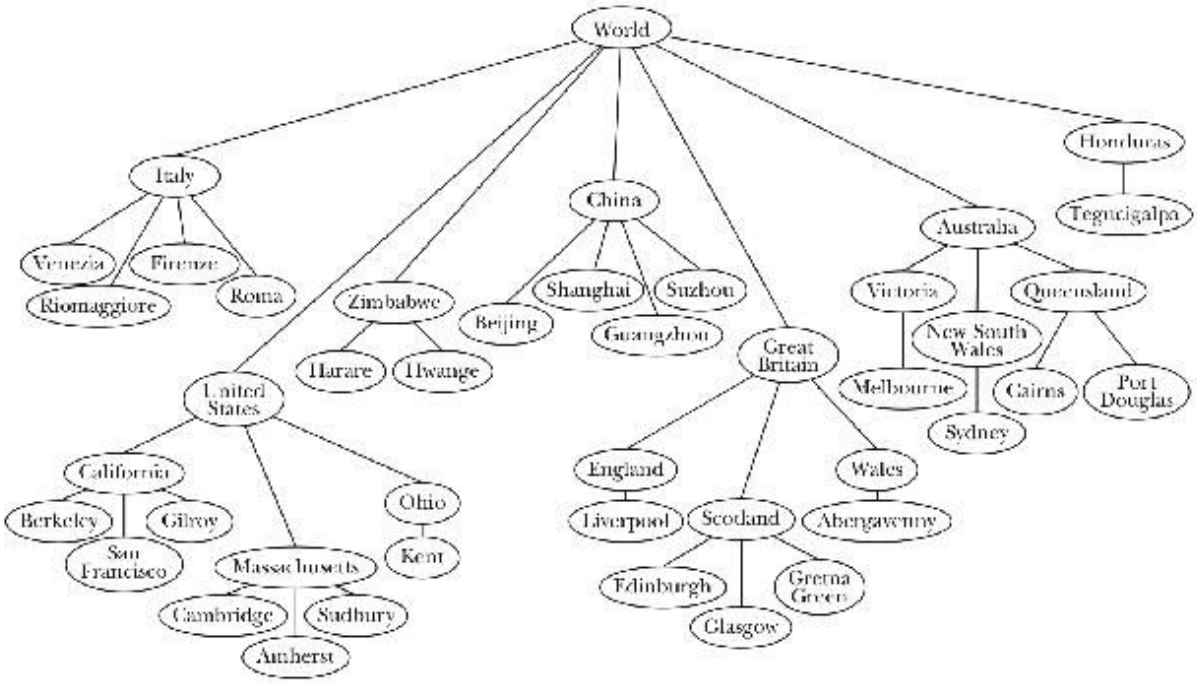
Introduction to Trees

Setup



For this problem:

1. Download the trees2.scm code by:
    a. (in UNIX)
    Wget http://faculty.cse.tamu.edu/slupoli/notes/Scheme/code/trees/trees2.txt
    b. (in Windows)
    http://faculty.cse.tamu.edu/slupoli/notes/Scheme/code/trees/trees2.txt

Use the code and picture above for the tree.

The old ways are not always the best

1. Using only the cdr/car function variations, display “Wales”.

Count number of non-leaf nodes in the tree

2. Write a function count-non-leaves to return the **number of non-leaf nodes in the world tree**. You can define a helper function if needed. Result should be 17.

First child of a node

3. Write a function first-child-tree that when given a place, **it returns the first child node for that place**. If there are no child nodes, just return the null value. Assume the place is in the tree. You can define a helper function if needed.

```
(first-child-tree 'china world-tree2) -> beijing
(first-child-tree 'liverpool world-tree2) -> '()
```

Display Leaf Nodes

4. Write a function leafDisplay to return a **flattened** list of all the leaf nodes of a tree. You can define a helper function if needed. Display the results for world-tree2.

Replacing a Node

5. Write replace, a procedure that takes place1, place2, and a tree as argument and returns a copy of the tree, with place2 replacing place1. Assume that place1 is present in the world-tree2. You can define a helper function if needed. Display the results for world-tree2.

   For example:

```
(display (replace 'italy 'hello world-tree2))
```

```
(world hello ((united states) (california (berkeley) ((san francisco)) (gilroy)) (massachusetts (cambridge) (amherst) (sudbury)) (ohio (kent))) (zimbabwe (harare) (hwange)) (china (beijing) (shanghai) (guangzhou) (suzhou)) ((great britain) (england (liverpool)) (scotland (edinburgh) (glasgow) ((gretna green))) (wales (abergavenny))) (australia (victoria (melbourne)) ((new south wales) (sydney)) (queensland (cairns) ((port douglas)))) (honduras (tegucigalpa)))
```