1.

a) 1.

b) 8, 9, 13, 6, 11, 15, 12.

c) 1, 2, 4, 3, 5, 10, 14, 7.

d) 5, 7.

e) 5, 10, 13, 14, 15.

f) 1, 3, 5, 10.

g) 10, 13, 14, 15.

h) 2, 4, 8, 9.

i) 6, 7, 11, 12

j) 1, 3, 5, 10, 14, 15.

k) 4.

l) 4.

m) 5.

2. A leaf is its own descendant. A leaf cannot have any proper descendants.

3. Let A and B be distinct leaves. If A is an ancestor of B, then A has at least one descendant. Thus A is an interior node. But A is a leaf. We have reached a contradiction. We conclude that a leaf cannot be an ancestor of another leaf. The same follows if we swap the names.

4. We prove the following statement by induction on n, the number of nodes in the tree.

STATEMENT $S(n)$: A tree having n nodes under the nonrecursive definition is a tree under the recursive definition.

BASIS. The basis is $n = 1$. The tree has one node, the root. This is a one-node tree under the recursive definition. This proves the basis.

INDUCTION. Assume $S(n)$ for $n \geq 1$. We shall prove $S(n + 1)$.