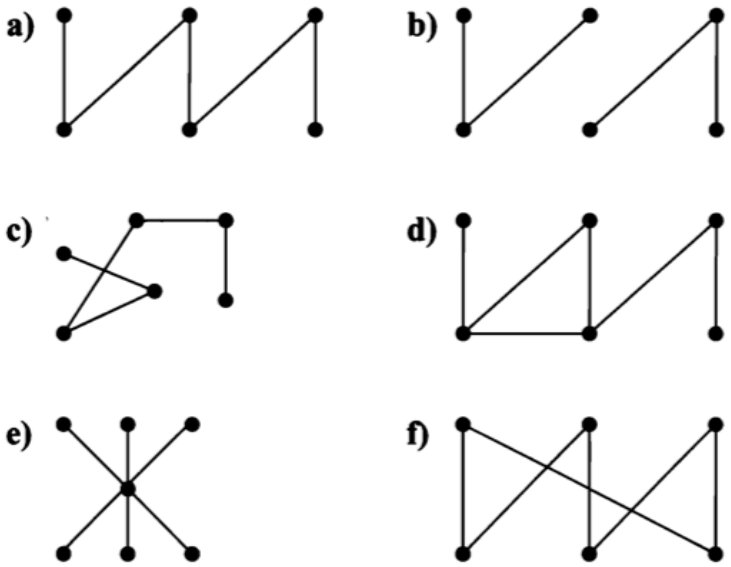
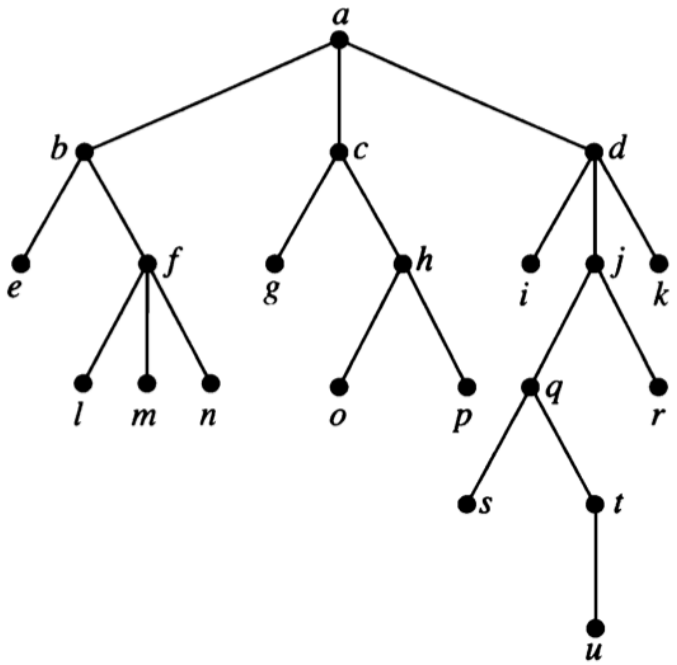
Exercises for Lecture 7

1) Which of these graphs are trees?



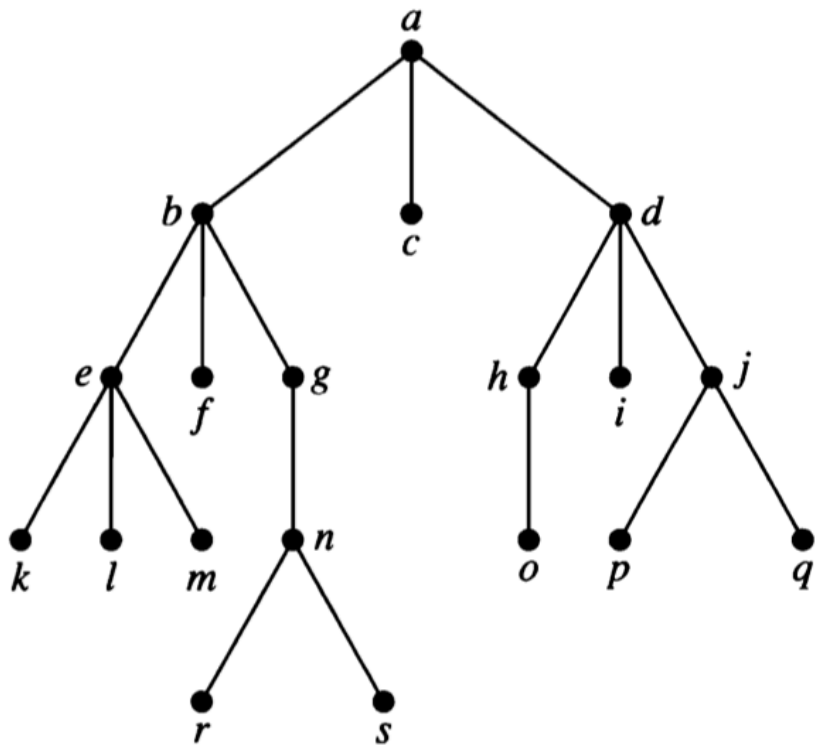
2) Answer there questions about the rooted tree illustrated



Questions:

a) Which vertex is the root?
b) Which vertices are internal?
c) Which vertices are leaves?
d) Which vertices are children of j?
e) Which vertex is the parent of h?
f) Which vertices are siblings of o?
g) Which vertices are ancestors of m?
h) Which vertices are descendants of b?

3) Determine the order in which a preorder traversal visits the vertices of the given ordered rooted tree.



4) What is the value of each of these prefix expressions?

a) - ∗ 2 / 8 4 3
b) ↑ - ∗ 3 3 ∗ 4 2 5
c) + - ↑ 3 2 ↑ 2 3 / 6 - 4 2
d) ∗ + 3 + 3 ↑ 3 + 3 3 3
e) + - * 2 3 5 / ↑ 2 3 4

Hint: Reconstruct a tree from the expression, and then compute the value of a tree by evaluating the subtrees and then compute the value as defined by the mathematical operator. ↑ stands for exponentiation.

5) Follow these steps to give a recursive definition of the factorial function *F(n)*=n!

a) Specify the initial value of this function
b) Give a rule for finding *F(n* + 1) from *F(n)*
c) Determine a value of the factorial function, such as *F(5)* = 5!

6) Suppose that *f* is defined recursively by

f(0) = 5
f(n+1)=4f(n)+5

Find f(n) for n=1...5 that is f(1), f(2), f(3), f(4), f(5)

7) We define the length of a list *l* as

length (*l*) = 0 if *l* = nil

length (l) = 1+ length(l') if l = x:: l'

Prove by structural induction that:

length (l_1@l_2)=length (l_1) + length(l_2)

8) Solve exercise 3 form the course notes.

9) [Extra credit] Solve exercise 4 from the course notes.