ICS 365 - Concepts of Programming Languages.
Problem Set 1

Due: 06/06/2017 **Points: 30**

1.Derive and draw parse trees for the given expressions using the following grammar. 15 points

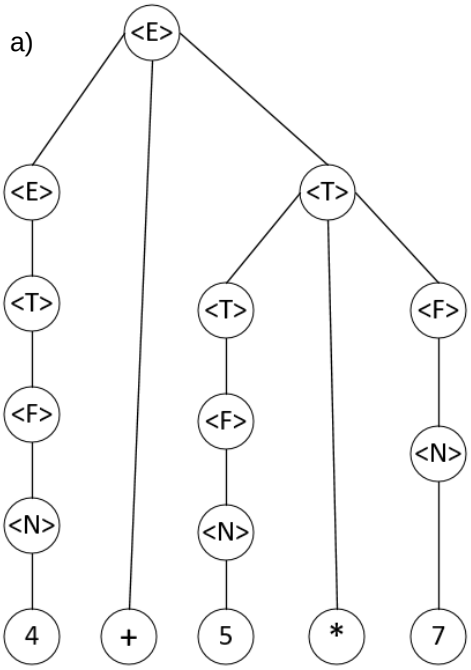
<E> -> <E> + <T>
| <E> – <T>
| <T>

<T> -> <T> * <F>
| <T> / <F>
| <F>

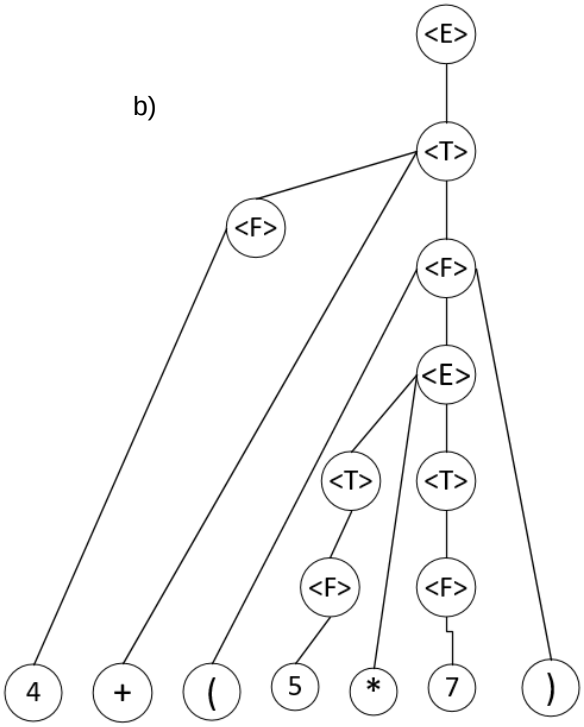
<F> -> <N> | (<E>)
<N> -> 0 | 1 | 2| 3 | 4 | 5 | 6 | 7| 8 | 9

a) 4 + 5 * 7 b) 4 + (5 * 7)

a)

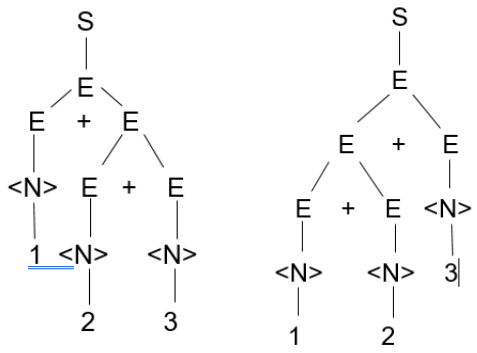


b)



2. Prove that the following grammar is ambiguous. 3 points

<S> -> <E>
<E> -> <E> + <E> | <N>
<N> -> 1 | 2 | 3



Two distinct parse trees = ambiguity

3.Compute the weakest precondition for each of the following assignments statements and postconditions 12points

1. a =2*(b-1)-1 {a>0}
2. b =(c+10)/3 {b>6}
3. a = a+2 * b - 1 {a > 1}
4. x = 2 * y + x-1 {x > 11}

1. a = 2 * (b – 1) – 1 {a > 0}
   2 * (b – 1) – 1 > 0
   2 * b – 2 – 1 > 0
   2 * b > 3
   b > 3 / 2

2. b = (c + 10) / 3 {b > 6}
   (c + 10) / 3 > 6
   c + 10 > 18
   c > 8

3. a = a + 2 * b – 1 {a > 1}
   a + 2 * b – 1 > 1
   2 * b > 2 – a
   b > 1 – a / 2

4. x = 2 * y + x – 1 {x > 11}
   2 * y + x – 1 > 11
   2 * y + x > 12