1  HW 3.5 - Regular Expressions 2008.10.08

Consider the following identities for regular expressions; some are false and some are true. You are asked to decide which and in case it is false to provide the correct counterexample.

1. \(R(S+T) = RS + RT\)

   Answer: True

2. \((R^*)^* = R^*\)

   Answer: True

3. \((R^*S^*)^* = (R+S)^*\)

   Answer: True

4. \((R+S)^* = R^* + S^*\)

   Answer: False, \(R=0, S=1, 0101 \in (0 + 1)^*\) but \(0^* + 1^* \notin 0^* + 1^*\) because \(0^* + 1^*\) contains only strings of all zeroes or strings of all ones

5. \(S(RS+S)^*R = RR^*S(RR^*S)^*\)

   Answer: False, \(R=0, S=1, 10 \in RHS, 01 \notin LHS\) since it must start with 1

6. (a) \((RS+R)^*R = R(SR+R)^*\)

   Answer: True

   \[
   (RS + R)^*R = R(RS + R)^*R \quad (1) \\
   = R() \quad (2) \\
   = R() \quad (3) \\
   = R() \quad (4) \\
   = R() \quad (5) \\
   
   \]

   (b) \((RS+R)^*R = R(SR+R)\) Erroneous problem 6, someone left off the star on the RHS.

   Answer: False, the length of RHS is at most three, the length of LHS is not limited, in particular \(R=1, S=1, 1111111 \in LHS\) but \(\notin RHS\).