Principles of Programming Languages [PLP-2014]
Mid-Term Exam - December 18, 2014
Solutions to Exercise 6

The solution of the other exercises will be published in the next days.

6)  
   a) What is an ambiguous grammar? Write down a precise or formal definition.
   b) Using the definition of ambiguity just given, show that the following grammar is ambiguous:

   \[ S \rightarrow aS \mid A \\
   A \rightarrow aAS \mid b \]

Solution
   a) A grammar is ambiguous if there exists a word in its language that has two different parse trees.
   b) The grammar is indeed ambiguous, as string \texttt{aababb} has two parse tree. Here are the corresponding left-most derivations:

   a. \[ S \rightarrow aS \rightarrow aA \rightarrow aaAS \rightarrow aabS \rightarrow aabA \rightarrow aabaAS \rightarrow aababS \rightarrow aababA \rightarrow aababb \]
   b. \[ S \rightarrow A \rightarrow aAS \rightarrow aaASS \rightarrow aabSS \rightarrow aabaSS \rightarrow aabaAS \rightarrow aababS \rightarrow aababA \rightarrow aababb \]