SSC1 exercise sheet: regular expressions and grammars

1. Give a regular expression for matching numbers in binary that are divisible by 16. (Hint: you can tell from the last 4 digits whether the number is divisible by 16). You should avoid superfluous 0s at the beginning.

2. Consider the following grammar:

   \[ S \rightarrow [S, S, S] \]
   \[ S \rightarrow 0 \]

   The only non-terminal symbol here is \( S \), which is also the start symbol. Give two different derivations of the string

   \[ [0, [0, 0, 0], 0] \]

3. Consider the following grammar rule, where the regular expression constructs alternation | and Kleene star * have been used on the right-hand side of the rule:

   \[ A \rightarrow a((b c) | (d e))^* f \]

   Rewrite the grammar so that | and * are eliminated. Hint: you need to introduce two new non-terminals \( P \) and \( Q \), together with two new rules for each of them.