Mock Exam
Formal Languages and Compilers
(A.Y. 2014/2015)

February 2^{nd}, 2015

1 Lexical Analysis

1.1

Write regular defintions for the following languages:

- All strings on the alphabet $\Sigma = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$
- All strings on the alphabet $\Sigma = \{a-z, A-Z, *)$ representing sentences, not containing two consecutive $*$, that can be followed by comments. Comments are encapsulated within two consecutive $*$, and within comments the $*$ symbol cannot appear.
- All strings on the alphabet $\Sigma = \{a, b\}$ respecting the following rules:
  (a) not containing the substring *abb*
  (b) not containing the subsequence *abb*

1.2

Discuss the rule *longest match* in lexical analysis clarifying why it is needed in not too much constrained languages.

1.3

Consider the following regular languages $\mathcal{L}$, $\mathcal{L}_1$ e $\mathcal{L}_2$. Show that the following properties are satisfied showing how the corresponding automaton could be combined:

1. $\mathcal{L}_1 \cup \mathcal{L}_2$ is a regular language
2. $\mathcal{L}_1 \bullet \mathcal{L}_2$ is a regular language
3. $\mathcal{L}^*$ is a regular language

2 Syntax Analysis

2.1

Let's G the grammar defined by the following productions:

$$S \longrightarrow B \mid C \quad B \longrightarrow bB \mid b \quad C \longrightarrow bbCa \mid a \tag{1}$$

please answer to the following questions and requests:

1. Without deriving the LL(1) parsing table is it possible to tell if the grammar is parsable with an LL(1) approach?
2. derive the FIRST, FOLLOW and *nullable* sets for G. In deriving the tables please indicate with two indexes the iteration and the production responsible for the insertion of the symbol in the tables.
3. Derive the LR(0) automaton and the corresponding parsing tables for LR(0) and SLR parsers. Discuss the applicability of the two parsing strategies.
4. Use one of the two parsing strategies to show the behaviour of the corresponding parser when asked to analyze the word "*bbbbaaa*"

2.2

Let's G the grammar defined by the following productions:

$$S \to aSa \mid A \quad A \to bAb \mid B \quad B \to b \tag{2}$$

1. Discuss the applicability of parsing LL(1)
2. In case the grammar is not parsable with an LL(1) approach modify the grammar in order to be parsable with a parser LL(1) (obviously without modifying the generated language).