Due Date: Wednesday, April 13, 2011

Name: ______________________________
1. (20 points)

Consider the following grammar (Λ is the empty string)

\[
\begin{align*}
S & \rightarrow BAB \\
A & \rightarrow aA \mid \Lambda \\
B & \rightarrow Bb \mid b
\end{align*}
\]

(a) Which of the following four regular expressions represents the language defined by this grammar? Circle your answer.

- \(bb*a*bb^*\)
- \(b*aa*b*\)
- \(bb*aa*bb^*\)
- \(b*a*b^*\)

(b) Draw an FSM that recognizes the language defined by the grammar.

2. (20 points)

We know that a particular language might be representable by two or more different grammars. Consider the following two grammars (Λ is the empty string)

(i) \[
\begin{align*}
S & \rightarrow 0A \\
A & \rightarrow 10A \mid \Lambda
\end{align*}
\]

(ii) \[
S \rightarrow S10 \mid 0
\]

(a) Do they generate the same language?

(b) If your answer to (a) is No, give an example of a string that can be generated by one grammar and not the other.
3. (20 points)

Consider the following regular expression

\[ x (a \mid b)^* (cd)^* (e \mid f) x \]

(a) Draw a Finite State Machine that recognizes the set of strings represented by the regular expression. The parentheses are not part of the language. Examples of strings in this language are: xfx  xbbacdcex  xcdex

(b) Give three more (different) strings that are also in the language.

4. (20 points)

Consider the following FSM

Give a regular expression that represents the language that this FSM recognizes.
5. (20 points)

Given the following grammar for expressions (an extended version of Fig. 7.5)

Non-terminals: \{ E, T, F \}
Terminals: \{ +, *, -, /, (, ) \, a \}
Start-symbol: E
Rules:
\[
E \rightarrow E + T \mid E - T \mid T \\
T \rightarrow T * F \mid T / F \mid F \\
F \rightarrow a \mid (E)
\]

Draw the syntax tree (see Fig 7.6 for an example) for the following expression

\[
(a + a) / (a - a)
\]