Spring 2014 **Exam #3** COSC 362

Name: _____

Write all of your responses on the exam paper or on the extra paper provided. Turn in all work and this exam paper.

1. (*20 Points*) Construct a Context-Free Grammar for the language

$$L = \{a^n b^m c^k \mid k = |n - m|, n \geq 0, m \geq 0\}$$

2. (*15 Points*) Show that the following grammar is ambiguous.

$$
\begin{aligned}
S &\rightarrow abAAB \mid BaCbB \mid \lambda \\
A &\rightarrow aaA \mid AbbAC \mid b \\
B &\rightarrow AaA \mid bb \\
C &\rightarrow CAB \mid bB \mid \lambda
\end{aligned}
$$

3. (*25 Points*) Convert the following grammar to Chomsky Normal Form.

$$
\begin{aligned}
S &\rightarrow AAB \mid BaCbD \mid B \\
A &\rightarrow aA \mid bbAC \mid b \\
B &\rightarrow AaA \mid b \mid a \mid \lambda \\
C &\rightarrow AB \mid bB \\
D &\rightarrow CaB \mid a
\end{aligned}
$$

4. (*20 Points*) Construct a Nondeterministic Push-Down Automaton for the following language. Use it to test the words *abaabaaa* and *ababaa* for acceptance.

$$L = \{w \mid n_a(w) = 3n_b(w)\}$$

5. (*20 Points*) Convert the following Context-Free Grammar into a Nondeterministic Push-Down Automaton.

$$
\begin{aligned}
S &\rightarrow AAB \mid BaCbD \mid B \\
A &\rightarrow aA \mid bbAC \mid b \\
B &\rightarrow AaA \mid b \mid a \\
C &\rightarrow AB \mid bB \\
D &\rightarrow CaB \mid a
\end{aligned}
$$

6. (*10 Points*) Show that every regular language is a deterministic context-free language.