# Test 2 for CS 3350 Automata, Spring 2025

1–4. Let us consider the grammar for palindromes, with the starting variable S and rules $S \to \varepsilon$, $S \to a$, $S \to b$, $S \to aSa$, and $S \to bSb$. The word *abba* is generated by this grammar as $\underline{S} \to a\underline{S}a \to ab\underline{S}ba \to abba$.

1. Show how the word *abba* will be represented as $uvxyz$ according to the Pumping Lemma for context-free grammars.

2. Use a general algorithm to construct a (non-deterministic) pushdown automaton that corresponds to this grammar.

3. Show, step by step, how the word *abba* will be accepted by this automaton.

4. Transform this grammar into Chomsky normal form.

5. Give an example of an ambiguous grammar and explain, on an example, why this grammar is ambiguous, why this is not good for compiling.

6. Show, step by step:

1. how the stack-based algorithm will transform the expression $3 \cdot (4-2)$ into a postfix expression, and then

2. how a second stack-based algorithm will compute the value of this expression.

(Turn over, please)

7–8. Let us consider the following pushdown automaton:
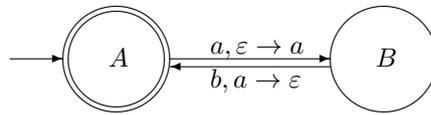
This pushdown automaton accepts the word *abab* as follows:

	a	b	a	b
A	B	A	B	A
	a		a	

Use the general algorithm to show how this word will be generated in the corresponding context-free grammar.

9-10. Let us consider the language L of all the words that (1) have equal number of letters a, b, and c, (2) start with the letter c, and (3) end with the letter a. Prove that this language is not context-free.