CS580 Homework 5

Fall 2024

September 18, 2024

(Due 4:10pm, September 25, 2024)

Email homework assignments to ldojcsak@vols.utk.edu by the beginning of class time.

1. Give a CFG generating each language.

   a. $L = \{\ a^i b^j c^k \mid i, j, k \geq 1, j \neq k\}$

   b. $L = \{x = w_1 w_2 \mid w_1$ has equal number of a's and b's and $w_2 = a^{2n} b^{2m}$ such that $n, m \geq 0\}$

   c. $\Sigma = \{a, b, (,)\}$ and $L = \{$ Strings containing any number of a's and b's and closed parentheses. $\}$ For example, $(aa(bb)aa)$ or $(aa)bb(a()aa)$ but not $aa)bb(aa$.

2. What language does the following CFG generate?

$$S \to SS \mid abSa \mid baSa \mid aaSb \mid \lambda$$

3. Is the following grammar ambiguous? Provide a convincing argument in either case. If it is ambiguous, is the language it generates inherently ambiguous?

$$S \to AB \mid aaB$$
$$A \to a \mid Aa$$
$$B \to b$$

4. Simplify the following grammar by applying the four lemmas you learned in class. Show the result after applying each lemma. Note: Use the proper order (3, 4, 1, 2).

$$S \to BF \mid E$$
$$A \to bBa \mid cF \mid \lambda$$
$$B \to aBb \mid G \mid \lambda$$
$$C \to DE$$
$$D \to EC$$
$$E \to DC$$
$$F \to Fc \mid \lambda$$
$$G \to B \mid \lambda$$