

# CS 181 Spring 2020 Homework Week 7

Assigned Tue 5/12; Due via GradeScope Mon 5/18 6:00pm

1. Consider the following language over the alphabet  $\Sigma = \{a, b, c\}$ .

$$L = \{a^i b^n c^j \mid n = i + j, \text{ where } i, j, n \geq 0\}.$$

Give a DPDA that recognizes  $L$ . Briefly describe how your machine correctly recognizes  $L$ .

For questions 2 and 3, you must show every step of the reduction, and at every step you must underline the reducing string that will be replaced in the next step.

2. Let terminal set  $\Sigma = \{+, \times, (, ), v\}$ , and consider the following unambiguous context-free grammar (CFG) from Sipser Ex. 2.1. (p. 154) that generates simplified arithmetic expressions:  $G = (\{E, T, F\}, \Sigma, R, E)$ , with rewriting rule set  $R$  given by:

$$E \rightarrow E + T \mid T$$

$$T \rightarrow T \times F \mid F$$

$$F \rightarrow (E) \mid v$$

Show the left-most reduction for  $v + v \times v + v$ .

3. Let  $\Sigma = \{(, )\}$ . Consider a simple ambiguous grammar for non-empty strings of balanced parentheses,  $G = (\{S\}, \Sigma, R, S)$  with rule set  $R$  given by:

$$S \rightarrow SS \mid (S) \mid ()$$

Show two different left-most reductions for  $()()()()$ .