
Question 1 (10%)
Consider the following grammar
\[ S \rightarrow D \mid DS \]
\[ D \rightarrow 0 \mid 1 \mid 2 \mid 3 \mid 4 \mid 5 \mid 6 \mid 7 \mid 8 \mid 9 \]

(a) Find a leftmost derivation of the string 7801.

(b) Find a rightmost derivation of the string 7801.

Question 2 (10%)
Find a grammar for each of the following languages. Note that \( \mathbb{N} \) represents the set of natural numbers \( \mathbb{N} = \{0, 1, 2, 3, \ldots\} \).

(a) \( \{bb, bbbb, bbbbbbb, \ldots\} = \{(bb)^{n+1} \mid n \in \mathbb{N}\} \)

(b) \( \{a, ba, bba, bbba, \ldots\} = \{b^n a \mid n \in \mathbb{N}\} \)

Question 3 (10%)
Find a grammar for \( \{a^m b c^n \mid m, n \in \mathbb{N}\} \)

Question 4 (10%)
Find a grammar for the set of binary numerals that represent even natural numbers.

Note: Total for this assignment is 40.