Test3

Context-Free Grammar

$$L_1 = \{w\ \epsilon\{0,1\}^* |\ w = w^R\ AND\ |w| = even\ \}$$
$$L_2 = \{w\ \epsilon\{0,1\}^* |\ \text{length is odd and its middle is } 0\}$$
$$L_3 = \{a^i b^j c^k\ |\ j > i + k\}$$

a. Write down a **Context-Free Grammar** for L_1

b. Write down a **Context-Free Grammar** for L_2

c. Write down a **Context-Free Grammar** for L_3

Derivations, Parse Tree, Ambiguity

Take a look at the grammar below and solve the following problems.

$$A \to 1A \mid 1C \mid 0B \mid 00A$$
$$B \to 0A \mid 1B \mid 00B$$
$$C \to 0C0 \mid 0C1 \mid 1C0 \mid 1C1 \mid \varepsilon$$

(a) **Give** a leftmost derivation for the string 01011001. (3 points)

(b) **Sketch** the parse tree corresponding to the derivation you gave in (a). (2 points)

(c) **Demonstrate** that the given grammar is ambiguous by showing two more parse trees (apart from the one you already found in (b)) for the same string. (3 points)

(d) **Find** a string w of length six such that w has exactly one parse tree in the grammar above. (1 point)

Pushdown Automata

$L_1 = \{w\ \epsilon\{0,1\}^* |\ w_1 \# w_2 : \text{where number of 00s in w1 is equal to the number of 11s in w2}\}$
$L_2 = \{a^x b^y\ |\ \ m >= 2n\ \}$

a. Write down a Pushdown Automata for L_1

b. Write down a Pushdown Automata for L_2

Regular Expression

$$L_1 = \{w\ \ \epsilon\{0,1\}^* |\ \text{w does not contain } 101\}$$
$$L_2 = \{w\ \ \epsilon\{0,1\}^* |\ \text{w does not end with } 00\}$$

a. Design a **Regular Expression** that recognizes the language L_1

b. Design a **Regular Expression** that recognizes the language L_2

c. Convert the following Regular Expression into a NFA and then CFG

$$(a+b)^*(a^*+(ba)^*)$$
