CSCI 4325
Review 2

Problem 1: Prove that the following languages are not regular.

(a) $L_1 = \{ww \mid w \in \{a, b\}^*\}$

(b) $L_2 = \{w \mid w \in \{a, b\}^*$ and the number of a's is greater than the number of b's$\}$

Problem 2: Prove that the following languages are not regular.

(a) $L_1 = \{a^n b^n c^n \mid n \geq 0\}$

(b) $L_2 = \{ww^R \mid w, w^R \in \{a, b\}^*$ and w^R is the reversal of $w\}$

Problem 3: Let $L = \{w \mid w \in \{a, b\}^*$ and w has twice as many a's than b's$\}$.

(a) Design a CFG to generate L

(b) Convert the CFG to Chomsky Normal Form (CNF)

(c) Design a PDA to accept L

Problem 4: Let $L = \{a^i b^j \mid i \neq j\}$

(a) Design a CFG to Generate L

(b) Convert the CFG to Chomsky Normal Form (CNF)

(c) Design a PDA to accept L

Problem 5: Consider the following CFG $G = (V, \Sigma, R, E)$, where V, Σ, and R are as follows:

$V = \{+, -, *, /, (,), id, T, F, E\}$,

$\Sigma = \{+, -, *, /, (,), id\}$,

$R = \{E \longrightarrow E + T \mid E - T \mid T,$

$T \longrightarrow T * F \mid T / F \mid F,$

$F \longrightarrow (E) \mid id\}$

(a) Draw a parse tree for $w = (id + id * id) / (id - id)$.

(b) Prove that G is unambiguous.

Problem 6: Prove that the language $L = \{a^n b^n c^n \mid n \geq 0\}$ is not CF.

Problem 7: Prove that the language $L = \{w \mid w \in \{a, b, c\}^*$ and w has an equal number of a's, b's, and c's$\}$ is not CF.