CMPS 130
HW #7

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Exercises 2.3 and 2.4
CFG Proof

2.3 G:

$R \to XRX \mid S$
$S \to aTb \mid bTa$
$T \to XTX \mid X \mid \varepsilon$
$X \to a \mid b$

a. Variables: R, S, T, X
b. Terminals: a, b
c. Start: R
d. ab, ba, aab
e. a, b, ε
f. False
g. True
h. False
i. True
j. True
k. False
l. True
m. True
n. False
o. L(G) is all a and b strings as long as they are NOT palindromes

2.4

a. {w | w contains at least three 1's}

$A \to B1B1B1$
$B \to 0B \mid 1B \mid \varepsilon$

b. {w | w starts and ends with the same symbol}

$A \to 0B0 \mid 1B1 \mid 0 \mid 1$
$B \to 0B \mid 1B \mid \varepsilon$

c. {w | the length of w is odd}

$A \to 0B \mid 1B$
$B \to 0A \mid 1A \mid \varepsilon$

[d] $\{w \mid$ the length of w is odd and its middle symbol is a $0\}$

$A \to 0 \mid 0A0 \mid 0A1 \mid 1A0 \mid 1A1$

[e] $\{w \mid w = w^R,\ w$ is a palindrome$\}$

$A \to 0A0 \mid 1A1 \mid 0 \mid 1 \mid \varepsilon$

[f] The empty set

$A \to A$

[3] $\{x \in \{a,b\}^* \mid x \neq ww$ for some $w \in \{a,b\}^*\}$ give a CFG

$S \to a \mid b \mid aT \mid bR$

$T \to b \mid R$

$R \to a \mid T$