Cpts 317 Homework #8

1. Describe the language generated by the following grammar G:

$S \to 0S \mid S1 \mid 0 \mid 1$

* Null will not be accepted here

- The given grammar accepted strings like {0, 1, 00, 01, 11, 000, 001, 011, 111} but not {Λ, 10, 010, 100, 101, 110...}

L(G) = All strings excluding substrings of 10.

Since 0 and 1 are terminal symbols, a string can end with either of them. However, we are unable to generate 10, but 11 can be generated due to a problem with the production rule $S \to S1$.

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2. Describe the language generated by the following grammar G:

$S \to 0S \mid S1 \mid \Lambda$

* Null will be accepted

* Grammar G producses is all strings over 0 and 1 end with either 0 or 1.

* Production Rules are given in such a way that we can generate all possible things including NULL

L(G) = Any possible string over 0 and 1.

3. Describe the language generated by the following grammar G:

$S \to 0S11 \mid \Lambda$

* The language that the given grammar G produces is all possible strings start with 0 and end with 11

* The string contains two times of 1 in terms of 0 i.e. $L(G) = \{0^n 1^{2n} \mid n >= 0\}$

* Null is accepted

* production rules are given in such away that we can generate $L(G) = \{0^n 1^{2n} \mid n >= 0\}$

$$L(G) = \{0^n 1^{2n} \mid n >= 0\}$$

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4. Given a context-free grammar that generates regular language $(1+0)^*10$.

$S \to A10$

$A \to 0A \mid 1A \mid 0 \mid 1 \mid \epsilon$

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5. $S - AB$

$A - 000A11 \mid 00011$

$B - 0B1 \mid 01$

A: will generate $0^{3n} 1^{2n}$

B: will generate $0^m 1^m$

6. Give a Context-free grammar that generates langrage

$\{0^n 1^m : n > 2m\}$

→ 00S1 is to have twice the number of 0s

0S is to have more number of 0s

CFG = $S \to 00S1 \mid 0S \mid 0$

7. Give a Context-free grammar that generates language

$\{0^n 1^m : n < 2m\}$

B is for 11^*

A is to have $n = 2n$

CFG : $S \to AB \mid 0AB \mid B \mid 0B$

$A \to 00A1 \mid 001$

$B \to 1Y \mid 1$

8. Give a Context-free grammar that generates language

$\{0^n 1^m : n \neq 2m\}$

$S \to G \mid H$

$G \to 00G1 \mid 0G \mid 0$

$H \to AB \mid 0AB \mid B \mid 0B$

$A \to 00A1 \mid 001$

$B \to 1Y \mid 1$

9. Eliminate Λ-productions from the following context free-grammar

$S \to ASB \mid AB \mid ab$

$A \to AS \mid a \mid \Lambda$

$B \to SB \mid A \mid b$

$\to$

$B \to \lambda$ is null production

$S \to ASB$ $\quad S \to AB$ $\quad B \to SB$

$S \to AS$ $\quad S \to A$ $\quad B \to S$

$S \to ASB$ $\quad S \to AB$

$S \to SB$ $\quad S \to B$

$A \to AS$ $\quad B \to A$

$A \to S$ $\quad B \to \lambda$

Final production:

$S \to ASB \mid AB \mid SB \mid AS \mid A \mid B \mid ab$

$A \to As \mid a$

$B \to SB \mid A \mid S \mid b$

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10. Elimate unit productions from the following context free grammar:

$S \to B \mid SB \mid ab$

$A \to a \mid SA$

$B \to A \mid SB \mid b$

Removing unit productions

$S \to B$ and $B \to A$

$B \to A$, replace A with rule $A \to a \mid SA$

- Therefore, $B \to a \mid SA \mid SB \mid b$

In $S \to B$, replace B with rule $B \to a \mid SA \mid SB \mid b$

- Therefore, $S \to a \mid SA \mid SB \mid b \mid ab$

After climinating unit productions:

$S \to a \mid SA \mid SB \mid b \mid ab$

$A \to a \mid SA$

$B \to a \mid SA \mid SB \mid b$

11. Transform the following grammar into CNF (Chomsky normal form):

$S \to AbBaS \mid ASA \mid AB \mid ab$

$A \to bB \mid a$

$B \to SBb \mid b$

$S \to H_0 S$

$H_1 B$

$A B$

$H_2 H_3$

$A \to H_3 B$

a

$B \to H_4 H_5$

b

$H_0 \to H_5 H_2$

$H_1 \to A S$