# 342 Assignment : cfg

March 28, 2021

Total points: 36
Due Date: Mar 27 2021
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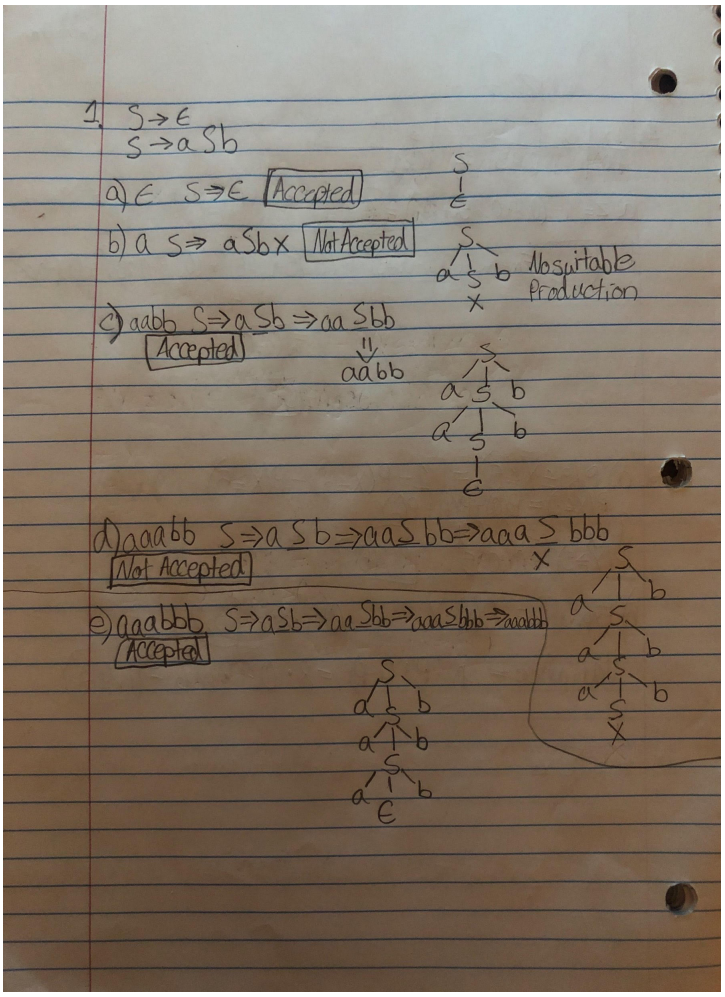
6 points for each question.

1. • Consider the following grammar.

   – Terminals : "a", "b"
   – Non-terminals : S
   – Start Symbol: S
   – Production rules:
     * $S \rightarrow \epsilon$
     * $S \rightarrow aSb$

   For each of the strings, state whether the grammar accepts it or not, and whether or not it accepts, try to give a parse tree. if the grammar does not accept it, you wont be able to make a full parse tree - do this till however much you can and show where it fails

   (a) $\epsilon$
   (b) $a$
   (c) $aabb$
   (d) $aaabb$
   (e) $aaabbb$




2. • Consider the following grammar.

   – Terminals : "a", "b"
   – Non-terminals : S
   – Start Symbol: S
   – Production rules:
     * $S \rightarrow aSb$

   For each of the strings, state whether the grammar accepts it or not, and whether or not it accepts, try to give a parse tree. if the grammar does not accept it, you wont be able to make a full parse tree - do this till however much you can and show where it fails

   (a) $\epsilon$

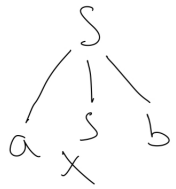
(b) $a$
(c) $aabb$
(d) $aaabb$
(e) $aaabbb$

2.) $S \rightarrow aSb$

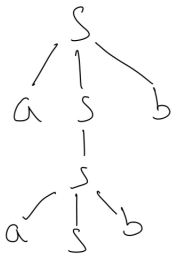
a.) $\varepsilon$ $S \rightarrow aSb$ X NOT Accepted


No Suitable Production

b.) a $S \rightarrow aSb$ X NOT Accepted

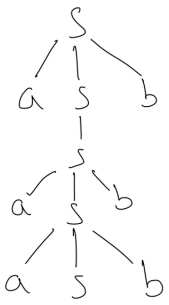



c.) aabb $S \rightarrow aSb \rightarrow aaSbb$ Accepted



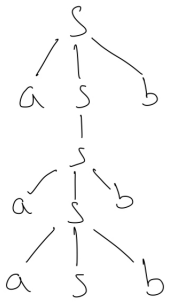
d.) aaabb $S \to aSb \to aaSbb \to aaaSbbb$ ✗

NOT Accepted



e.) aaabbb $S \to aSb \to aaSbb \to aaaSbbb$

Accepted

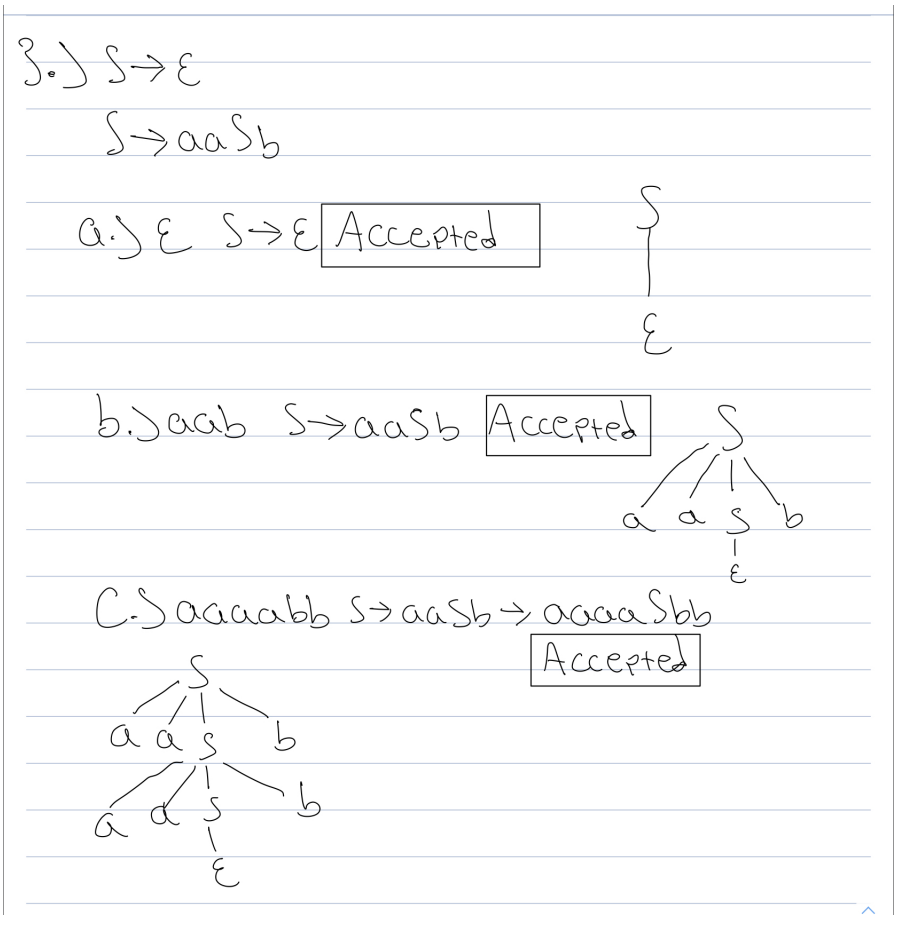


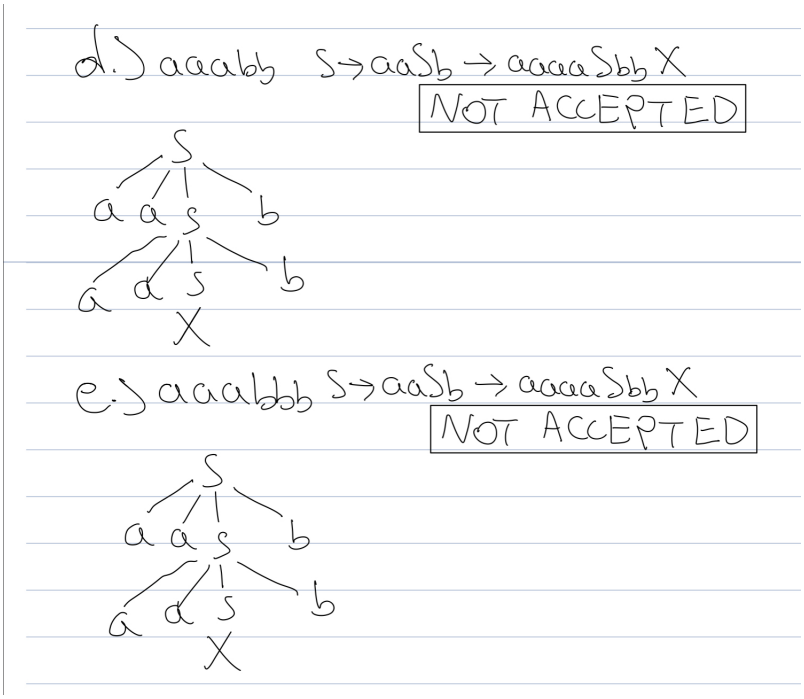
- What is the language accepted by this grammar?
  $L = \{s \mid s$ number of a's in s = number of b's in s $\}$

3. - Consider the following grammar.
     - Terminals : "a", "b"
     - Non-terminals : S
     - Start Symbol: S
     - Production rules:
       * $S \to \epsilon$
       * $S \to aaSb$

For each of the strings, state whether the grammar accepts it or not, and whether or not it accepts, try to give a parse tree. if the grammar does not accept it, you wont be able to make a full parse tree - do this till however much you can and show where it fails

- $\epsilon$
- $aab$
- $aaaabb$
- $aaabb$
- $aaabbb$






- What is the language accepted by this grammar?
  $L = \{s \mid s$ number of a's in s is twice the number of b's in s $\}$

4. • Consider the following grammar.

   – Terminals : "a", "b"
   – Non-terminals : S, A
   – Start Symbol: S
   – Production rules:
     * $S \to A$
     * $S \to aSb$
     * $A \to a$
     * $A \to Aa$

   For each of the strings, state whether the grammar accepts it or not, and whether or not it accepts, try to give a parse tree. if the grammar does not accept it, you wont be able to make a full parse tree - do this till however much you can and show where it fails

   – $\epsilon$
   – $a$
   – $aabb$
   – $aaabb$

– *aaaaabbb*

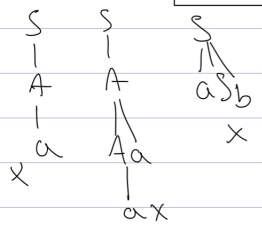
4.) $S \to A$

$S \to aSb$

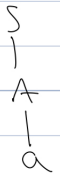
$A \to a$

$A \to Aa$

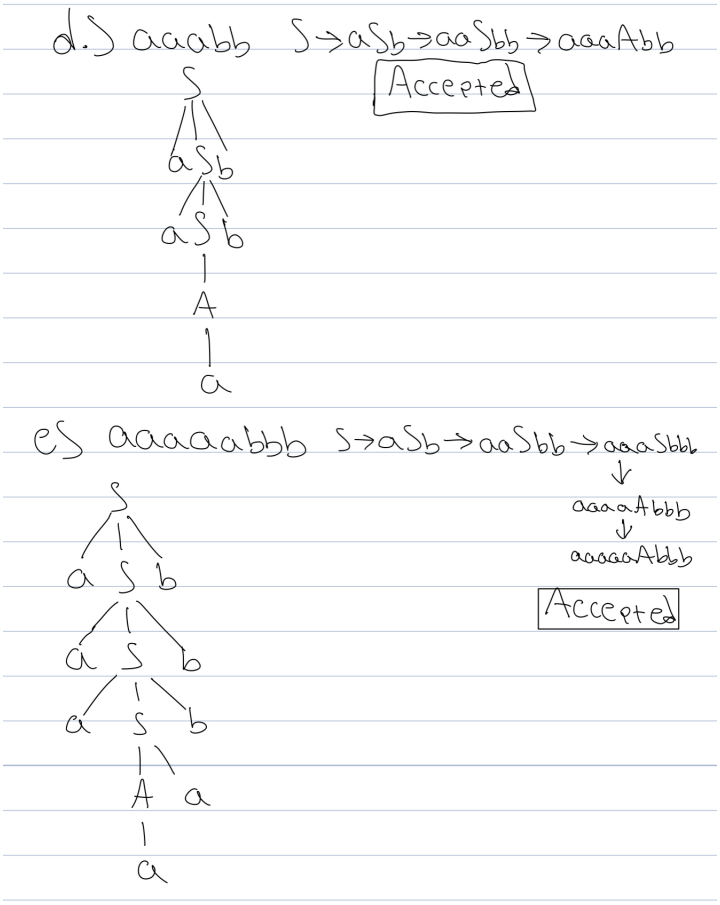
a.) $\varepsilon$ $S \to AX$ Not Accepted



b.) a $S \to A \to a$ Accepted



c.) aabb $S \to aSb \to aaSbb$ Accepted




- What is the language accepted by this grammar?
  $L = \{s \mid s$ number of a's in s = number of b's in s OR number of a's in s is greater than number of b's in s by at most 2$\}$

5. - Consider the following grammar.

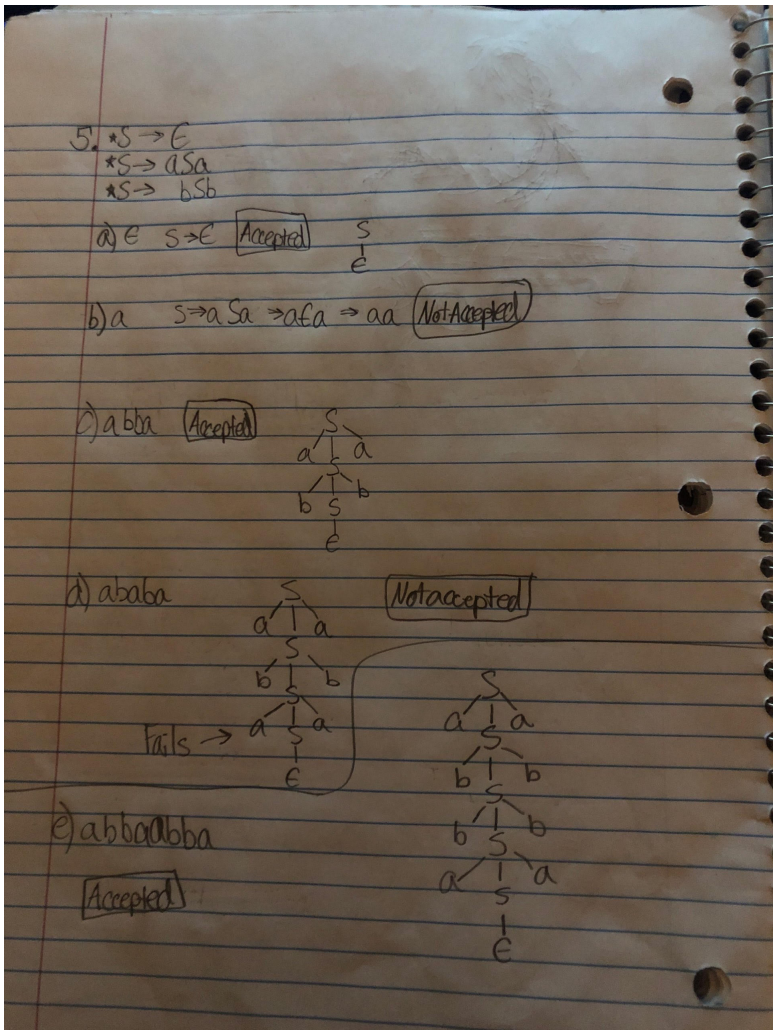
     - Terminals : "a", "b"
     - Non-terminals : S, A
     - Start Symbol: S
     - Production rules:
       * $S \rightarrow \epsilon$
       * $S \rightarrow aSa$
       * $S \rightarrow bSb$

     For each of the strings, state whether the grammar accepts it or not, and whether or not it accepts, try to give a parse tree. if the grammar

does not accept it, you wont be able to make a full parse tree - do this till however much you can and show where it fails

- $\epsilon$
- $a$
- $abba$
- $ababa$
- $abbaabba$

- What is the language accepted by this grammar?
  $L = \{s \mid s$ number of a's and b's in s is even $\}$




6. Give a grammar for the following languages. You only need to attempt this. For all of these the alphabets (terminals) are {a, b} and the start state is S.

(a) $L = \{s \mid s$ number of a's in s $>$ number of b's in s $\}$

(b) $L = \{s \mid s$ s is odd-lengthed palindromes $\}$

(c) $L = \{s \mid s$ number of a's in s is three times number of b's in s and all the a's come before b's $\}$