342 Assignment : cfg

March 28, 2021

Total points: 36
Due Date: Mar 27 2021
Julian Garcia
Caleb Carnathan
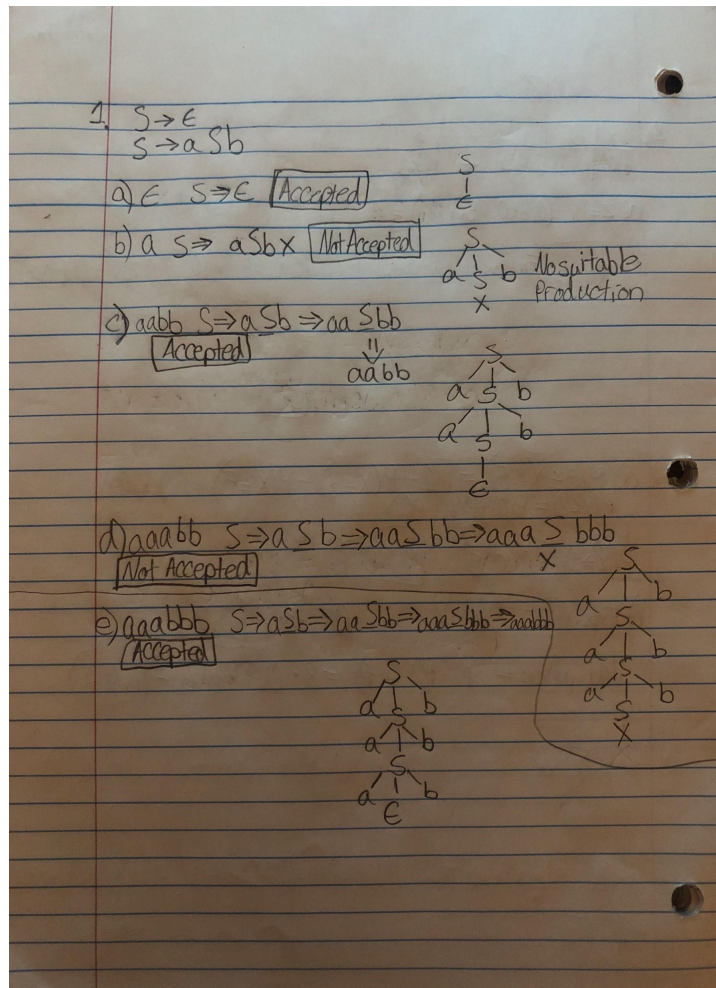
6 points for each question.

1. • Consider the following grammar.

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

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

1. $S \to \epsilon$
   $S \to aSb$

a) ϵ $S \to \epsilon$ [Accepted]

b) a $S \Rightarrow aSbx$ [Not Accepted]

No suitable Production

c) $aabb$ $S \Rightarrow aSb \Rightarrow aaSbb$
   [Accepted]

   $aabb$

d) $aaabb$ $S \Rightarrow aSb \Rightarrow aaSbb \Rightarrow aaaSbbb$
   [Not Accepted]

e) $aaabbb$ $S \Rightarrow aSb \Rightarrow aaSbb \Rightarrow aaaSbbb \Rightarrow aaabbb$
   [Accepted]

2. • Consider the following grammar.

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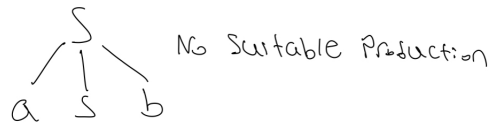   – Production rules:
     * $S \to aSb$

   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) ϵ

(b) *a*

(c) *aabb*

(d) *aaabb*
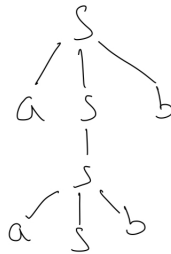
(e) *aaabbb*

2.) $S \rightarrow aSb$

    a) ε $S \rightarrow aSb$ $\times$ ‖NoT Accepted‖

    No Suitable Production

    b.) a $S \rightarrow aSb$ $\times$ ‖NOT Accepted‖

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

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

NOT Accepted

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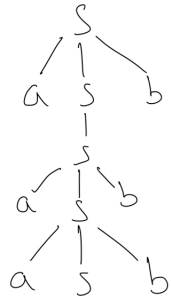
e.) aaabbb $S \to aSb \to aaSbb \to aaaSbbb$

Accepted
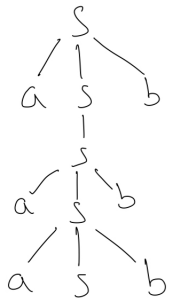
- What is the language accepted by this grammar?

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

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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
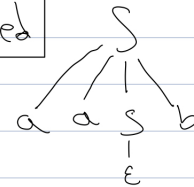
- ϵ
- *aab*
- *aaaabb*
- *aaabb*
- *aaabbb*

3.) $S \to \mathcal{E}$

$S \to aaSb$

a.) $\mathcal{E}$ $S \to \mathcal{E}$ | Accepted |

S
|
$\mathcal{E}$

b.) aab $S \to aaSb$ | Accepted |
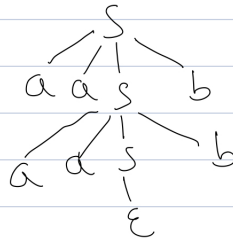
S
 / | \ \
a a S b
      |
      $\mathcal{E}$

c.) aaaabb $S \to aaSb \to aaaaSbb$
| Accepted |

S
 / | \ \
a a S b
      / | \ \
     a a S b
           |
           $\mathcal{E}$

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d.) aaabb S→aaSb → aaaaSbb X

NOT ACCEPTED

e.) aaabbb S→aaSb → aaaaSbb X

NOT ACCEPTED

- What is the language accepted by this grammar?

4. - Consider the following grammar.
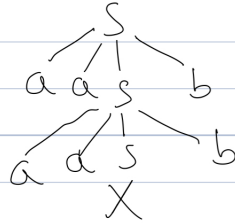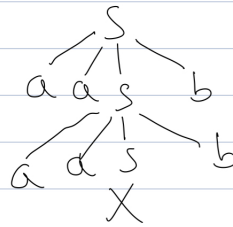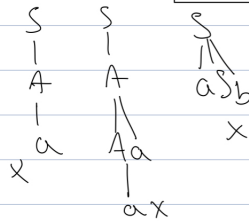
    - Terminals : "a", "b"
    - Non-terminals : S, A
    - Start Symbol: S
    - Production rules:
        * $S \rightarrow A$
        * $S \rightarrow aSb$
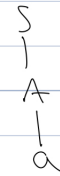   * $A \rightarrow a$
        * $A \rightarrow Aa$

    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

    - ϵ
    - a
    - $aabb$
    - $aaabb$

- *aaaaabbb*

4.) S→A
   S→aSb
   A→a
   A→Aa

a.) Ɛ   S→AX   NoT Accepted

S
|
A
|
a
|
x

S
|
A
/ \
A a
|
a x

S
/|\
a S b
|
x

b.) a   S→A→a   Accepted

S
|
A
|
a

c.) aabb   S→aSb → aaSbb   Accepted

S
/|\
a S b
/|\
a S b
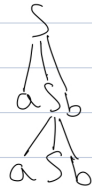
d.) aaabb $S \to aSb \to aaSbb \to aaaAbb$

Accepted

S
/ | \
a S b
/ | \
a S b
|
A
|
a
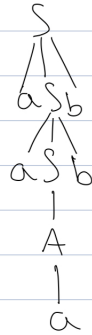
e.) aaaaabbb $S \to aSb \to aaSbb \to aaaSbbb$
↓
aaaaAbbb
↓
aaaaaAbbb

Accepted

S
/ | \
a S b
/ | \
a S b
/ | \
a S b
/ \
A a
|
a
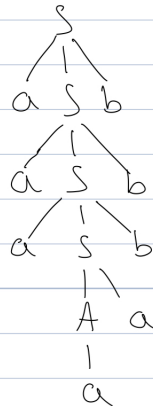
- What is the language accepted by this grammar?

5. - Consider the following grammar.

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

    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

- ϵ
- a
- $abba$
- $ababa$
- $abbaabba$

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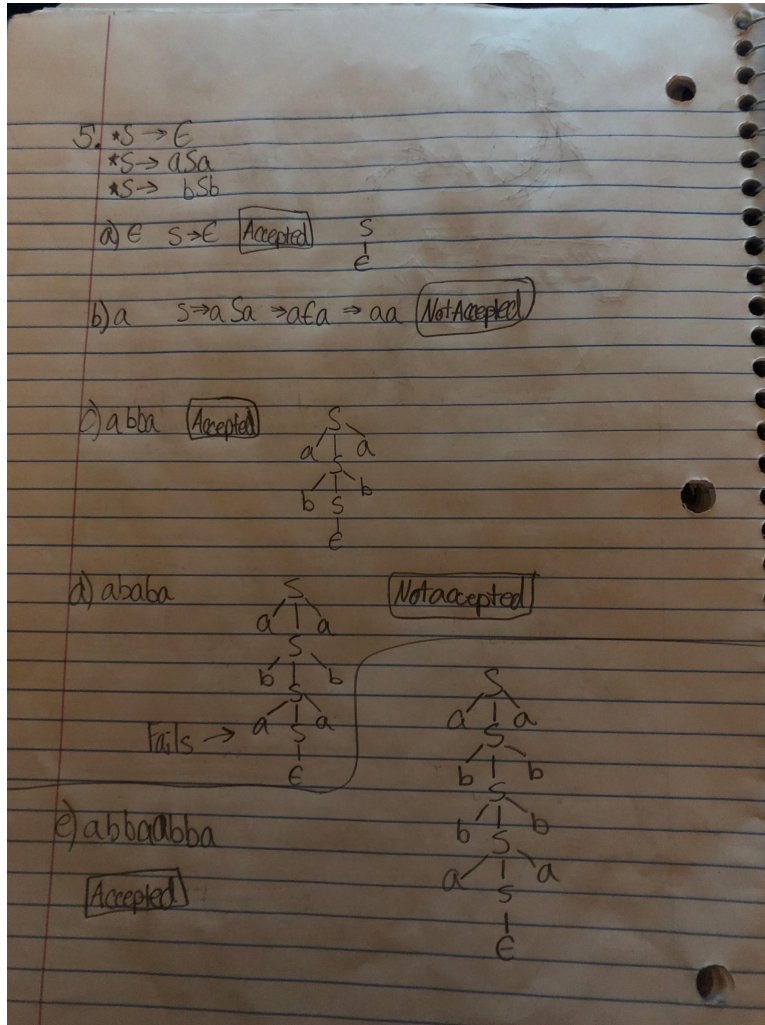
6. Give a grammar for the following languages. You only need to attempt this. For all of these the alphabets (terminals) are {a, b} and the start state is S.

   (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 $\}$

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(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 $\}$

6. a) $S \rightarrow a\,Sb$
       $S \rightarrow bSa$
       $S \rightarrow \epsilon$

   b) $S \rightarrow a/b$
       $S \rightarrow aSa \,/\, bSb$

   c) $S \rightarrow \epsilon$
       $S \rightarrow aaaSb$