

Homework 5

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Homework Description

Context free grammars and parse trees.

Course Details

- **Course** - CS435
- **Instructor** - Dr. Chi-Cheng Lin

Homework Results

Problem Set 1

Complete exercise 1b from Chapter 11

$$\Sigma = \{a, b\}$$

$$G = \{S \rightarrow aSa|bSb|a \mid b\}$$

Part I

List 5 strings that are in L: $\{a, b, aaa, aba, bab\}$

Part II

List 5 strings that are not in L: $\{\epsilon, aa, bb, ab, ba\}$

Part III

Describe L concisely. You can use regular expressions, expressions using variables, etc: This language contains a set of palindromes, where there is a central character. This can be represented by the the language:

$$L = \{w = z(a \cup b)z : z \text{ is a sequence of characters } \in (a, b)^*\}$$

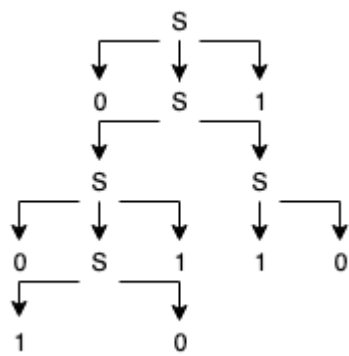
Problem Set 2

Exercise 3b of Chapter 11

Problem

Consider grammar $G = \{S \rightarrow 0S1|SS|10\}$

Show a parse tree produced by G for string 00101101



Problem Set 3

The context free language $L = \{a^i b^j c^k, k \geq 0 \text{ and } (k \leq i \text{ or } k \leq j)\}$ can be defined by the context free grammar $G = (V, \Sigma, R, S)$, where:

```
R = {
S -> A | B,
A -> aAc | aA | M,
B -> aB | F,
F -> bFc | bF | ε,
M -> bM | ε}
```

Part A

What is the value of V?

V is the rule alphabet: { A, B, F, M, S, a, b, c }

Part B

What is the value of Σ?

Σ is the language alphabet: { a, b, c }

Problem Set 4

Show context free grammar for each of the following languages. You only need to show the rule part (R) of the grammar.

Part A

$\{a^i b^j : i, j \geq 0, 3i = 5j + 1\}$

Analysis

i	j
7	4
12	7
17	10
22	13

i	j
Every time we add 5 a's we need to add 3 b's.	

Solution

```
R = {
  T -> aaaaaTbbb | I,
  I -> aaaaaaBBBB
}
```

Part B

$\{a^m b^n c^k : n, k \geq 0, m = n + k\}$

Analysis

m	n	k
0	0	0
1	1	0
2	1	1

Solution

```
R = {
  T -> aSc,
  S -> aSb | ε
}
```

Part C

$\{a^m b^n : m, n > 0, m - n \text{ is even if } m \geq n, n - m \text{ is odd if } m < n\}$

Did not have time to finish the problem :(

Part D

$\{w \in \{a, b\}^* : \#_a(w) = \#_b(w) + 2\}$

Analysis

Always two more b's than a's but in any order

Solution

```
R = {
  S -> aSb | bSa | I,
  I -> bb
}
```

Version 1.0

Last updated 2019-11-12 09:28:55 -0500