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CSC 344

First Problem Set Assignment: BNF

Learning Abstract

This assignment features defining BNF and its functions. It also demonstrates making a parse tree using the BNF created.

Problem 1: Shapes

BNF Description

<SL> ::= < empty > | (<style>)

<style> ::= (size <size>) <style> | (color <color>) <style> | (pattern <pattern>) <style> | (shape <shape>) <style>

<style> ::= <empty>

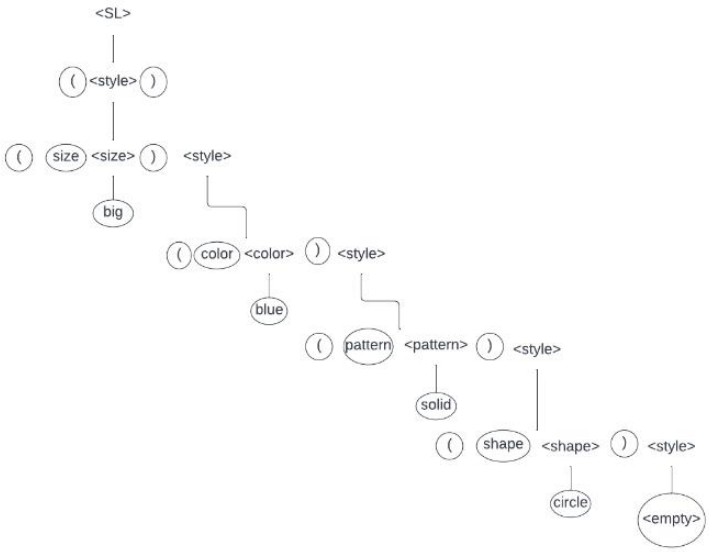
<size> ::= large | medium | small

<color> ::= red | blue | yellow

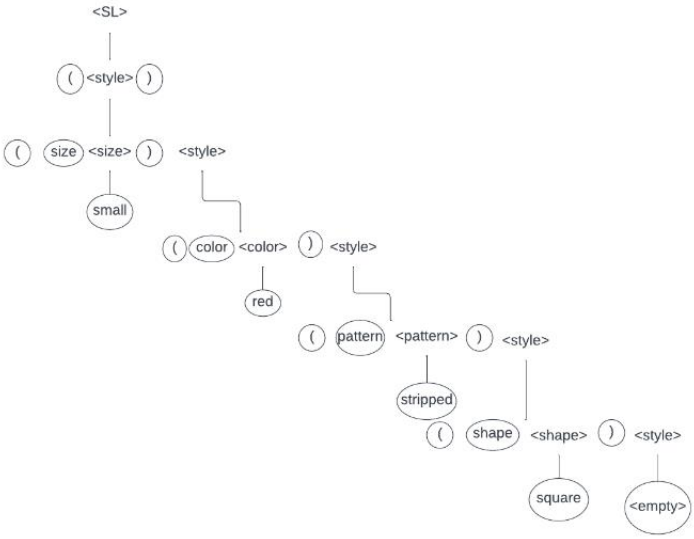
<pattern> ::= stripped | dotted | solid

<shape> ::= circle | triangle | square

Parse Tree for Shapes (1)



Parse Tree for Shapes (2)

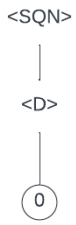


Problem 2 - SQN (Special Quaternary Numbers)

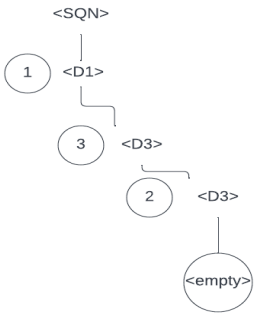
BNF Description

<SQN> ::= <empty> | <D> | 0 <D0> | 1 <D1> | 2 <D2> | 3 <D3>
<D> ::= 0 | 1 | 2 | 3
<D0> ::= 1 <D1> | 2 <D2 > | 3 <D3> | <empty>
<D1> ::= 0 <D0> | 2 <D2> | 3 <D3> | <empty>
<D2> ::= 0 <D0> | 1 <D1> | 3 <D3> | <empty>
<D3> ::= 0 <D0> | 1 <D1> | 2 <D2> | <empty>

Parse Tree for SQN (1)



Parse Tree for SQN (2)



Parse Tree for SQN (3)

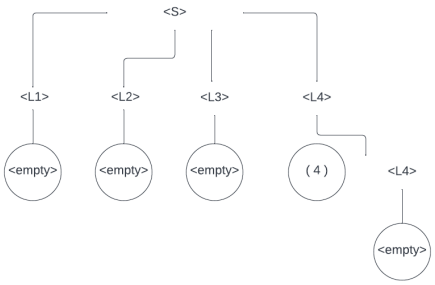
The string “1223” cannot be drawn because the production rule for <D2> won’t allow another 2 to come after.

Problem 3: Fours

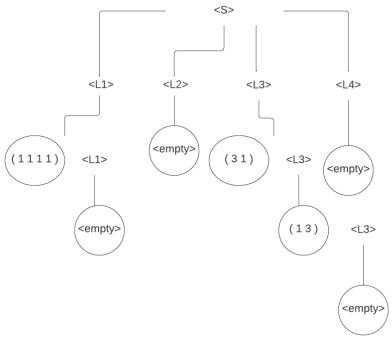
BNF Description

<S> ::= < empty > | <L1><L2><L3><L4>
<L1> ::= (1 1 1 1) | <empty>
<L2> ::= (1 1 2) <L2> | (1 2 1) <L2> | (2 1 1) <L2> | <empty>
<L3> ::= (3 1) <L3> | (1 3) <L3> | <empty>
<L4> ::= (4) <L4> | <empty>

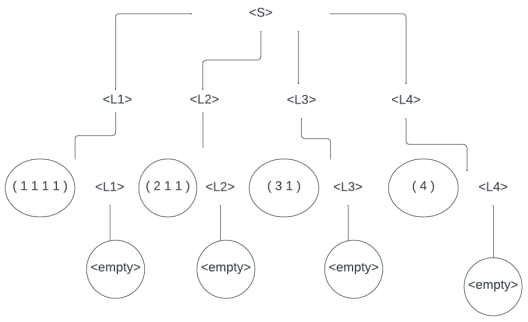
Parse Tree for Fours (1)



Parse Tree for Fours (2)



Parse Tree for Fours (3)

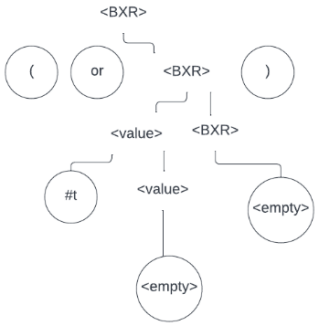


Problem 4: BXR

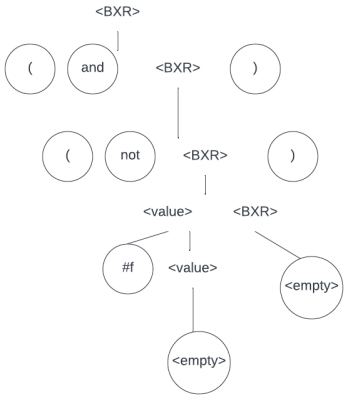
BNF Description

< BXR> ::= (and <BXR>) | (or <BXR>) | (not #f) <BXR> | (not #t) <BXR> | <value> <BXR> | <empty>
<value> ::= #t <value> | #f <value> | <empty>

Parse Tree for BXR (1)



Parse Tree for BXR (2)



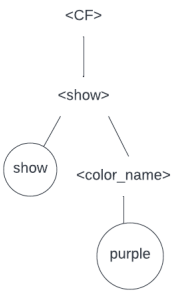
Problem 5: CF (Color Fun)

BNF Description

<CF> ::= <add> | <describe> | <show> | colors | exit
<add> ::= add (<color_RGB> <color_RGB> <color_RGB>) <color_name> | add color <color_name>
<describe> ::= describe <color_name>
<show> ::= show <color_name>
<color_RGB> ::= 0 | 1 | 2 | 3 | … | 256

Parse Tree for CF (1)

Parse Tree for CF (2)



Parse Tree for CF (3)

Problem 6: BNF?

BNF Definition

BNF, short for Backus–Naur Form, was created by a program designer named John Bakus. It's the formal technique used in computer science for structuring and describing the grammar syntax of any programming language. It contains sets of terminal symbols, nonterminal symbols, tokens, and the production rule. The production rule gets used to represent the left-hand nonterminal side being replaced by what is on the right-hand terminal or nonterminal side. After that, a parse tree gets constructed that breaks down the long expression into tiny parts based on the BNF made for it.