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CSC344 BNF Assignment

First Problem Set Assignment

Learning Abstract: In this assignment I made BNF rules with parse trees for languages and then checked them.

Problem 1 - Shapes

$\langle \text{shapes} \rangle ::= (\langle \text{size} \rangle) (\langle \text{color} \rangle) (\langle \text{pattern} \rangle) (\langle \text{shape} \rangle)$

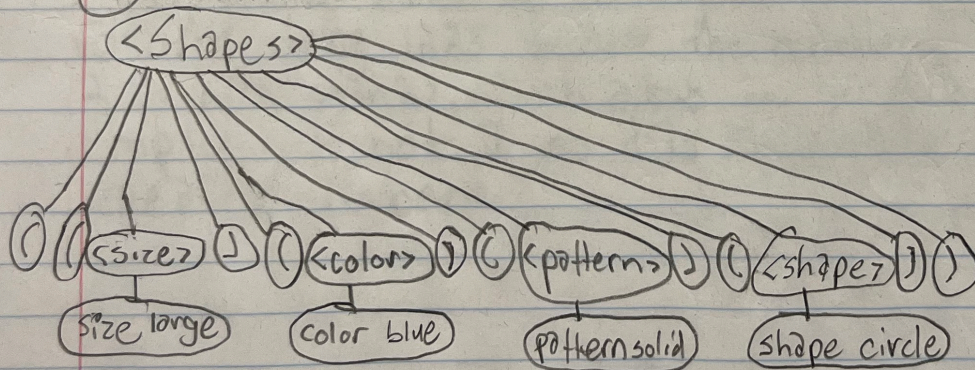
$\langle \text{size} \rangle ::= \text{size large} \mid \text{size medium} \mid \text{size small}$

$\langle \text{color} \rangle ::= \text{color red} \mid \text{color blue} \mid \text{color yellow}$

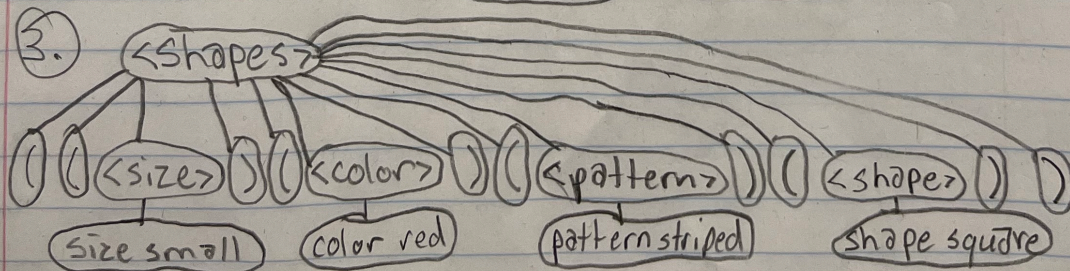
$\langle \text{pattern} \rangle ::= \text{pattern striped} \mid \text{pattern dotted} \mid \text{pattern solid}$

$\langle \text{shape} \rangle ::= \text{shape circle} \mid \text{shape square} \mid \text{shape triangle}$

2.



3.



Problem 2 - SQN (Special Quaternary Numbers)

$\langle \text{SQN} \rangle ::= \langle qtn \rangle$

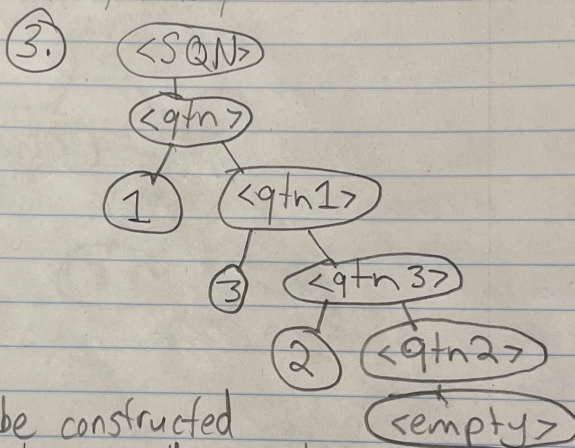
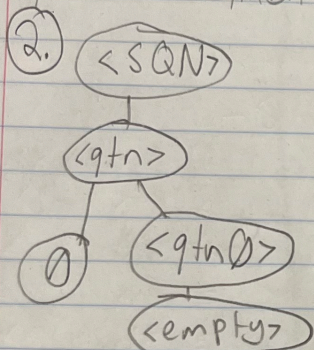
$\langle qtn0 \rangle ::= 1 \langle qtn1 \rangle \mid 2 \langle qtn2 \rangle \mid 3 \langle qtn3 \rangle \mid \langle \text{empty} \rangle$

$\langle qtn1 \rangle ::= 0 \langle qtn0 \rangle \mid 1 \langle qtn1 \rangle \mid 3 \langle qtn3 \rangle \mid \langle \text{empty} \rangle$

$\langle qtn2 \rangle ::= 0 \langle qtn0 \rangle \mid 1 \langle qtn1 \rangle \mid 3 \langle qtn3 \rangle \mid \langle \text{empty} \rangle$

$\langle qtn3 \rangle ::= 0 \langle qtn0 \rangle \mid 1 \langle qtn1 \rangle \mid 2 \langle qtn2 \rangle \mid \langle \text{empty} \rangle$

$\langle qtn \rangle ::= 0 \langle qtn0 \rangle \mid 1 \langle qtn1 \rangle \mid 2 \langle qtn2 \rangle \mid 3 \langle qtn3 \rangle$

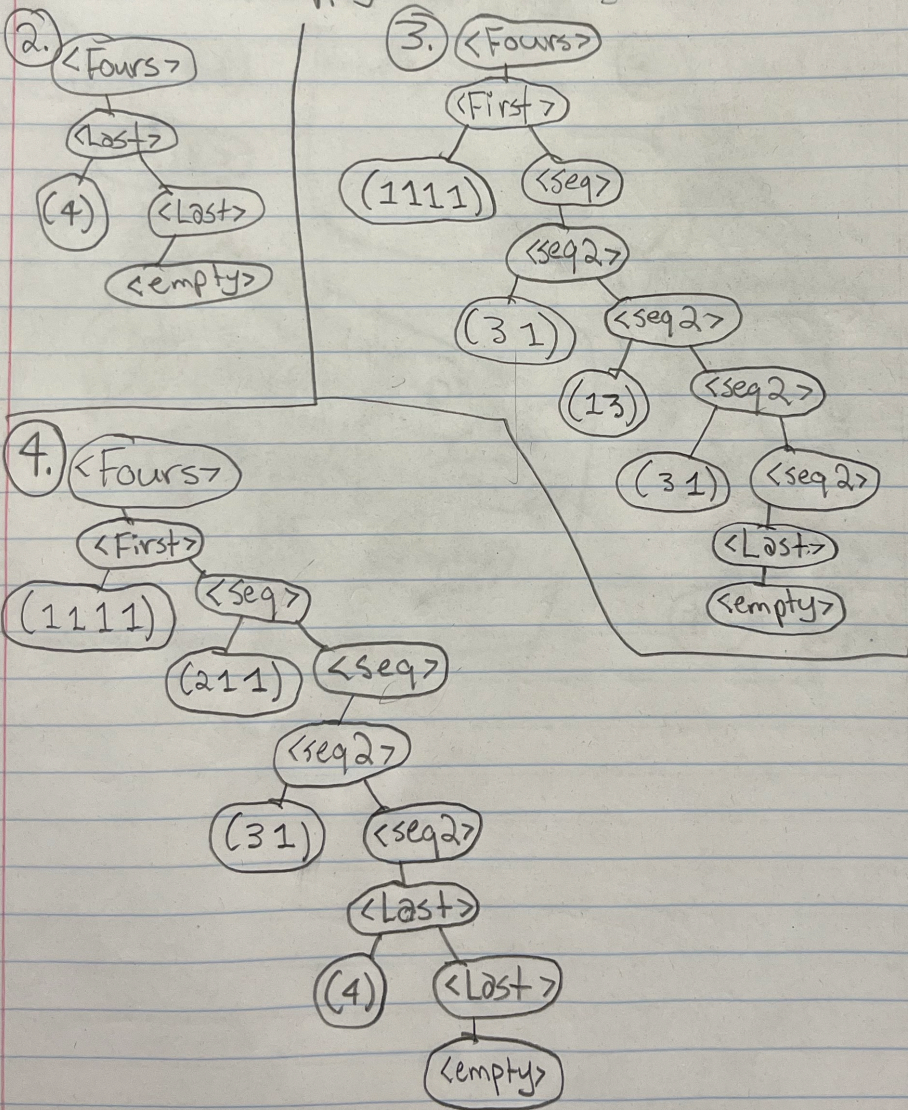


A parse tree cannot be constructed

for the string 1223 because the number

2 is with $\langle qtn2 \rangle$, which allows you to pick 0, 1, 3 or empty, but not 2 so it is impossible to have repeated numbers.

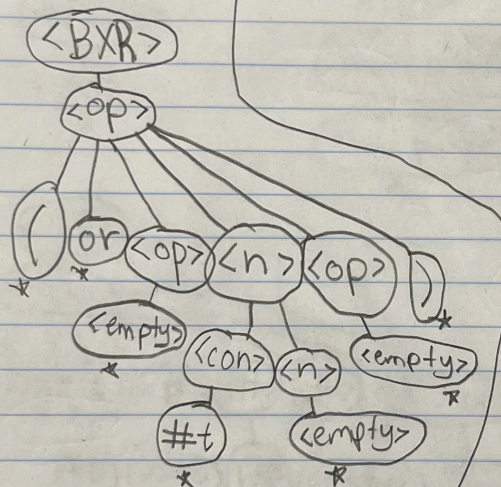
Problem 3-Fours

$$\langle \text{Fours} \rangle ::= \langle \text{First} \rangle$$
$$\langle \text{First} \rangle ::= (1111) | (1111) \langle \text{seq} \rangle | \langle \text{seq} \rangle | \langle \text{seq} 2 \rangle | \langle \text{Last} \rangle$$
$$\langle \text{seq} \rangle ::= (112) \langle \text{seq} \rangle \mid (121) \langle \text{seq} \rangle \mid (211) \langle \text{seq} \rangle \mid \langle \text{last} \rangle \mid \langle \text{seq} 2 \rangle$$
$$\langle \text{seq } 2 \rangle ::= (3 \ 1) \langle \text{seq } 2 \rangle \mid (1 \ 3) \langle \text{seq } 2 \rangle \mid \text{Last}$$
$$\langle \text{Last} \rangle ::= \langle \text{empty} \rangle \mid (4) \langle \text{Last} \rangle$$


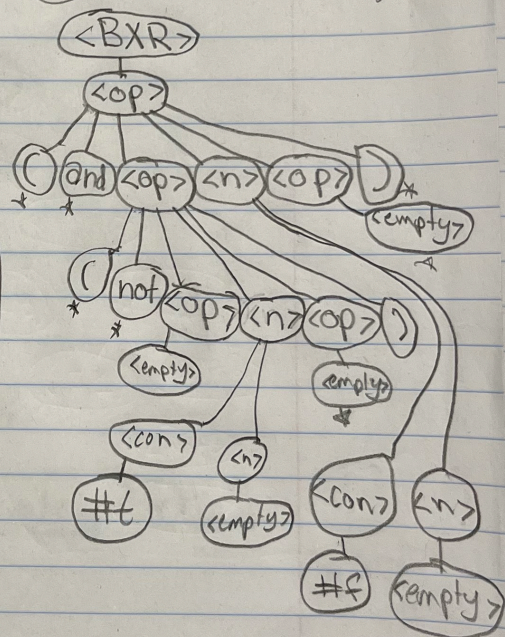
Problem 4-BXR

$\langle \text{BXR} \rangle ::= \langle \text{op} \rangle \mid \langle \text{empty} \rangle$
 $\langle \text{op} \rangle ::= (\text{and } \langle \text{op} \rangle \langle \text{n} \rangle \langle \text{op} \rangle) \mid (\text{or } \langle \text{op} \rangle \langle \text{n} \rangle \langle \text{op} \rangle) \mid (\text{not } \langle \text{op} \rangle \langle \text{n} \rangle \langle \text{op} \rangle) \mid \langle \text{empty} \rangle$
 $\langle \text{n} \rangle ::= \langle \text{con} \rangle \langle \text{n} \rangle \mid \langle \text{empty} \rangle$
 $\langle \text{con} \rangle ::= \#f \mid \#t \mid \langle \text{empty} \rangle$

2. (or #t) * = ending



3. (and (not #t) #f)



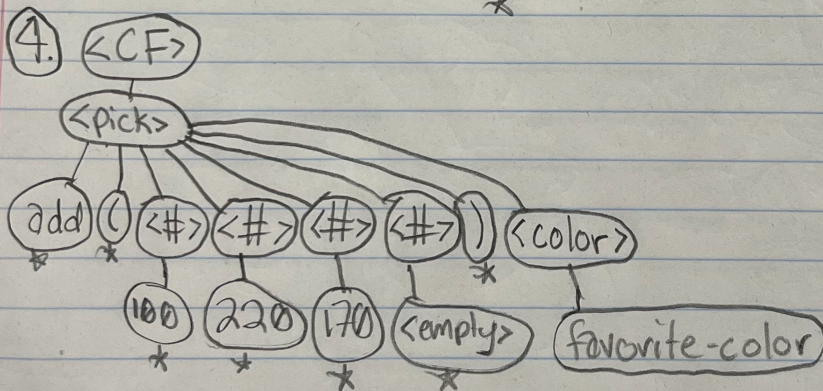
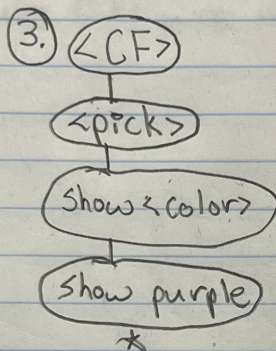
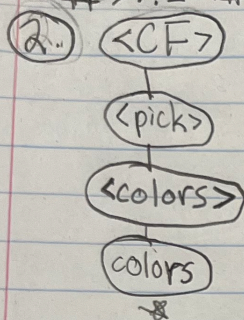
Problem 5 - CF (Color Fun)

$\langle CF \rangle ::= \langle pick \rangle$

$\langle pick \rangle ::= add(\langle \# \rangle \langle \# \rangle \langle \# \rangle \langle \# \rangle) \langle color \rangle \mid describe \langle color \rangle \mid show \langle color \rangle$

$\langle colors \rangle ::= \# \mid \langle empty \rangle$

$\langle \# \rangle ::= \langle \# \rangle \mid \langle empty \rangle$



Problem 6 - BNF?

BNF is a type of grammar that creates structure and rules for a language to follow so that it works without conflict. These rules are written so that all possible outcomes can be outputted through those specific set of rules that were made.

Submitted 23 September 2022.