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September 19th, 2022

Problem Set Assignment #1 BNF

Learning Abstract: This assignment is all about BNF. You will be asked to compose some BNF grammars for given languages. You will be asked to draw some BNF parse trees. You will be asked to describe BNF in English, in a straightforward, compelling manner. This assignment will help you compose parse trees and understand BNF grammar and be able to explain it.

Problem 1 Shapes:

$\langle \text{Shapes} \rangle ::= \langle \text{ent} \rangle$

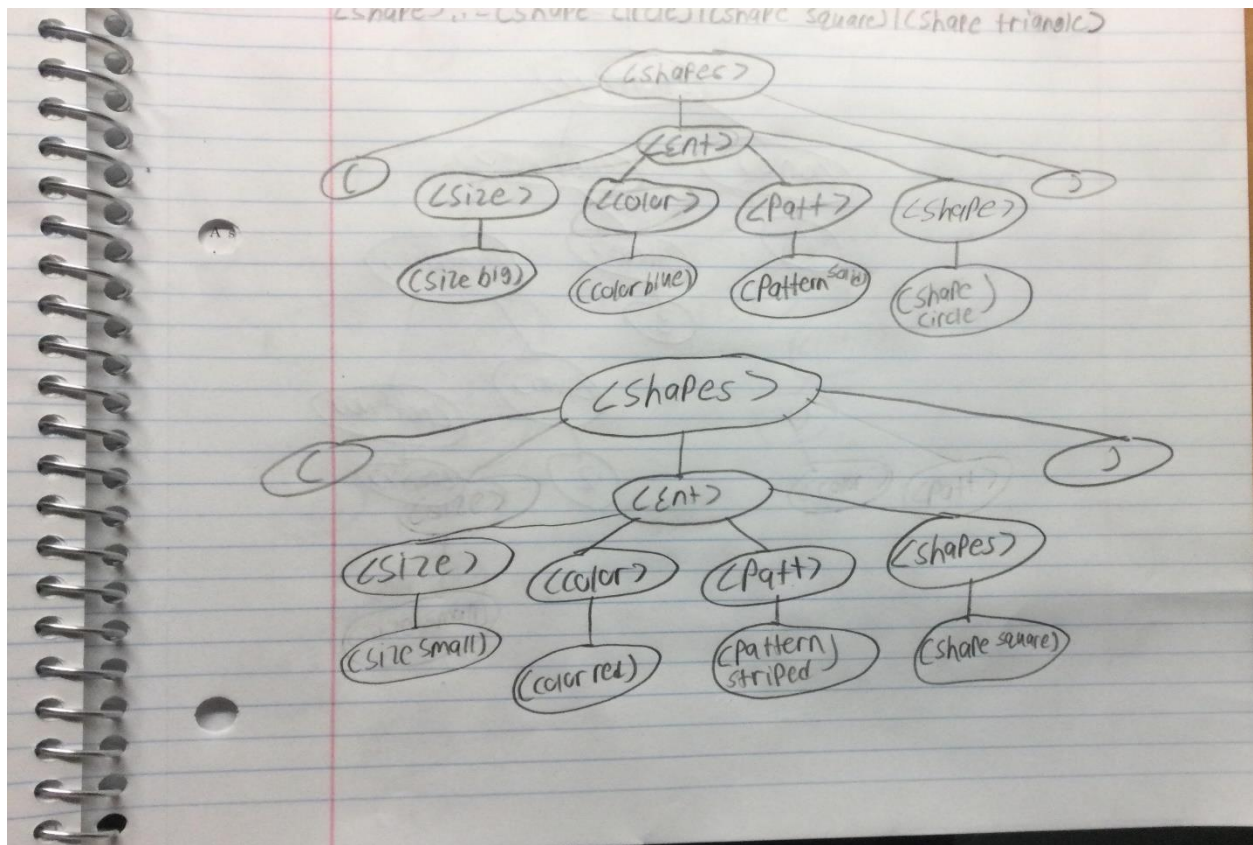
$\langle \text{ent} \rangle ::= (\langle \text{size} \rangle \langle \text{color} \rangle \langle \text{patt} \rangle \langle \text{shape} \rangle)$

$\langle \text{size} \rangle ::= (\text{size big}) \mid (\text{size medium}) \mid (\text{size small})$

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

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

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



Problem 2 SQN:

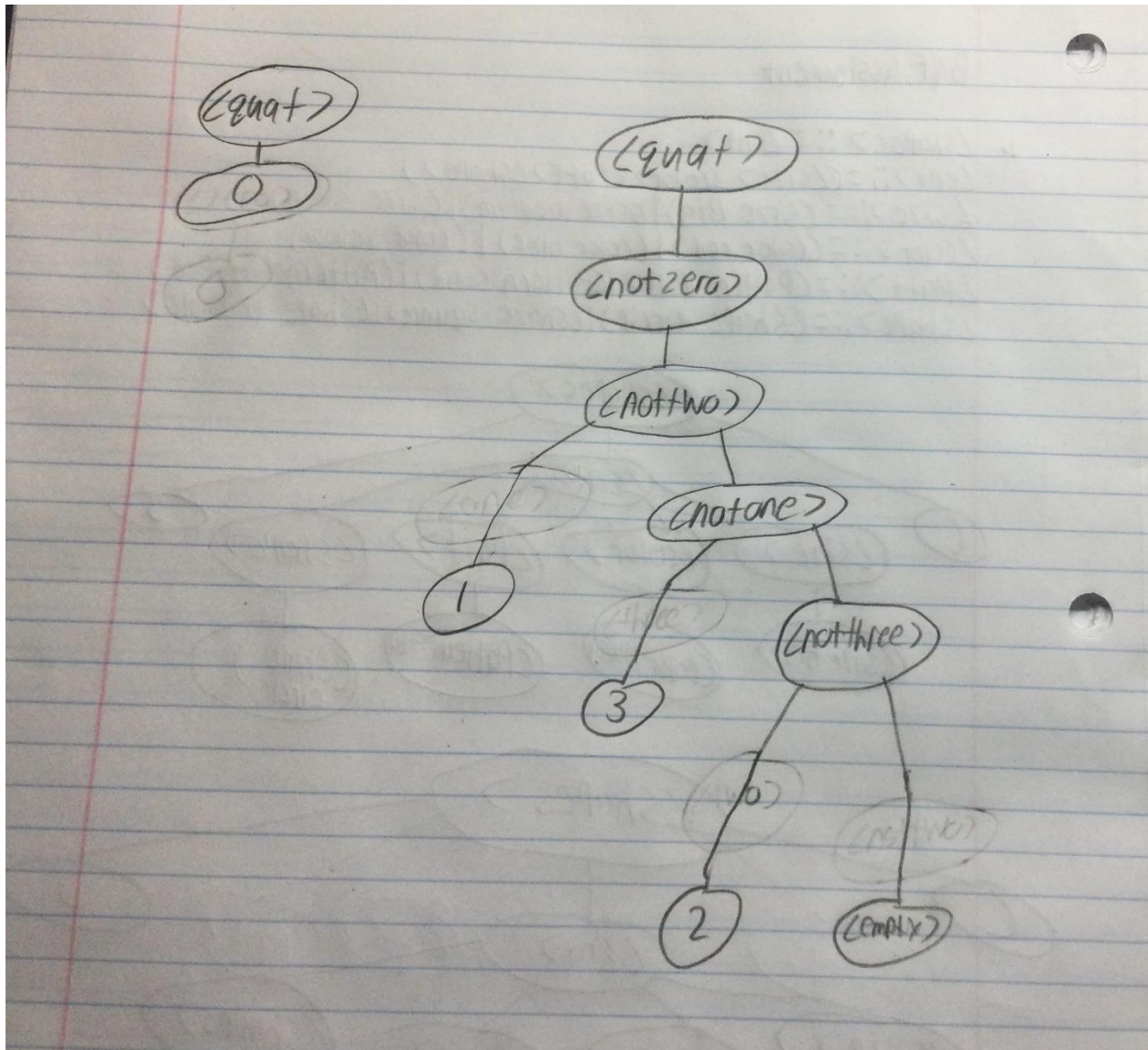
$\langle \text{quat} \rangle ::= \langle \text{zero} \rangle \mid \langle \text{notzero} \rangle \langle \text{zero} \rangle \mid \langle \text{notzero} \rangle$

$\langle \text{notzero} \rangle ::= \langle \text{notthree} \rangle \mid \langle \text{nottwo} \rangle \mid \langle \text{notone} \rangle$

$\langle \text{notone} \rangle ::= \langle \text{zero} \rangle \langle \text{notzero} \rangle \mid \langle \text{two} \rangle \langle \text{nottwo} \rangle \mid \langle \text{three} \rangle \langle \text{notthree} \rangle \mid \langle \text{empty} \rangle$

$\langle \text{nottwo} \rangle ::= \langle \text{zero} \rangle \langle \text{notzero} \rangle \mid 1 \langle \text{notone} \rangle \mid 3 \langle \text{notthree} \rangle \mid \langle \text{empty} \rangle$

$\langle \text{notthree} \rangle ::= 0 \langle \text{notzero} \rangle \mid 1 \langle \text{notone} \rangle \mid 2 \langle \text{nottwo} \rangle \mid \langle \text{empty} \rangle$



Problem 3 Fours:

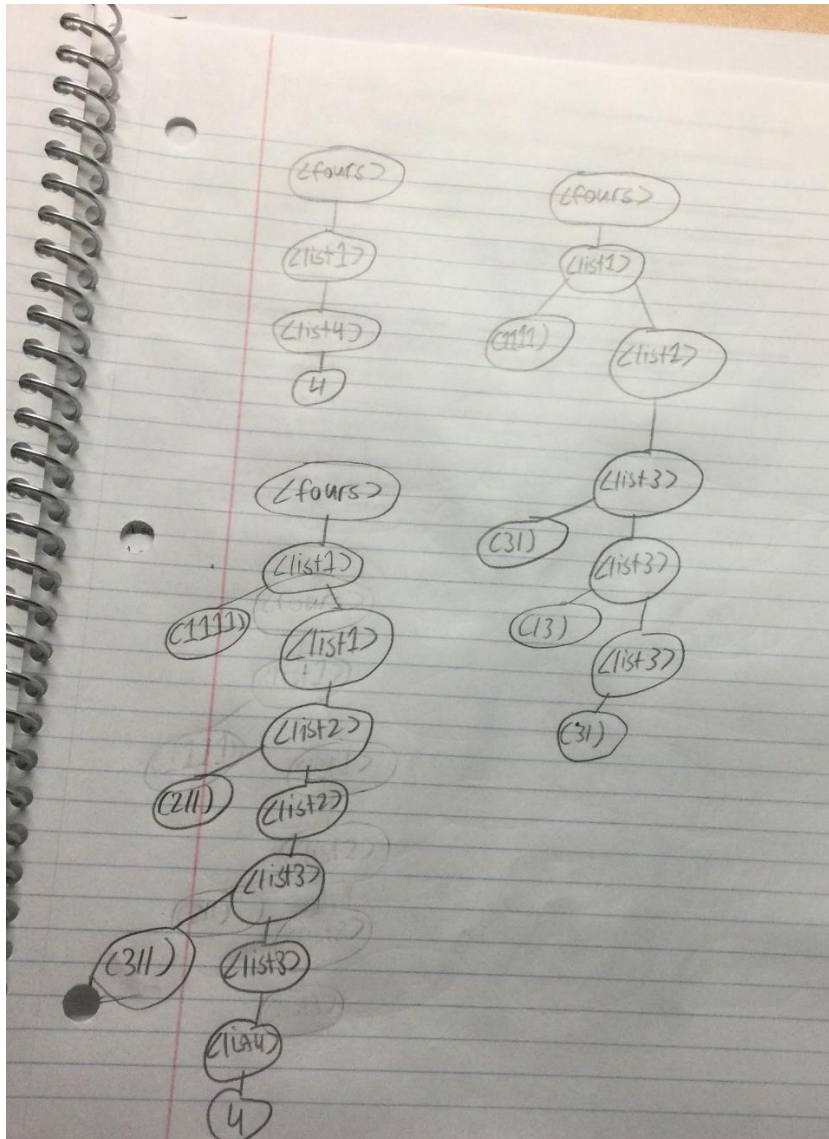
$\langle \text{Fours} \rangle ::= \langle \text{empty} \rangle \mid \langle \text{List1} \rangle \mid \langle \text{List2} \rangle \mid \langle \text{List3} \rangle \mid \langle \text{List4} \rangle$

$\langle \text{List1} \rangle ::= (1111) \mid (1111) \langle \text{List1} \rangle \mid \langle \text{List2} \rangle \mid \langle \text{List3} \rangle \mid \langle \text{List4} \rangle$

$\langle \text{List2} \rangle ::= (112) \mid (112) \langle \text{List2} \rangle \mid (121) \mid (121) \langle \text{List2} \rangle \mid (211) \mid (211) \langle \text{List2} \rangle \mid \langle \text{List3} \rangle \mid \langle \text{List4} \rangle$

$\langle \text{List3} \rangle ::= (31) \mid (31) \langle \text{List3} \rangle \mid (13) \mid (13) \langle \text{List3} \rangle \mid \langle \text{List4} \rangle$

$\langle \text{List4} \rangle ::= (4) \mid (4) \langle \text{List4} \rangle$

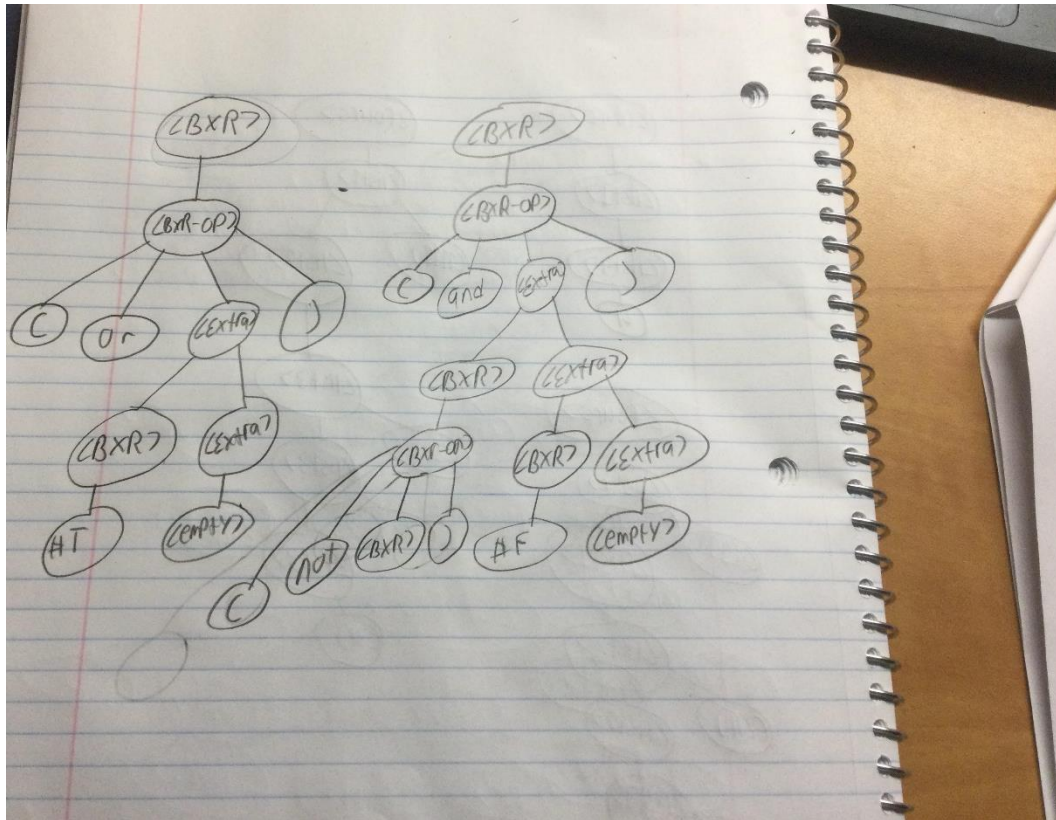


Problem 4 BXR:

$\langle \text{BXR} \rangle ::= \langle \text{BXR-op} \rangle \mid \#f \mid \#t \mid \langle \text{empty} \rangle$

$\langle \text{BXR-op} \rangle ::= (\text{not } \langle \text{BXR} \rangle) \mid (\text{or } \langle \text{Extra} \rangle) \mid (\text{and } \langle \text{Extra} \rangle)$

$\langle \text{Extra} \rangle ::= \langle \text{BXR} \rangle \langle \text{Extra} \rangle \mid \langle \text{empty} \rangle$



Problem 5 Color Fun

$\langle \text{colorfun} \rangle ::= \langle \text{describe} \rangle \mid \langle \text{add} \rangle \mid \langle \text{show} \rangle \mid \langle \text{colors} \rangle$

$\langle \text{describe} \rangle ::= \langle \text{colors} \rangle \mid \langle \text{ColorC} \rangle$

$\langle \text{ColorC} \rangle ::= \langle \text{color1} \rangle \mid \langle \text{color2} \rangle \mid \langle \text{color3} \rangle \mid \langle \text{color4} \rangle \mid \langle \text{favorite-color} \rangle$

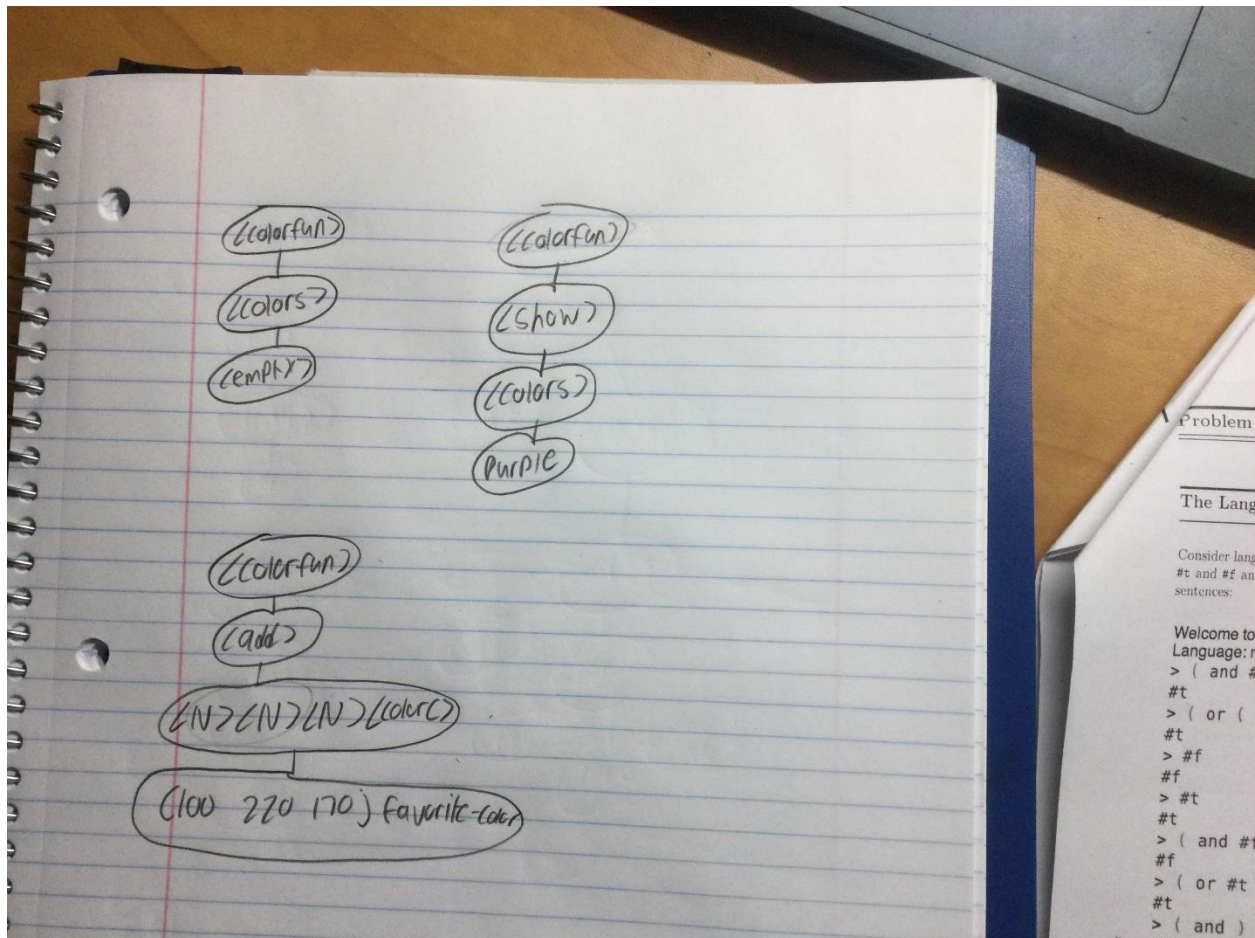
$\langle \text{show} \rangle ::= \langle \text{colors} \rangle \mid \langle \text{ColorC} \rangle$

$\langle \text{add} \rangle ::= (\langle \text{N} \rangle \langle \text{N} \rangle \langle \text{N} \rangle) \langle \text{color} \rangle \mid (\langle \text{N} \rangle \langle \text{N} \rangle \langle \text{N} \rangle \langle \text{N} \rangle) \langle \text{color} \rangle \mid$

$\langle \text{colors} \rangle \langle \text{ColorC} \rangle \mid (\langle \text{N} \rangle \langle \text{N} \rangle \langle \text{N} \rangle) \langle \text{ColorC} \rangle$

$\langle \text{N} \rangle ::= 0 \mid 1 \mid 2 \mid 3 \mid 4 \mid 5 \mid 6 \mid 7 \mid 8 \mid 9 \mid \text{until you reach } 255$

$\langle \text{colors} \rangle ::= \text{light red} \mid \text{red} \mid \text{purple} \mid \langle \text{empty} \rangle$



Problem 6 BNF?

BNF is a type of context-free grammar, and it is also an abbreviation for Backus-Naur form. BNF consists of four major parts which are tokens, nonterminals, productions, and a start symbol. BNF boils down to a grammar that can be used to define a language with precision.