
BNF Assignment #1

Learning Abstract

This assignment is all about BNF. Here I have composed some BNF grammars for given languages, drawn some BNF parse trees to accompany the laid out grammars and finally, I have described BNF in English, in a straightforward, and compelling manner.

Task 1: Shapes

BNF grammar of the Shapes Language...

`<shapes-stmt> ::= ( <shape-phrase> <color-phrase> <pattern-phrase> <shape-phrase> )`

`<shape-phrase> ::= ( size <sizes> )`

`<color-phrase> ::= ( color <colors> )`

`<pattern-phrase> ::= ( pattern <patterns> )`

`<shape-phrase> ::= ( shape <shapes> )`

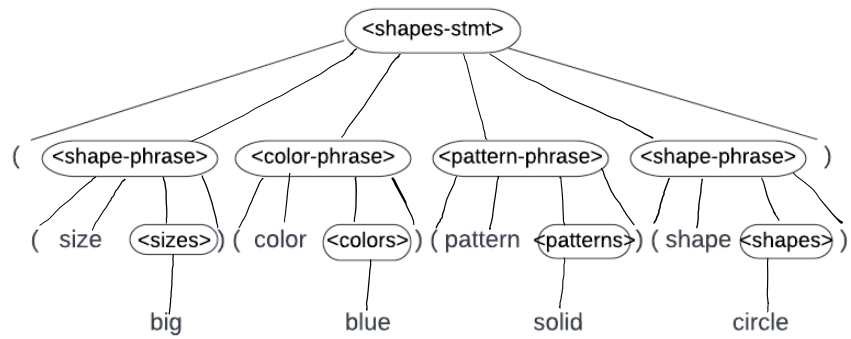
`<sizes> ::= big | medium | small`

`<colors> ::= red | blue | yellow`

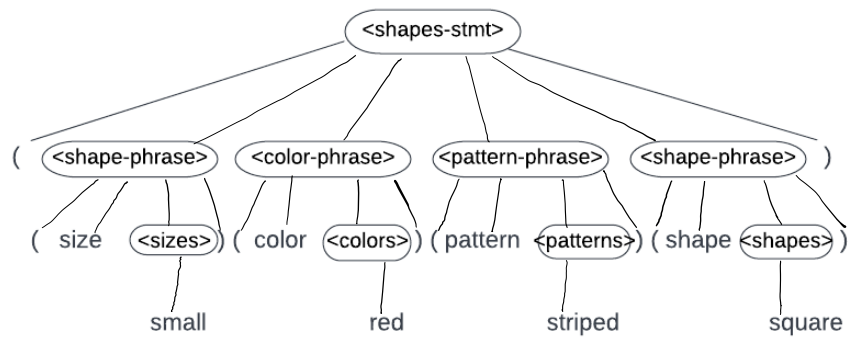
`<patterns> ::= stripped | dotted | solid`

`<shapes> ::= circle | square | triangle`

Parse tree: ((size big) (color blue) (pattern solid) (shape circle))



Parse tree: ((size small) (color red) (pattern striped) (shape square))



Task 2: SQN (Special Quaternary Numbers)

$\langle \text{stmt} \rangle ::= 0 \mid \langle \sim 0 \rangle$

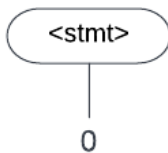
$\langle \sim 0 \rangle ::= 1 \langle \sim 1 \rangle \mid 2 \langle \sim 2 \rangle \mid 3 \langle \sim 3 \rangle \mid \langle \text{empty} \rangle$

$\langle \sim 1 \rangle ::= 0 \langle \sim 0 \rangle \mid 2 \langle \sim 2 \rangle \mid 3 \langle \sim 3 \rangle \mid \langle \text{empty} \rangle$

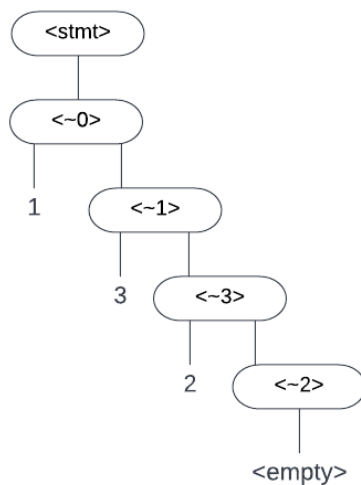
$\langle \sim 2 \rangle ::= 0 \langle \sim 0 \rangle \mid 1 \langle \sim 1 \rangle \mid 3 \langle \sim 3 \rangle \mid \langle \text{empty} \rangle$

$\langle \sim 3 \rangle ::= 0 \langle \sim 0 \rangle \mid 1 \langle \sim 1 \rangle \mid 2 \langle \sim 2 \rangle \mid \langle \text{empty} \rangle$

Phrase: 0



Phrase: 132



Explanation:

You cannot draw a parse tree for the string "1223" with this grammar because when you pass the char '2', not 2, $\langle \sim 2 \rangle$ must come immediately after as a rule. In this way you avoid having two adjacent occurrences of the same quaternary digit.

Task 3: Fours

$\langle \text{stmt} \rangle ::= \langle \text{ones} \rangle \langle \text{twos} \rangle \langle \text{threes} \rangle \langle \text{fours} \rangle$

$\langle \text{ones} \rangle ::= \langle \text{quarters} \rangle \mid \langle \text{quarters} \rangle \langle \text{ones} \rangle \mid \langle \text{empty} \rangle$

$\langle \text{twos} \rangle ::= \langle \text{halves} \rangle \mid \langle \text{halves} \rangle \langle \text{twos} \rangle \mid \langle \text{empty} \rangle$

$\langle \text{threes} \rangle ::= \langle \text{dotted-halves} \rangle \mid \langle \text{dotted-halves} \rangle \langle \text{threes} \rangle \mid \langle \text{empty} \rangle$

$\langle \text{fours} \rangle ::= \langle \text{whole} \rangle \mid \langle \text{whole} \rangle \langle \text{fours} \rangle \mid \langle \text{empty} \rangle$

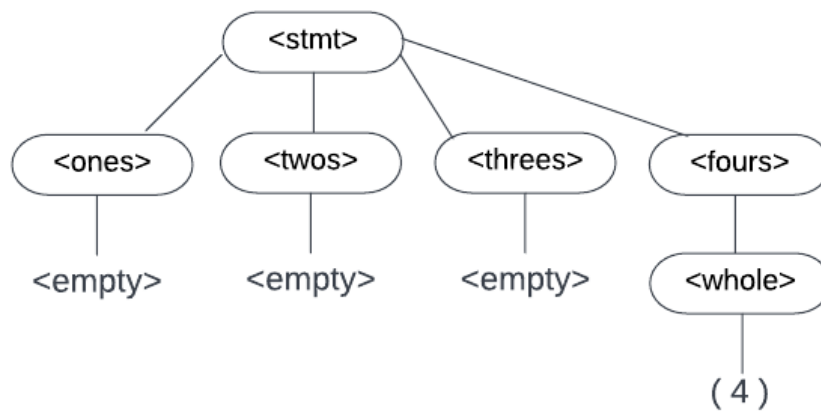
$\langle \text{quarters} \rangle ::= (1\ 1\ 1\ 1)$

$\langle \text{halves} \rangle ::= (1\ 1\ 2) \mid (1\ 2\ 1) \mid (2\ 1\ 1)$

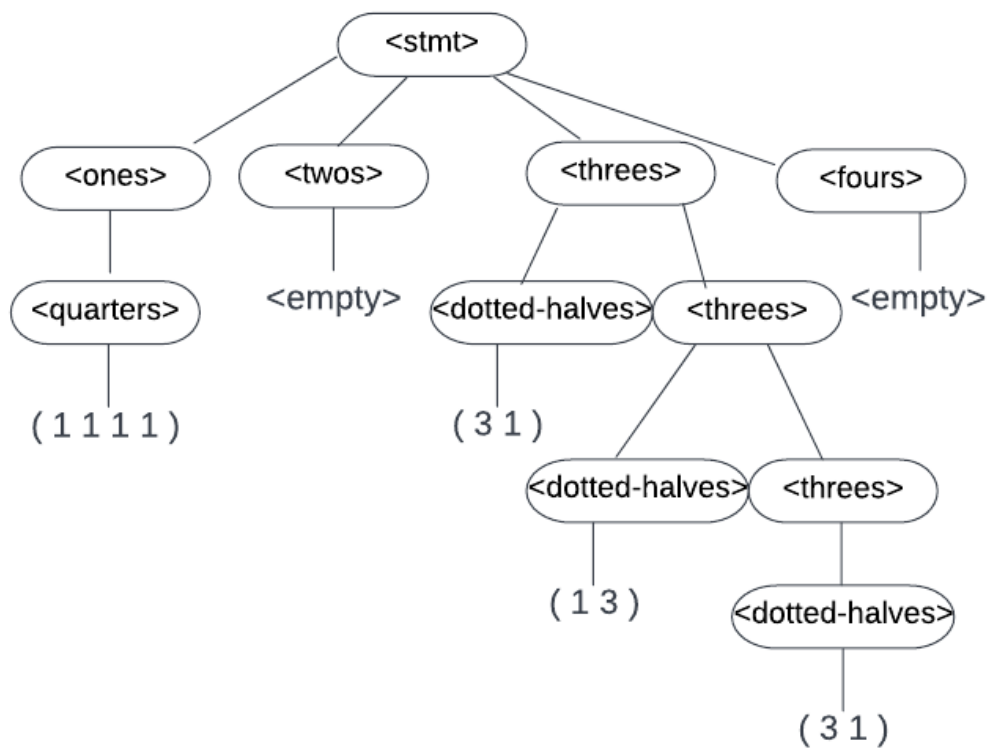
$\langle \text{dotted-halves} \rangle ::= (1\ 3) \mid (3\ 1)$

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

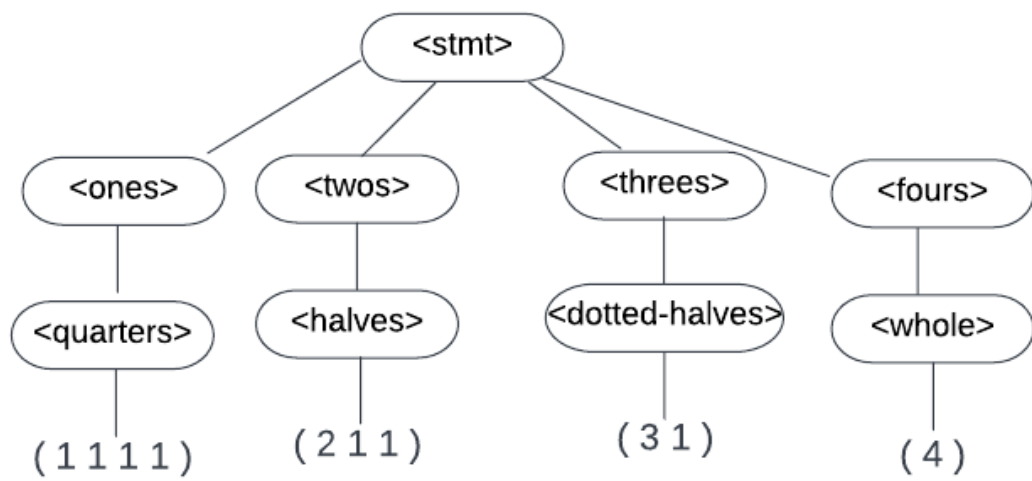
Parse: (4)



Parse: (1 1 1 1) (3 1) (1 3) (3 1)



Parse: (1 1 1 1) (2 1 1) (3 1) (4)



Task 4: BXR

$\langle \text{bxr-stmt} \rangle ::= \langle \text{exp} \rangle$

$\langle \text{exp} \rangle ::= (\langle \text{n} \rangle \langle \text{bool} \rangle) \mid (\langle \text{n} \rangle \langle \text{exp} \rangle) \mid (\langle \text{ao} \rangle) \mid (\langle \text{ao} \rangle \langle \text{exp-list} \rangle) \mid \langle \text{empty} \rangle$

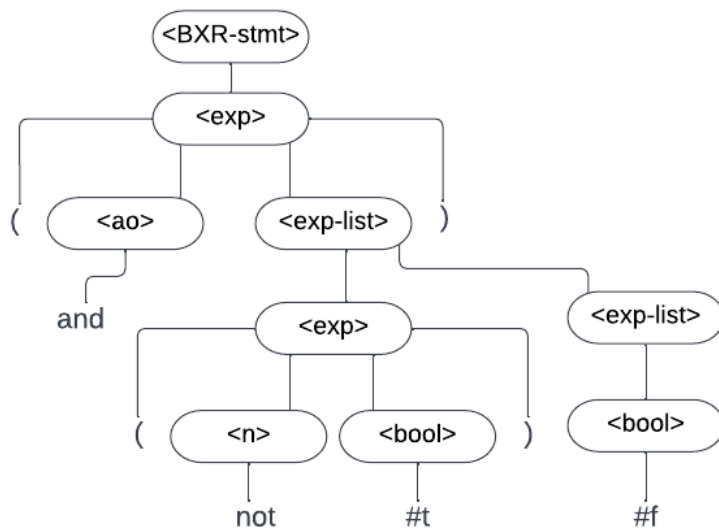
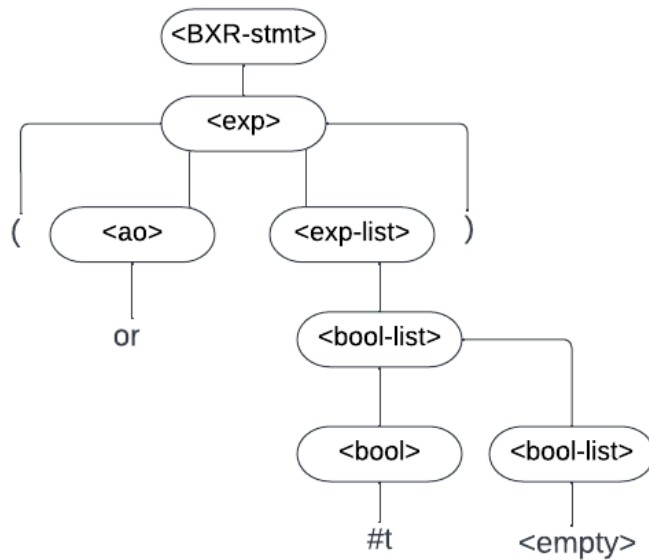
$\langle \text{exp-list} \rangle ::= \langle \text{exp} \rangle \langle \text{exp-list} \rangle \mid \langle \text{bool-list} \rangle \mid \langle \text{bool} \rangle \mid \langle \text{empty} \rangle$

$\langle \text{n} \rangle ::= \text{not}$

$\langle \text{ao} \rangle ::= \text{and} \mid \text{or}$

$\langle \text{bool-list} \rangle ::= \langle \text{bool} \rangle \langle \text{bool-list} \rangle \mid \langle \text{empty} \rangle$

$\langle \text{bool} \rangle ::= \#t \mid \#f$



Task 5: CF (Color fun)

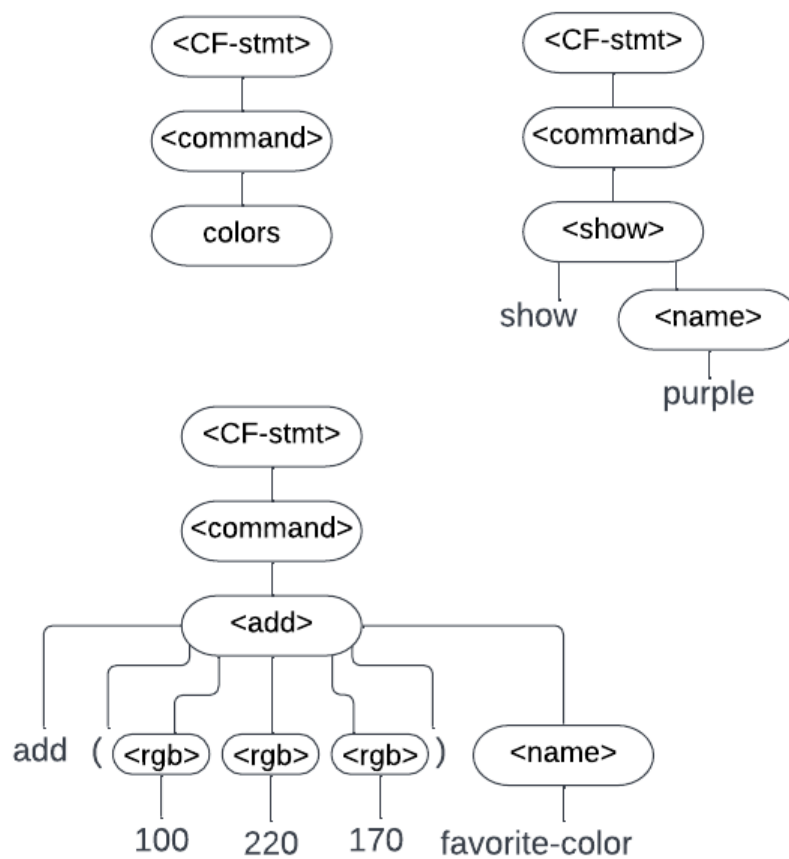
<CF-stmt> ::= <command>

<command> ::= <add> | <show> | colors | <describe> | exit

<add> ::= add (<rgb> <rgb> <rgb>) <name> | add (<rgb> <rgb> <rgb> <rgb>) <name> | add color <name>

<describe> ::= describe <name>

<show> ::= show <name>



Task 6: BNF?

Backus–Naur form or Backus normal form (BNF) is a way of outlining and describing, or defining, the grammar (syntax and semantics) for a language in a formal and logical way. It's often used to describe the syntax of languages used in computing, such as computer programming languages. It's well-suited for circumstances when exact descriptions of languages are needed.