

Timothy Germakovski Csc344 BNF Assignment

Task 1: “Laugher”

1.1

$\langle S \rangle ::= \langle AS \rangle \mid \langle ES \rangle \mid \langle SS \rangle$

$\langle SS \rangle ::= \langle AES \rangle \mid \langle EAS \rangle$

$\langle AES \rangle ::= \langle AS \rangle \mid \langle AS \rangle \langle EAS \rangle$

$\langle EAS \rangle ::= \langle ES \rangle \mid \langle ES \rangle \langle AES \rangle$

$\langle AS \rangle ::= \text{HA HA} \mid \text{HA HA} \langle AS \rangle$

$\langle ES \rangle ::= \text{HEE} \mid \text{HEE} \langle ESE \rangle$

$\langle ESE \rangle ::= \text{HEE HE E} \mid \text{HEE HE E} \langle ESE \rangle$

1.2

<S>

|

<SS>

|

<AES>

|

\

<AS>

<EAS>

|

|

\

HA HA

|

<AES>

|

|

<ES>

<AS>

/

|

\

HEE

|

HA HA

<ESE>

/

\

HEE HEE

<ESE>

|

HEE HEE

1.3

<S>

|

<SS>

\

<EAS>

/

\

<ES>

<AES>

|

/

\

HEE

<AS>

<AES>

/

/

\

HA HA

<AS>

<AES>

/

|

HA HA

<AS>

/

HA HA

Task 2: “SQN”

2.1

$\langle S \rangle ::= 0 \mid \langle ZR \rangle$
 $\langle ZR \rangle ::= 1 \langle ON \rangle \mid 2 \langle TW \rangle \mid 3 \langle TR \rangle \mid 4 \langle FR \rangle$
 $\langle ZR \rangle ::= 1 \mid 2 \mid 3 \mid 4$
 $\langle ON \rangle ::= 2 \langle TW \rangle \mid 3 \langle TR \rangle \mid 4 \langle FR \rangle \mid 0 \langle ZR \rangle$
 $\langle ON \rangle ::= 2 \mid 3 \mid 4 \mid 0$
 $\langle TW \rangle ::= 3 \langle TR \rangle \mid 4 \langle FR \rangle \mid 0 \langle ZR \rangle \mid 1 \langle ON \rangle$
 $\langle TW \rangle ::= 3 \mid 4 \mid 0 \mid 1$
 $\langle TR \rangle ::= 4 \langle FR \rangle \mid 0 \langle ZR \rangle \mid 1 \langle ON \rangle \mid 2 \langle TW \rangle$
 $\langle TR \rangle ::= 4 \mid 0 \mid 1 \mid 2$
 $\langle FR \rangle ::= 0 \langle ZR \rangle \mid 1 \langle ON \rangle \mid 2 \langle TW \rangle \mid 3 \langle TR \rangle$
 $\langle FR \rangle ::= 0 \mid 1 \mid 2 \mid 3$

2.2

<S>

|

0

2.3

<S>

|

<ZR>

/

\

1

<ON>

/

\

3

<TR>

/

2

2.4

You cannot write 1223 because the only nonterminals that have a 2 on the right side of the ::= sign are of the form 2 <TW> (where <TW> is any quaternary or sequence of quaternaries that does not start with 2) or simply 2, with nothing after. Therefore any string of quaternaries containing a double 2 is impossible.

Task 3: “BXR”

3.1

$\langle S \rangle ::= \langle TF \rangle \mid \langle PAR \rangle$

$\langle TF \rangle ::= \#t \mid \#f$

$\langle OP \rangle ::= \text{and} \mid \text{or} \mid \text{not}$

$\langle PAR \rangle ::= (\langle OP \rangle \langle TF \rangle)$

$\langle PAR \rangle ::= (\langle OP \rangle \langle PAR \rangle \langle TF \rangle)$

$\langle PAR \rangle ::= (\langle OP \rangle \langle TFS \rangle)$

$\langle PAR \rangle ::= (\langle OP \rangle \langle PAR \rangle \langle TFS \rangle)$

$\langle TFS \rangle ::= \langle TF \rangle \mid \langle TF \rangle \langle TFS \rangle$

3.2

<S>

|

<PAR>

/ | | \

(| |)

/ \

or #t

<OP>

|

<TF>

/

<PAR>

\

and

/

|

|

\

#f

(/ \)

/

\

<OP>

<TF>

/

\

not

#t

3.3

<S>

|

<PAR>

/ | | | \

(| | |)

/

|

\

<OP>

|

<TF>

/

<PAR>

\

/

|

|

\

(/ \)

/

\

<OP>

<TF>

/

\

not

#t

Task 4: “Line Segment Seq”

4.1

$\langle S \rangle ::= \langle \text{SEQ} \rangle \mid \langle \text{empty} \rangle$

$\langle \text{SEQ} \rangle ::= \langle \text{PAR} \rangle \mid \langle \text{PAR} \rangle \langle \text{SEQ} \rangle$

$\langle \text{PAR} \rangle ::= (\langle D \rangle \langle D \rangle \langle C \rangle)$

$\langle D \rangle ::= * \text{ some number above zero } *$

$\langle C \rangle ::= \text{RED} \mid \text{BLACK} \mid \text{BLUE}$

4.2

$\langle S \rangle$

|

$\langle \text{SEQ} \rangle$

|

$\langle \text{PAR} \rangle$

/ | | | \

(| | |)

/ | \

$\langle D \rangle \langle D \rangle \langle C \rangle$

/ | \

120 95 BLACK

```

<S>
 \
 <SEQ>
 /   \
<PAR>  <SEQ>
 |      /    \
|       <PAR>  <SEQ>
|        /  |  \           \
|       (  |  )             <PAR>
|         |               /  |  |  |  \
|          \              /  /  |  \  \
|            |            ( <D> | <C> )
|           // | \         /  <D>  \
|          /  |  \       191     | RED
|         /  |  \                145
|        <D> <D> <C>
|         |     |    \
|        770  187  RED
L_____
 /      |      |      |      \
(  <D>  <D>  <C>  )
|        |      |
70      180    BLUE

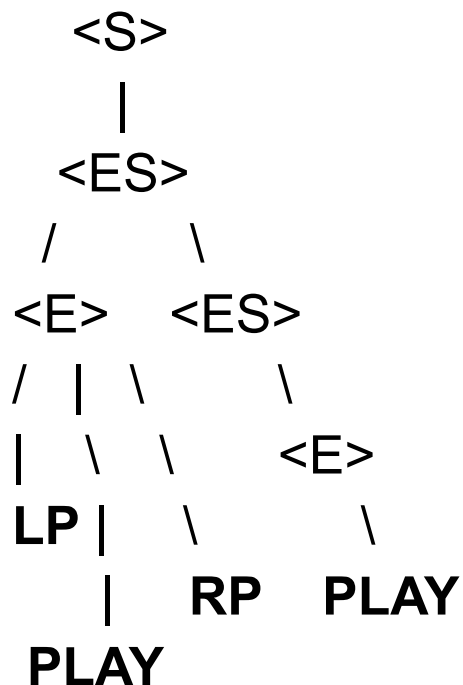
```

Task 5: “M-Lines”

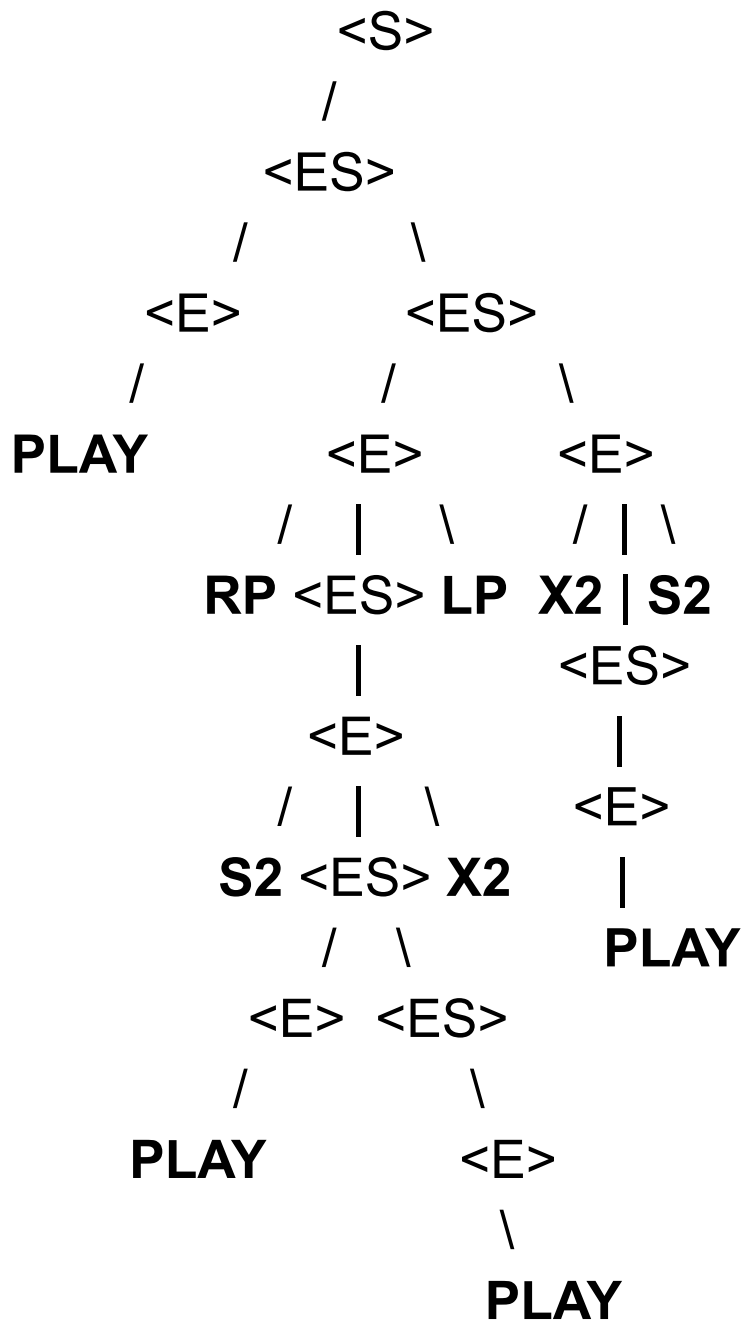
5.1

$\langle S \rangle ::= \langle ES \rangle \mid \langle \text{empty} \rangle$
 $\langle ES \rangle ::= \langle E \rangle \mid \langle E \rangle \langle ES \rangle$
 $\langle E \rangle ::= \text{PLAY} \mid \text{REST}$
 $\langle E \rangle ::= \text{RP} \langle ES \rangle \text{LP} \mid \text{LP} \langle ES \rangle \text{RP}$
 $\langle E \rangle ::= \text{S2} \langle ES \rangle \text{X2} \mid \text{X2} \langle ES \rangle \text{S2}$
 $\langle E \rangle ::= \text{X3} \langle ES \rangle \text{S3} \mid \text{S3} \langle ES \rangle \text{X3}$
 $\langle E \rangle ::= \text{X2} \langle ES \rangle \text{X2}$

5.2



5.3



Task 6:

BNF is a system for breaking down the syntax of some language or language-like system. It categorizes tokens (pieces of text) into a hierarchy/network of types of tokens (non-terminals). Ideally, a good BNF allows you to construct every possible sentence (given the limitations of the BNF) using these tokens and nonterminals