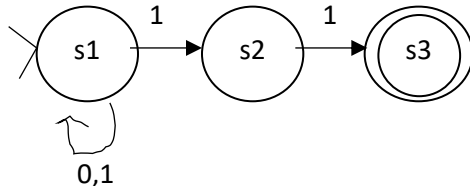


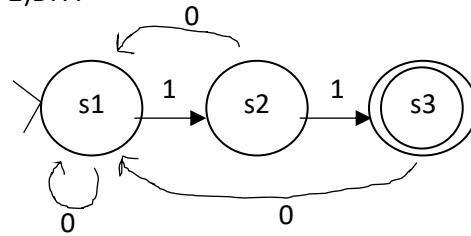
CS 314 HW 2

1.

1)NFA



2)DFA



1)NFA

	1	0
s1	s1, s2	s1
s2	s3	
s3		

$S=\{s1,s2,s3\}$

$s=s1$

$F=s3$

$T= (s1,1) \mapsto s1, (s1,1) \mapsto s2, (s1,0) \mapsto s1, (s2,1) \mapsto s3$

2)DFA

	1	0
s1	s2	s1
s2	s3	s1
s3	s3	s1

$S=\{s1,s2,s3\}$

$s=s1$

$F=s3$

$T= (s1,1) \mapsto s2, (s1,0) \mapsto s1, (s2,1) \mapsto s3, (s2,0) \mapsto s1, (s3,1) \mapsto s3, (s3,0) \mapsto s1$

2.

1)

$\langle S \rangle ::= \langle A \rangle \langle B \rangle \langle C \rangle$

$\langle A \rangle ::= \langle A \rangle a \mid b$

$\langle B \rangle ::= \langle B \rangle b \mid b$

$\langle C \rangle ::= \langle C \rangle c \mid c$

it has a regular expression $\rightarrow a^*b^+c^+$

2)

$\langle S \rangle ::= \langle A \rangle \langle B \rangle \langle C \rangle$

$\langle A \rangle ::= a \langle A \rangle b \mid \varepsilon$

$\langle B \rangle ::= \langle B \rangle b \mid b$

$\langle C \rangle ::= \langle C \rangle c \mid c$

3)

Not a CFG because we cannot use pushdown automata for this language. we cannot put same amount of a, b and c (we cannot guarantee that we have same amount of b or c follow by a)

4)

$\langle S \rangle ::= \langle A \rangle$

$\langle A \rangle ::= 00 \langle A \rangle 111 \mid \varepsilon$

5)

$\langle S \rangle ::= \langle A \rangle$

$\langle A \rangle ::= a \langle A \rangle a \mid b \langle A \rangle b \mid \varepsilon$

6)

$\langle S \rangle ::= \langle AD \rangle$

$\langle AD \rangle ::= \langle BC \rangle \mid a \langle AD \rangle d \mid \varepsilon$

$\langle BC \rangle ::= b \langle BC \rangle c \mid \varepsilon$

7)

Not a CFG because in pushdown automata we cannot guarantee that the grammar can generate same number of alternative characters.

8)

$\langle S \rangle ::= \langle AB \rangle \langle CD \rangle$

$\langle AB \rangle ::= a \langle AB \rangle b \mid \varepsilon$

$\langle CD \rangle ::= c \langle CD \rangle d \mid \varepsilon$

9)

$\langle S \rangle ::= \langle A \rangle \langle B \rangle$

$\langle A \rangle ::= a \langle A \rangle a \mid \varepsilon$

$\langle B \rangle ::= b \langle B \rangle b \mid \varepsilon$

10)

$\langle S \rangle ::= \langle A \rangle \langle A \rangle \langle A \rangle \langle A \rangle \langle B \rangle$

$\langle A \rangle ::= a \mid b$

$\langle B \rangle ::= \varepsilon \mid a \langle B \rangle \mid b \langle B \rangle$

it has regular expression $\rightarrow (a|b)(a|b)(a|b)(a|b)(a|b)^*$

3.

1. Leftmost derivation

$\langle \text{start} \rangle$

$\Rightarrow_L \langle \text{expr} \rangle$

$\Rightarrow_L \langle \text{expr} \rangle \wedge \langle \text{expr} \rangle$

$\Rightarrow_L \langle \text{var} \rangle \wedge \langle \text{expr} \rangle$

$\Rightarrow_L a \wedge \langle \text{expr} \rangle$

$\Rightarrow_L a \wedge \langle \text{expr} \rangle \wedge \langle \text{expr} \rangle$

$\Rightarrow_L a \wedge \langle \text{const} \rangle \wedge \langle \text{expr} \rangle$

$\Rightarrow_L a \wedge \text{true} \wedge \langle \text{expr} \rangle$

$\Rightarrow_L a \wedge \text{true} \wedge \langle \text{expr} \rangle \leftrightarrow \langle \text{expr} \rangle$

$\Rightarrow_L a \wedge \text{true} \wedge \langle \text{var} \rangle \leftrightarrow \langle \text{expr} \rangle$

$\Rightarrow_L a \wedge \text{true} \wedge b \leftrightarrow \langle \text{expr} \rangle$

$\Rightarrow_L a \wedge \text{true} \wedge b \leftrightarrow \langle \text{expr} \rangle \vee \langle \text{expr} \rangle$

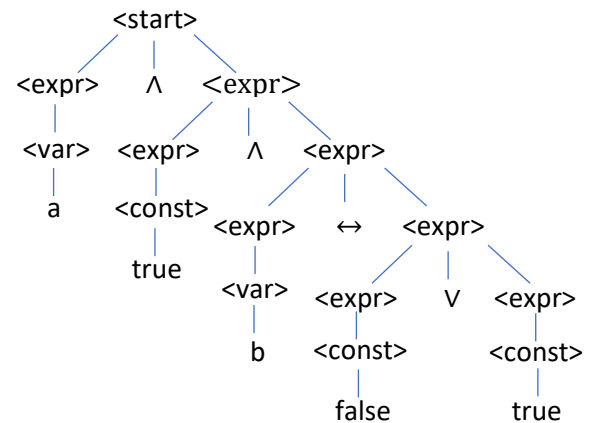
$\Rightarrow_L a \wedge \text{true} \wedge b \leftrightarrow \langle \text{const} \rangle \vee \langle \text{expr} \rangle$

$\Rightarrow_L a \wedge \text{true} \wedge b \leftrightarrow \text{false} \vee \langle \text{expr} \rangle$

$\Rightarrow_L a \wedge \text{true} \wedge b \leftrightarrow \text{false} \vee \langle \text{const} \rangle$

$\Rightarrow_L a \wedge \text{true} \wedge b \leftrightarrow \text{false} \vee \text{true}$

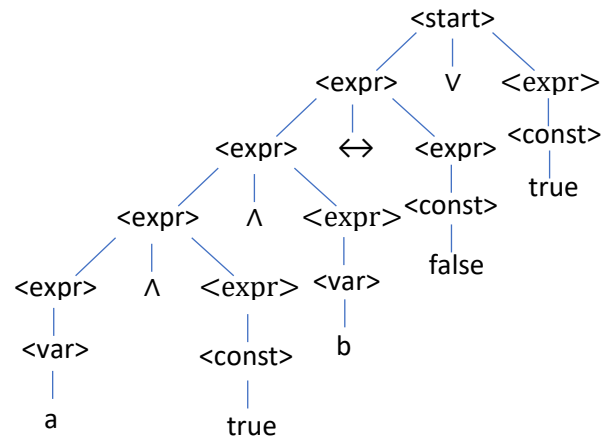
2. leftmost derivation parse tree



Rightmost derivation parse tree

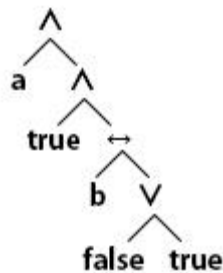
Rightmost derivation

$\langle \text{start} \rangle$
 $\Rightarrow_R \langle \text{expr} \rangle$
 $\Rightarrow_R \langle \text{expr} \rangle V \langle \text{expr} \rangle$
 $\Rightarrow_R \langle \text{expr} \rangle V \langle \text{const} \rangle$
 $\Rightarrow_R \langle \text{expr} \rangle V \text{true}$
 $\Rightarrow_R \langle \text{expr} \rangle \leftrightarrow \langle \text{expr} \rangle V \text{true}$
 $\Rightarrow_R \langle \text{expr} \rangle \leftrightarrow \langle \text{const} \rangle V \text{true}$
 $\Rightarrow_R \langle \text{expr} \rangle \leftrightarrow \text{false} V \text{true}$
 $\Rightarrow_R \langle \text{expr} \rangle \wedge \langle \text{expr} \rangle \leftrightarrow \text{false} V \text{true}$
 $\Rightarrow_R \langle \text{expr} \rangle \wedge \langle \text{var} \rangle \leftrightarrow \text{false} V \text{true}$
 $\Rightarrow_R \langle \text{expr} \rangle \wedge b \leftrightarrow \text{false} V \text{true}$
 $\Rightarrow_R \langle \text{expr} \rangle \wedge \langle \text{expr} \rangle \wedge b \leftrightarrow \text{false} V \text{true}$
 $\Rightarrow_R \langle \text{expr} \rangle \wedge \langle \text{const} \rangle \wedge b \leftrightarrow \text{false} V \text{true}$
 $\Rightarrow_R \langle \text{expr} \rangle \wedge \text{true} \wedge b \leftrightarrow \text{false} V \text{true}$
 $\Rightarrow_R \langle \text{var} \rangle \wedge \text{true} \wedge b \leftrightarrow \text{false} V \text{true}$
 $\Rightarrow_R a \wedge \text{true} \wedge b \leftrightarrow \text{false} V \text{true}$

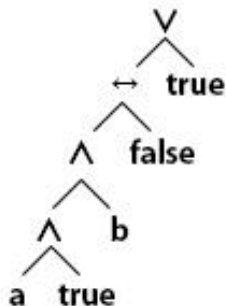


3. AST

Leftmost



Rightmost



4. Since our leftmost parse tree and rightmost parse tree is distinct but produce same language, the grammar is ambiguous.

5. $\langle \text{start} \rangle ::= \langle \text{ex} \rangle$
 $\langle \text{ex} \rangle ::= \langle \text{ex} \rangle \leftrightarrow \langle \text{orex} \rangle \mid \langle \text{orex} \rangle$
 $\langle \text{orex} \rangle ::= \langle \text{orex} \rangle \vee \langle \text{andex} \rangle \mid \langle \text{andex} \rangle$
 $\langle \text{andex} \rangle ::= \langle \text{term} \rangle \wedge \langle \text{andex} \rangle \mid \langle \text{term} \rangle$
 $\langle \text{term} \rangle ::= \langle \text{const} \rangle \mid \langle \text{var} \rangle$
 $\langle \text{const} \rangle ::= \text{true} \mid \text{false}$
 $\langle \text{var} \rangle ::= a \mid b \mid c \mid \dots \mid z$

6.

