Context Free Grammar Using User Control Parse_{JP}

• Prerequisite knowledge: *Context Free Grammar*

JFLAP User Control Parse

Consider the following context-free grammar. (See: cfguucp.jflap)

 $V = \{ A, N, O, S, V \}$ $T = \{ a, d, r, t \}$ S = S $S \rightarrow OV$ $O \rightarrow AN$ $A \rightarrow a$ $A \rightarrow a$ $N \rightarrow d$ $V \rightarrow r$

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File	Edit	Inp	out	Tes	t	Cor	nvert		Help			 	 	×
						Gra	amma	ar E	dito	r				
\cap	\bigcirc													
LHS			RHS											
S		\rightarrow	Ο	V										
0		\rightarrow	A	Ν										
А		\rightarrow	a											
А		\rightarrow	t											
Ν		\rightarrow	d											
V		\rightarrow	r											
Gra	mmar	= (V,	Т, Р	, S)										_
V	= {	A	N 0	SV	1									}
Т	$T = \{ a d r t \}$													
S :	S = S													
Tab	Table Text Size													
							()						,

Use the Brute Force Parse to determine which of the following strings are in this language.

- adr
- tdr
- dr
- ar
- aadr

For example, here are the results for strings "adr" and "ar".

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Input: adr Set Change										
Step	Step Complete Reset									
Inpu	t accepted	! Chang	je view to see	e derivation!						
S	\rightarrow O V	Brute	Parse Table		÷					
А	\rightarrow a	Level 7	otal Nodes	Current Derivations						
А	\rightarrow t	1	1	[O V]						
N	\rightarrow d	2 3 [A N V, O r]								
0	\rightarrow A N	3	8	[a N V, A d V, A N r]					
V	\rightarrow r	4	16	[a d V, a N r, A d r]						
		5	17	[a d r]						
Gramma	ar = (V, T, P, S)									
V =	{ A N O S	V			}					
T =	$T = \{ a d r t \}$									
S =	S = S									
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File Help)				د				
	Grammar Editor Brute Force Parser								
Input	: ar				Set Change				
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Input	rejected	Try anot	her string!						
S	\rightarrow O V	Brute P	arse Table		\$				
A	\rightarrow a	Level To	otal Nodes	Current Derivations					
A	\rightarrow t	1	1	[O V]					
N	\rightarrow d	2	3	[O r]					
0	\rightarrow A N	3	4	1					
V	\rightarrow r								
		-							
Grammar	= (V, T, P, S)								
V = {	ANOS	5 V			}				
т – {	adrt								
S = S									
Table Tex	t Size			0					
				<u> </u>					

Consider the rejected string "ar". Why is that string rejected?

JFLAP provides the User Control Parse feature to facilitate exploration of string derivations.

Return to the Grammar Editor and choose Input > User Control Parse.

⊖ ⊖ ⊖ JFLAP : (cfguucp.jff)								
File Input Test Convert Help	×							
Editor User Control Parser Table Text Size								
Start Previous Step Derivation Table								
Input ar								
LHS RHS Production Derivation								
$S \rightarrow OV$								
$O \rightarrow AN$								
$A \rightarrow a$								
$A \rightarrow t$								
$\mathbf{N} \rightarrow \mathbf{d}$								
S S								

	Τc	begin.	choose	the rule	with	the start	symbol	on the	e left and	click	Start.
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File Input Test Convert Help Editor User Control Parser Table Text Size Table Text Size Imput ar Input ar Imput ar Production Derivation Derivation Derivation Table * * Production Derivation Derivation Derivation * * * * * * * * * * * * * * * * * * * * * <th <="" colspan="2" th=""><th>00</th><th></th><th>JFLAP : (cfguucp.jff)</th><th></th></th>	<th>00</th> <th></th> <th>JFLAP : (cfguucp.jff)</th> <th></th>		00		JFLAP : (cfguucp.jff)	
Editor User Control Parser Table Text Size Start Previous Step Derivation Table Input ar Input ar Production Derivation Derivation Production A A C C C nput a string to begin.	le Inp	ut Test Conver	rt Help	×		
Table Text Size Imput ar Input ar IHS Production S \rightarrow OV O \rightarrow AN \rightarrow AN \rightarrow A			Editor User Control Parser			
Start Previous Step Derivation Table Input ar $$ LHS RHS S \rightarrow OV O \rightarrow AN A \rightarrow a A \rightarrow t N \rightarrow d V \rightarrow r nput a string to begin.	Table Te	xt Size				
Start Previous Step Derivation Table \updownarrow Input ar * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * <td></td> <td></td> <td>0</td> <td></td>			0			
$ \begin{array}{c c} Input ar \\ \hline Input ar \\ \hline Input ar \\ \hline Input ar \\ \hline Production \\ \hline Prodot \\ \hline Production \\ \hline Production \\ \hline Production \\ \hline Prod$	Start	Previous Step	Derivation Table	÷		
Input ar LHS RHS S \rightarrow OV O \rightarrow AN A \rightarrow a A \rightarrow t N \rightarrow d V \rightarrow r nput a string to begin.						
Input ar $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$						
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Input a					
LHS RHS Production S \rightarrow OV O O \rightarrow AN A A \rightarrow a A \rightarrow t N \rightarrow d V \rightarrow r nput a string to begin.						
LHS RHS Production S \rightarrow OV O \rightarrow AN A \rightarrow a A \rightarrow t N \rightarrow d V \rightarrow r			^ 			
$S \longrightarrow OV$ $O \longrightarrow AN$ $A \longrightarrow a$ $A \longrightarrow t$ $N \longrightarrow d$ $V \longrightarrow r$ $nput a string to begin.$	LHS	RHS	Production Derivation			
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	ა ი	$\rightarrow 0^{\circ}$				
$ \begin{array}{c cccc} A & \rightarrow a \\ \hline A & \rightarrow t \\ \hline N & \rightarrow d \\ \hline V & \rightarrow r \\ \hline \end{array} $ nput a string to begin.	0	\rightarrow AN				
$ \begin{array}{c c} A & \rightarrow t & & \\ \hline N & \rightarrow d & & \\ \hline V & \rightarrow r & & \\ \hline & & & \\ \hline \end{array} $ nput a string to begin.	A	\rightarrow a				
$\begin{array}{c c} N & \longrightarrow d \\ \hline V & \longrightarrow r \\ \hline \end{array}$ nput a string to begin.	A	\rightarrow t				
$V \longrightarrow r$ nput a string to begin.	N	\rightarrow d				
nput a string to begin.	V	\rightarrow r				
nput a string to begin.						
nput a string to begin.						
	put a str	ing to begin.				

Thi	is results	in	showing	the	current	state	of	the	derivation	, which	is	just	S.
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ile Inp	out Test Convert	Help Editor User Con	trol Parser	×
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1.46		Production	Designation	
S	$\rightarrow OV$	Production	S	
0	\rightarrow AN			
A	\rightarrow a			
A	\rightarrow t	~		
N	\rightarrow d			
V	\rightarrow r			
S		·		

To continue the derivation, select a rule and click on Step. Note that selecting a rule that is not applicable will result in an error message, as shown in the next two images.

00			JFLAP :	cfguucp.jff)
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				,
LHS	RH	S	Production	Derivation
S	$\rightarrow 0$	V	l	S
0	\rightarrow A	N		
Δ	$\rightarrow a$			
<u>^</u>			~	
A	$\rightarrow t$			
N	\rightarrow d			
V	\rightarrow r			
c				<u>٨</u>
3				

○ ○ ○ JFLAP : (cfguucp.jff)								
File Input Test Convert Help	×							
Editor User Control Parser								
Start Previous Step Derivation Table								
Input ar Bad Input								
LHS Previous Derivation does not support this Production S ->								
$ \begin{array}{cccc} O & \longrightarrow \\ A & \longrightarrow \\ \end{array} $								
$A \longrightarrow t$								
$\frac{N}{V} \rightarrow d$								
S								

The following sequence of images demonstrates a potential derivation sequence.

JFLAP : (cfguucp.jff)								
File Inpu	t Test Conve	rt Help				>		
Editor User Control Parser								
Input ar			~					
LHS S		Produc	tion		Derivation			
0	\rightarrow AN							
А	\rightarrow a							
А	\rightarrow t	<u>^</u>						
N	\rightarrow d							
V	\rightarrow r							
S			~					

⊖ ⊖ ⊖ JFLAP : (cfguucp.jff)								
File Input Test Convert	Help	×						
Editor User Control Parser Table Text Size								
Start Previous Step Deriv	ation Table	\$						
Input ar								
LHS RHS	Production	Derivation						
$S \longrightarrow OV$	S→OV	S OV						
$O \longrightarrow AN$								
$A \rightarrow a$								
$A \longrightarrow t$								
$N \longrightarrow d$								
$V \longrightarrow r$								
	ē							
0V								
Derived current Strings using $S \rightarrow C$	V production							

00	JFLAP : (cfguucp.jff)	
File Input Test Convert H	lelp	×
Table Text Size	Editor User Control Parser	
Input ar	ation Table	÷
LHS RHS	Production	Derivation
$S \rightarrow OV$	S→OV	S OV
$O \longrightarrow AN$		
$A \rightarrow a$		
$A \rightarrow t$		
$N \rightarrow d$		
$V \rightarrow r$		
OV	r •	
Derived current Strings using S-AO	V production	
Derived current strings using 3→0		

0 0	JFLAP : (cfguucp.jff)	
File Input Test Convert H	lelp	×
Table Text Size	Editor User Control Parser	
Input ar	Production	Derivation
$ \begin{array}{cccc} \mathbf{S} & \rightarrow \mathbf{OV} \\ \mathbf{O} & \rightarrow \mathbf{AN} \\ \mathbf{A} & \rightarrow \mathbf{a} \end{array} $	S→OV V→r	OV Or
$\begin{array}{ c c c } \hline A & \longrightarrow t \\ \hline N & \longrightarrow d \end{array}$		
$V \rightarrow r$	~	
Derived current Strings using V→r	production	

00	JFLAP : (cfguucp.jff)	
File Input Test Convert H	Help Editor User Control Parser	×
Table Text Size		
Start Previous Step Deriv	ation Table	\$
Înput ar		
$ \begin{array}{c} LHS & RHS \\ S & \longrightarrow OV \end{array} $	Production	Derivation
$\begin{array}{c} 0 \\ 0 \\ \end{array} \rightarrow AN \end{array}$	$S \rightarrow OV$ $V \rightarrow r$ $O \rightarrow AN$	OV Or ANr
$\begin{array}{ c c c c } A & \longrightarrow a \\ \hline A & \longrightarrow t \end{array}$		
$\frac{N}{V} \rightarrow d$		
	4	
Derived current Strings using O→A	N production	

	put lest Conve	Editor User Co	ntrol Parser	
Table T	ext Size			
_		0		
Start	Previous Step	Derivation Table		\$
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Input	ar			
LHS	RHS	Production	Derivation	
LHS S	$\rightarrow \mathrm{OV}$	Production S OV	Derivation S OV	
LHS S	$ \xrightarrow{RHS} OV $	Production S→OV V→r	Derivation S OV Or	
LHS S O	$\begin{array}{c} \stackrel{\text{RHS}}{\longrightarrow} \text{OV} \\ {\longrightarrow} \text{AN} \end{array}$	Production $S \rightarrow OV$ $V \rightarrow r$ $O \rightarrow AN$	Derivation S OV Or ANr	
LHS S O A	$ \begin{array}{c} \ \ \text{RHS} \\ \rightarrow \ \text{OV} \\ \rightarrow \ \text{AN} \\ \hline \rightarrow \ \text{a} \end{array} $	Production $S \rightarrow OV$ $V \rightarrow r$ $O \rightarrow AN$ $A \rightarrow a$	Derivation S OV Or ANr aNr	
LHS S O A A	$ \begin{array}{c} & \text{RHS} \\ \rightarrow & \text{OV} \\ \rightarrow & \text{AN} \\ \hline \rightarrow & \text{a} \\ \rightarrow & \text{t} \end{array} $	Production $S \rightarrow OV$ $V \rightarrow r$ $O \rightarrow AN$ $A \rightarrow a$	Derivation S OV Or ANr aNr	
LHS S O A A N	$ \begin{array}{c} & \text{RHS} \\ \rightarrow & \text{OV} \\ \rightarrow & \text{AN} \\ \hline \rightarrow & \text{AN} \\ \hline \rightarrow & \text{t} \\ \rightarrow & \text{d} \end{array} $	Production $S \rightarrow OV$ $V \rightarrow r$ $O \rightarrow AN$ $A \rightarrow a$	Derivation S OV Or ANr aNr	
LHS S O A A N V	$ \begin{array}{c} & \text{RHS} \\ \rightarrow & \text{OV} \\ \rightarrow & \text{AN} \\ \hline \rightarrow & \text{A} \\ \hline \rightarrow & \text{t} \\ \hline \rightarrow & \text{d} \\ \hline \rightarrow & \text{r} \end{array} $	Production $S \rightarrow OV$ $V \rightarrow r$ $O \rightarrow AN$ $A \rightarrow a$	Derivation S OV Or ANr aNr	
LHS S O A A N V	$ \begin{array}{c} & \text{RHS} \\ \rightarrow & \text{OV} \\ \rightarrow & \text{AN} \\ \hline \rightarrow & \text{AN} \\ \hline \rightarrow & \text{a} \\ \hline \rightarrow & \text{t} \\ \hline \rightarrow & \text{d} \\ \hline \rightarrow & \text{r} \end{array} $	Production $S \rightarrow OV$ $V \rightarrow r$ $O \rightarrow AN$ $A \rightarrow a$	Derivation S OV Or ANr aNr	
LHS S O A A N V a Nr	$ \begin{array}{c} & \text{RHS} \\ \rightarrow & \text{OV} \\ \rightarrow & \text{AN} \\ \hline \rightarrow & \text{a} \\ \hline \rightarrow & \text{t} \\ \rightarrow & \text{d} \\ \hline \rightarrow & \text{r} \end{array} $	$ \begin{array}{ c c } \hline Production \\ \hline S \rightarrow OV \\ \hline V \rightarrow r \\ \hline O \rightarrow AN \\ \hline A \rightarrow a \\ \hline \end{array} $	Derivation S OV Or ANr aNr	

Note that at this point, both terminals, a and r, have been produced, but there is a remaining non-terminal, N. There is only one production rule applicable, with N on the LHS.

00		JFLAP : (d	fguucp.jff)	
File In	put Test Conve	rt Help		×
Table T	Fext Size	Editor Use	r Control Parser	
Input	ar	Serivation Table	<u></u>	
LHS	RHS	Production	Derivation	
S	$\rightarrow OV$		S	
-		S→OV	OV	
0	\rightarrow AN	V→r O→AN	Or	
A	$\rightarrow a$	A→a	aNr	
A	\rightarrow t	~		
Ν	\rightarrow d			
V	\rightarrow r			
D. N.r.			۴	
d Nr				
Derived	current Strings using	A→a production		

After applying that rule, as shown in the following image, there are no additional productions possible.

ile Input	Test	<u> </u>				
		Convert	Help			×
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II						_
Input ar						
No Additi	onal Pro	duction is Po	ssible			
				r		
LHS	RH	IS	Production		Derivation	
S	$ \rightarrow O$	V	S→OV		S OV	
0	$\rightarrow A$	N	V→r		Or	
	/ 11		O→AN		ANr	
А	\rightarrow a		A→a N→d		aNr	
А	\rightarrow t		N→a		adr	
NT	- d	_				
IN	\rightarrow a					
V	\rightarrow r					
a d r				<u>^</u>		
erived curi	ent Strii	ngs using N-	•a production			

Questions to Think About

- 1. What causes each of the rejected strings from the previously specified set to be rejected?
- 2. What changes would you make to JFLAP to facilitate exploring rejected strings?