Example: Unrestricted Grammar_{JP}

Consider the following definition of an unrestricted grammar.

		JFLAP : (L	JG.jff)	
File In	out Test Convert Help			×
		Edito	r	
Table T	ext Size			
_		O		
LHS	RHS			
S	\rightarrow ABCD			
A	\rightarrow AC			
Ab	\rightarrow xB			
Aa	\rightarrow z			
Ac	\rightarrow w			
AC	\rightarrow D			
xBC	\rightarrow aBC			
BCD	\rightarrow y			
D	\rightarrow cD			
В	\rightarrow b			
zy	\rightarrow BC			
BC	\rightarrow Bc			
DD	\rightarrow d			
У	\rightarrow zyC			
С	\rightarrow d			
	\rightarrow			

Confirm that this grammar is unrestricted using Test > Test for Grammar Type.

		JFLAP : (UG.jff)	
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	_	Test for Grammar Type Editor	
Table Te	ext Size	e	
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LHS		RHS	
S	\rightarrow	ABCD	
A	\rightarrow	AC	
Ab	\rightarrow	xB	
Aa	\rightarrow	Z	
Ac	\rightarrow	W	
AC	\rightarrow	D	
xBC	\rightarrow	aBC	
BCD	\rightarrow	У	
D	\rightarrow	cD	
В	\rightarrow	b	
zy	\rightarrow	BC	
BC	\rightarrow	Bc	
DD	\rightarrow	d	
у	\rightarrow	zyC	
С	\rightarrow	d	
	\rightarrow		

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LHS					
3	-	ABCD			-1
A	-	→ AC			-
Ab		→ XB			-1
Aa		→ Z			-1
Ac	-	→ W 			_
AC		→ D			_
xBC		→ aBC			_
BCD	-	→ y			
D	-	→ cD			
В	-	→ b	$\bullet \circ \circ$	Grammar Type	
zy	-	→ BC	_		
BC	-	→ Bc	- <u>-</u>	This is an Unrestricted Grammar	
DD	-	→ d			
у	-	→ zyC		ОК	
С	-	→ d			
	-	>			

Consider strings in the language specified by this grammar.

- What is the alphabet of the language of this grammar?
- What are the set of non-terminals (variables) used in specifying this grammar?
- What strings are in the language?
- Is the empty string an element of this language?

Predict whether the string "abcd" is in the language.

• What features of the grammar are you using in making your prediction?

Try using Input > Brute Force Parse to determine if the string "abcd" is in the language.

• What issues do you run into using this approach?

Try using Input > User Control Parse to explore potential derivations of "abcd".

- What features of the grammar are you using in narrowing down to a derivation of that string?
- Is "abcd" actually in the language?

Sample Solution (see: UG.jff)

Sample Result Using Input > User Control Parse



	JFLAP : (UG.jff)	
File Ing	put Test Convert Help	×
	Editor	
Table T	ext Size	
		2
LHS	RHS	
3	\rightarrow ABCD	-
A	\rightarrow AC	_
Ab	\rightarrow XB	_
Aa	\rightarrow Z	_
Ac	\rightarrow W	_
AC	\rightarrow D	_
xBC	\rightarrow aBC	_
BCD	\rightarrow y	_
D	\rightarrow cD	
В	\rightarrow b	
zy	\rightarrow BC	
BC	ightarrow Bc	
DD	\rightarrow d	
У	\rightarrow zyC	
С	\rightarrow d	
	\rightarrow	

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LHS	User C	ontrol Parse		-
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AD	\rightarrow	хв		-1
Aa	\rightarrow	Z		_
Ac	\rightarrow	W		
AC	\rightarrow	D		
xBC	\rightarrow	aBC		
BCD	\rightarrow	у		
D	\rightarrow	cD		
В	\rightarrow	b		
zy	\rightarrow	BC		
BC	\rightarrow	Bc		
DD	\rightarrow	d		
у	\rightarrow	zyC		
С	\rightarrow	d		
	\rightarrow			

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		c
LHS	RHS	
S	\rightarrow ABCD	
A	$\rightarrow AC$	
Ab	$\rightarrow xB$	
Aa	\rightarrow Z	
Ac	\rightarrow w	
AC	\rightarrow D	
xBC	$\rightarrow aBC$	c
BCD	\rightarrow y	
D	\rightarrow cD	
В	\rightarrow b	
zy	\rightarrow BC	
BC	\rightarrow Bc	
DD	\rightarrow d	
у	\rightarrow zyC	
~		c
nnut a str	ing to begin	

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			Editor User Control Parser	
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			c	
LHS	R	HS		
S	$\rightarrow A$	ABCD		
A	$\rightarrow A$	٨C	-	
Ab	$\rightarrow x$	В		
Aa	\rightarrow 7		-	
Ac		1	-	
		>		
AC	$\rightarrow L$			
xBC	\rightarrow a	BC		
BCD	\rightarrow y			
D	\rightarrow c	D		
В	$\rightarrow b$			
zv	\rightarrow B	BC	-	
BC	$\rightarrow B$	le.	-	
סס	, D		-	
עט	\rightarrow d	0		
У	$\rightarrow z$	уС		
C	$\rightarrow d$		c	
S				

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able Te:	xt Size		
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	\rightarrow ABCD		
	\rightarrow AC		
vp	\rightarrow xB		
a	\rightarrow Z		
1C	\rightarrow w		
'C	\rightarrow D		
BC	\rightarrow aBC		
SCD	\rightarrow y		
)	\rightarrow cD		
6	\rightarrow b		
У	\rightarrow BC		
SC	\rightarrow Bc		
D	\rightarrow d		
	\rightarrow zyC		
N	1	c	
BCD			
rived cu	urrent Strings using S→ABCD prod	luction	

	JFLAP : (UG.jff)
le Input Test C	onvert Help
	Editor User Control Parser
able Text Size	
	0
Start Previous Step	Noninverted Tree
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nput abcd	
	с .
HS RHS	
\rightarrow ABC)
$\rightarrow AC$	
$Ab \longrightarrow xB$	
$a \rightarrow z$	
Ac \rightarrow w	
$AC \rightarrow D$	
$BC \rightarrow aBC$	
BCD \rightarrow y	
$\rightarrow cD$	
$3 \rightarrow b$	
$a \to BC$	
$3C \rightarrow Bc$	
$D \rightarrow d$	b
\rightarrow ZyC	
hCD	с С
rived current Strings	ising B→b production





			JFLAP : (UG.jff)
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			Editor User Control Parser
Table Te	ext Size		
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input a	ibcu		
			c
LHS			
3		ABCD	S
A	\rightarrow	AC	
Ab	\rightarrow	xВ	
Aa	\rightarrow	Z	
Ac	\rightarrow	W	
AC	\rightarrow	D	
xBC	\rightarrow	aBC	
BCD	\rightarrow	V	
D	\rightarrow	cD	(х) (в) (с)
B	, ,	h	
<u>р</u>			
Zy DC	\rightarrow	DC	
BC	\rightarrow	Вс	
DD	\rightarrow	d	
У	\rightarrow	zyC	V V
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a y			
Derived c	urrent	Strings using BCD→v productio	n
	arrente	ing saying beb y productio	•

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File Input	t Test Convert Help		×
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Table Text	t Size		
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Input abc	:d		_
LHS	RHS	c.	_
Ab	-> vB	S	
Au			
Aa	\rightarrow Z		
Ac	\rightarrow W		
AC	\rightarrow D		
xBC	\rightarrow aBC		
BCD	\rightarrow y		
D	\rightarrow cD		
В	\rightarrow b		
zy	\rightarrow BC		
BC	\rightarrow Bc		
DD	\rightarrow d		
N N	$\rightarrow \pi V C$	Y	
y C	> d		
<u> </u>	\rightarrow u		
a z y C		C	
Derived curi	rent Strings using y→zyC productio	1	

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Input a	bcd			
LHS	-	RHS		
Ab		vB	5	
		7		
Aa	\rightarrow	Z	B	
AC	\rightarrow	W		
AC	\rightarrow	D		
xBC	\rightarrow	aBC		
BCD	\rightarrow	У	(x) (B) (C)	
D	\rightarrow	cD		
В	\rightarrow	b		
zy	\rightarrow	BC		
BC	\rightarrow	Bc	Y	
DD	\rightarrow	d		
v	\rightarrow	zvC		
$\frac{r}{C}$		d		
<u> </u>		u	BC	
a B C C				
Dorivod -	urrant C	trings using TV DC production		
Derived Cl	arrent S	things using $2y \rightarrow BC$ production		

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Start	Previou	vious Step	
Jarr	Treviou		
Input a	bcd		
LHS		BHS	
Ah		A set D	s
AD	\rightarrow	$\rightarrow \lambda B$	
Aa	\rightarrow	\rightarrow Z (B)	
Ac	\rightarrow	\rightarrow W	
AC	\rightarrow	\rightarrow D (A) (b)	
xBC	\rightarrow	\rightarrow aBC	
BCD	\rightarrow	\rightarrow y	
D	\rightarrow	\rightarrow cD	
В	\rightarrow	\rightarrow b	
zy	\rightarrow	\rightarrow BC	y v
BC	\rightarrow	\rightarrow Bc	
DD	\rightarrow	\rightarrow d	
	, ,		
y C			
	\rightarrow	$\rightarrow d$	
a B c C		c	
Derived c	urrent S	nt Strings using BC \rightarrow Bc production	

			JFLAP : (UG.jff)	
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Input a	bcd			
LHS	F	RHS		
Ah		^z B	S	
	× 7	,		
Aa	$\rightarrow 2$			
AC	\rightarrow	N		
AC	\rightarrow I)		
xBC	$\rightarrow a$	aBC		
BCD	\rightarrow y	/		
D	\rightarrow c	сD		
В	\rightarrow t)	Y	
zy	\rightarrow I	3C		
BC	\rightarrow I	Зс		
DD	\rightarrow	1	В	
v		zvC		
, C		1	B C	
<u> </u>		1		
a b c C				
L				
Derived c	urrent St	rings using B→b production		

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ile Inp	ut Test Convert Help		
		Editor User Control Parser	
Table Te	xt Size		
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Start	Previous Step Noninverted	Tree	\$
o Input a	bcd		
String A	ccepted!		
[0	
LHS	RHS	S	
Ab	\rightarrow xB		
Aa	\rightarrow Z		
Ac	\rightarrow w		
AC	\rightarrow D		
xBC	\rightarrow aBC		
BCD	\rightarrow y	a B C D	
D	\rightarrow cD	C V	
В	\rightarrow b		
zy	\rightarrow BC		
BC	\rightarrow Bc	В	
DD	\rightarrow d	R	
у	\rightarrow zyC		
С	\rightarrow d	b	
a b c d			
Derived cu	urrent Strings using C→d produc	tion	