## **Example: Context Free Grammar**<sub>JP</sub>

Enter a context-free grammar that generates the following language L over the alphabet  $\Sigma = \{a, b\}$ : L = { w | w contains at least two **a** symbols }

## Sample Solution (see CFG xaxax.jff)

Consider that the only constraint is two appearances of the symbol  $\mathbf{a}$  and that any number of symbols may appear before and between them.

This suggests that the start symbol produce the required number of **a** symbols surrounded and separated by arbitrary strings.

$$S \rightarrow XaXaX$$

The remaining rules combine to produce all strings over {a, b}\*.

$$X \to \varepsilon \mid aX \mid bX$$

1. Enter this grammar into JFLAP.

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S	$\rightarrow$	ХаУ	KaΧ						
Х	$\rightarrow$	λ							
Х	$\rightarrow$	аX							
Х	$\rightarrow$	bX							

2. Check the type of grammar using *Test > Test for Grammar Type*.

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3. Verify known strings using *Input > Multiple Brute Force Parse*.

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Х	-	$\rightarrow \lambda$			
Х	-	→ aX			
Х		→bX			

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		6		abaaab	Accept				
LHS		RHS		a	Reject				
S	$\rightarrow$	XaXaX		ab	Reject				
			_	bbbabbb	Reject				
X	$\rightarrow$	λ		-					
X	$\rightarrow$	aX	e		'				
X	$\rightarrow$	bX							
Input a strin	ng to l	begin.		Load Inputs	Run Inputs Clear Enter La	ambda			

Now use the Generate Language feature of JFLAP (8 or higher) to produce all strings of length 3.

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🛑 😑 🔵 File He	elp	JFLAP v8.0(CFG_xa	axax.jff)					
	Gram	mar Editor Langu	age Generator					
Gen	erate: 3		# of Strings String Length					
S	$\rightarrow$ X a	aaa						
Х	$\rightarrow \lambda$	a a b						
Х	$\rightarrow$ a X	a b a						
Х	$\rightarrow b X$	baa						
Gramm	nar = (V, T, P, S)							
V =	{		}					
T =	$T = \{ \begin{array}{c} a \ b \end{array} \}$							
S =	S							
Table T	ext Size							