

## Context-Free Grammar Using Multi-Character Mode - Exercise

*Problem:*

Suppose we want to accept simple sentences as:

bob wants oranges

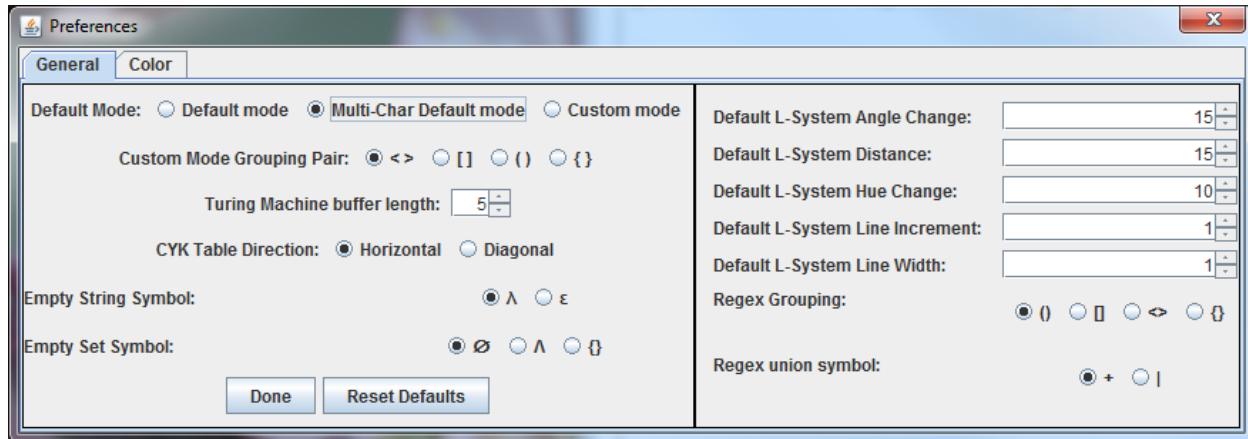
bob likes apples

jen wants apples

Create a context-free grammar on JFLAP to accept such sentences.

*Solution:*

By default, JFLAP assumes that each terminal on a context-free grammar is a single character. We may change this by opening JFLAP and changing this setting to a multi-character mode. Click *Help > Preferences* to do this. Select the Multi-Char Default mode radio button and click *Done*.



Next, create a grammar rule to accept a noun verb object,  $S \rightarrow N V O$ . Note that you should add spaces in between the right-hand side variables. We will limit *nouns* to *bob* and *jen*.

Next, we add the rules for *verbs* allowing *needs* and *wants*.

Lastly, we add the *objects apples, oranges, and bananas*.

JFLAP v8.0(CFG\_sentence.jflap)

File Edit Input Test Convert Help

Grammar Editor

LHS	RHS
S	$\rightarrow N V O$
N	$\rightarrow \text{bob}$
N	$\rightarrow \text{jen}$
V	$\rightarrow \text{needs}$
V	$\rightarrow \text{wants}$
O	$\rightarrow \text{apples}$
O	$\rightarrow \text{oranges}$
O	$\rightarrow \text{bananas}$

Grammar = (V, T, P, S)

V = { N O S V }

T = { apples bananas bob jen needs oranges wants }

S = S

Table Text Size Start Variable

The screenshot shows the JFLAP v8.0 Grammar Editor window. The title bar reads "JFLAP v8.0(CFG\_sentence.jflap)". The menu bar includes File, Edit, Input, Test, Convert, and Help. The "Grammar Editor" tab is selected. Below the tabs is a toolbar with a lock icon and a refresh icon. A table lists the grammar rules with "LHS" and "RHS" columns. The rules are: S → N V O, N → bob, N → jen, V → needs, V → wants, O → apples, O → oranges, and O → bananas. The last rule, O → bananas, is currently selected. Below the table, the grammar components are defined: V = { N O S V }, T = { apples bananas bob jen needs oranges wants }, and S = S. A "Start Variable" button is located at the bottom right of the component definitions. At the bottom left, there is a "Table Text Size" slider. The overall interface is a standard Windows-style application window.

Test an input sentence like bob wants bananas and check that input should be accepted.

JFLAP v8.0(CFG\_sentence.jflap)

File Help

Grammar Editor Brute Force Parser

Input: bob wants bananas Set Change

Step Complete Reset

Input accepted! Change view to see derivation!

S	$\rightarrow$	N V O
N	$\rightarrow$	bob
N	$\rightarrow$	jen
O	$\rightarrow$	apples
O	$\rightarrow$	bana...
O	$\rightarrow$	oran...
V	$\rightarrow$	needs

Brute Parse Table

Level	Total Nodes	Current Derivations
1	1	[N V O]
2	8	[bob V O, N wants O, N V ...]
3	22	[bob wants O, bob V bana...]
4	24	[bob wants bananas]

Grammar = (V, T, P, S)

V = { N O S V }

T = { apples bananas bob jen needs oranges wants }

S = S

Table Text Size

Lastly, try an invalid sentence and verify that it is rejected.

