Assignment 4

Sterling Kohel

March 19, 2014

1 Give a BNF grammar for the set of all strings consisting of the keyword begin, followed by one or more statements with a semi-colon after each statement, followed by the keyword end. Use the non-terminal $< statement >$ for a statement and do not give a production for it.

$< string >$	:==	begin ; $< phrase >$
$< phrase >$	:==	$< statement >$; $< phrase >$ | end

2 Repeat Problem 1 except now use EBNF extensions wherever possible to simplify the grammar.

$< string >$	:==	begin ; $< statement >$?
$< phrase >$	:==	$< statement > *$ | end?

3 Write a BNF grammar that can generate all strings in the language $a^n c^k b^m$ where $n > m \geq 1$ and $k = 0, 1, or 2$. In other words, there are more a's than b's. There is at least 1 b. The a's and b's may be separated by nothing, 1 c or 2 c's. Hint: In the review problems you've seen a grammar for a language whose sentences are a string of a's followed by an equal number of b's. Think about how to extend that grammar to satisfy the specifications of this problem.

$< expression >$	:==	aa $< expression >$ b | aaa$< expression > bb$
		| a $< expression >$ | $< term >$
$< term >$	:==	c | cc | $< empty >$

4 Repeat Problem 3, but now use EBNF extensions to make your grammar as concise as possible.

$< expression >$	:==	(aa $< expression >$ b)* | aaa$< expression > bb*$
		| a$< expression > *$ | $< term >$?
$< term >$	:==	c? | cc?