CS5003
Quiz 0110

Foundations of C.S.

Spring, 2017

PRINT NAME: _____

$\mathcal{SIGN}$: _____

1. (4 points) Construct a grammar for the language on $\Sigma = \{a, b, c\}$ consisting of all strings with either an even number of letters, or be a string of the form $a^{2k}b^{2k+1}c^3$, $k \geq 0$.

♣ We use A and B to split the types. From A will derive all strings with an even numbers of characters. From B will derive the others.

$$\begin{aligned} G: S &\rightarrow A \mid Bbc^3 \\ A &\rightarrow aaA \mid abA \mid acA \mid baA \mid bbA \mid bcA \mid caA \mid cbA \mid ccA \mid \lambda \\ B &\rightarrow a^2Ab^2 \mid \lambda \end{aligned}$$ ♣

2. (6 points) Let G be the grammar given by

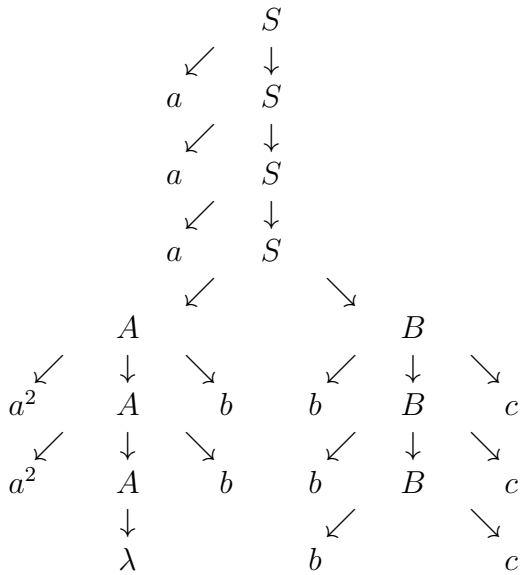
$$\begin{aligned} G: S &\rightarrow aS \mid AB \\ A &\rightarrow a^2Ab \mid \lambda \\ B &\rightarrow bBc \mid bc \end{aligned}$$

a) Give a derivation sequence for $a^7b^5c^3$

♣ Consider rewriting $a^7b^5c^3 = a^3(a^4b^2)(b^3c^3)$ and the derivation sequence is

$$S \overset{3}{\Rightarrow} a^3S \Rightarrow a^3AB \overset{2}{\Rightarrow} a^3a^4Ab^2B \Rightarrow a^3a^4b^2B \overset{2}{\Rightarrow} a^3a^4b^2b^2Bc^2 \Rightarrow a^3a^4b^2b^2bcc^2$$ ♣

b) On the back of this paper draw the derivation tree of your derivation of part a.



c) Give a set theoretic definition of the language.

♣ From B derives $b^{k+1}c^{k+1}$, $k \geq 0$. From A derives $a^{2j}b^j$, $j \geq 0$. From S derives a^iAB, $i \geq 0$. So the language is

$$\{a^{i+2j}b^{j+k+1}c^{k+1} \mid i \geq 0, j \geq 0, k \geq 0\},$$ ♣