

# CSCI 301, Winter 2018

## Math Exercises # 8

Jesse Ericksen

Due date: Midnight, Wednesday, Mar 7

Find a context free grammar for each of the following languages.

1.  $\{a^i b^j \mid i \geq j \geq 0\}$

$$\begin{aligned} S &\rightarrow A \\ A &\rightarrow aA \mid aAb \mid \epsilon \end{aligned}$$

2.  $\{a^{4n+5} b^{3n+2} : n \geq 0\}$

$$\begin{aligned} S &\rightarrow aaaaaAbb \\ A &\rightarrow aaaaAB \mid \epsilon \\ B &\rightarrow bbb \end{aligned}$$

3.  $\{a^i b^j c^k \mid i = j \text{ or } j = k\}$

$$\begin{aligned} S &\rightarrow S_1 C \mid A S_2 \\ S_1 &\rightarrow a S_1 b \mid \epsilon \\ S_2 &\rightarrow b S_2 c \mid \epsilon \\ A &\rightarrow a A \mid \epsilon \\ C &\rightarrow c C \mid \epsilon \end{aligned}$$