

**CS3133**  
**HW #6**

**DUE:** Friday, October 6

1. (5 points) Add the rule

$$\langle \text{variable} \rangle \rightarrow \langle \text{identifier} \rangle$$

to the grammar of **Sections 3.5** and **3.6** of our text, and then show a derivation tree for

$$\langle \text{expression} \rangle \Rightarrow x \mathbf{div} (y * 3)$$

2. (3 points) Find a context-free grammar with no useless symbols equivalent to the grammar

$$S \rightarrow AD|CA$$

$$A \rightarrow a$$

$$B \rightarrow cA|E$$

$$C \rightarrow aD|b$$

$$D \rightarrow DC|AD$$

3. (9 points) Describe a grammar in Chomsky Normal Form equivalent to

$G = (\{S, A, B\}, \{a, b\}, P, S)$  where  $P$  contains the rules

$$S \rightarrow bA$$

$$A \rightarrow AbA|aS|B$$

$$B \rightarrow aB|\lambda$$

4. (10 points) Convert the grammar  $G = (\{S, A, B\}, \{a, b\}, P, S)$  where  $P$  contains

$$S \rightarrow AB$$

$$A \rightarrow BS|b$$

$$B \rightarrow SA|a$$

to an equivalent grammar in Greibach Normal Form.