CS 3133 Foundations of Computer Science, C term 2018

Homework 2, due Monday, January 29

READING: Chapters 3, 4, 5, 18.

1. Exercise 2 on page 97. (15 points)

2. Exercise 4 on page 98. (20 points)

3. Exercise 11 on page 99. (15 points)

4. Show by induction that for every natural number n

$$0^2 + 1^2 + \ldots + n^2 = \frac{n(n+1)(2n+1)}{6}.$$

   (15 points)

5. Let G be the grammar
$$S \rightarrow ASB|\lambda$$
$$A \rightarrow a$$
$$B \rightarrow b.$$

   (a) What is $L(G)$?

   (b) Prove formally (so using induction on the length of the derivations) that $L(G)$ is the set given in (a). (20 points)

6. In this problem we consider the grammar of arithmetic expressions AE, so

$$
\begin{aligned}
AE: \quad V &= \{S, A, T\} \\
\Sigma &= \{b, +, (,)\} \\
P: \quad &1. S \rightarrow A \\
&2. A \rightarrow T \\
&3. A \rightarrow A + T \\
&4. T \rightarrow b \\
&5. T \rightarrow (A)
\end{aligned}
$$

   Build the search tree constructed by the breadth-first top-down parsing algorithm for the string $b + b$. (15 points)