1. Reading: D. Kozen *Automata and Computability*, Lectures 19,20 
J. Hopcroft and J. Ullman *Introduction to Automata Theory, etc.*, section 4.1, 4.2.

2. The main message of this lecture:

   **It is usually difficult to prove rigorously that a given finite automaton accepts a given language (except for very simple cases).** The problem here is caused by an artificial way of scanning inputs linearly, left-to-right, which not necessarily coincides with a natural way the accepted strings are built. Context Free Grammars are more flexible and way friendlier to prove things about. A CFG usually follows the definition of the accepted strings which makes proofs by induction easy and natural.

First of all, read Handout 17 of October 6 about

   Pushdown Automata,
   Context Free Grammars,
   Context Free Languages.

It will be repeated briefly at the lecture.

**Theorem 18.1.** The language PAREN of all balanced strings of parentheses is generated by the grammar

   \[ S \rightarrow [S] \mid SS \mid \epsilon. \]

**Proof.** Follows Lecture 20 from Kozen's book closely.

**Homework problems:** # 2, 3. p.306 of Kozen's book.