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

$$S \longrightarrow [S] \mid SS \mid \epsilon \, .$$

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

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