Homework 9
Com S 331, Spring 2017
Due date: **Wednesday, April 19, 2017**
Please submit the homework via BlackBoard **before the class that day**.

Note: All submissions should be **typed** and in .pdf or .doc(x) format. However, state diagrams can be drawn with hand and presented in the final manuscript as images. We recommend to use Latex for typing homeworks. You **do not** need to formally prove the correctness of your constructions unless a question specifically asks to do so. However, in most cases you need to present a reasonable justification of correctness.

Total points available: 134

0. Read pages 165–182 up to section 3.2 in the class-book (Sipser, **3rd** edition).

1. **(20 points)** Solve items **(b)** and **(c)** of the Exercise 3.8 in the class-book.

2. **(25 points)** Solve Problem 3.12 from the class-book.

3. **(25 points)** Solve Problem 3.13 from the class-book.

4. **(32 points)** Solve items **(b)**, **(c)**, **(d)** and **(e)** of the Problem 3.15 in the class-book.

5. **(32 points)** Solve items **(b)**, **(c)**, **(d)** and **(e)** of the Problem 3.16 in the class-book.

   Let $f : \Sigma_1 \to \Sigma_2^*$ be a mapping from the symbols in an alphabet Σ_1 to strings over an alphabet Σ_2. Then for any string $w = w_1 w_2 \dots w_k \in \Sigma_1^*$ we define

   $$f(w) = f(w_1) f(w_2) \dots f(w_k).$$

   Such mapping of strings over the Σ_1 alphabet to strings over the Σ_2 alphabet is called homomorphism. In item **(e)** you are asked to prove that if a language $L \subseteq \Sigma_1^*$ is Turing-recognizable, then the language $f(L) = \{f(w) \mid w \in L\}$ is Turing-recognizable as well (for some Σ_1, Σ_2, and f).