Name: _____

Kennitala: _____

Your email: _____

Collaborators emails: _____   (omit @hi.is ending)

Return your answers on paper to **the box at VR-II** *latest on Monday 11.9.2017.*

Problems:

1. Suppose the alphabet is $\Sigma = \{a, b, \ldots, z, 0, 1, \ldots, 9, :\}$, i.e., the standard letters a-z, decimal numbers, and colon (:). The colon is used as a delimiter between fields in a text file. Each line of the file thus corresponds to a string.

   a) Give a regular expression that accepts strings with four fields (i.e., with 3 delimiters).

   b) Give a regular expression that accepts strings where the second field is numerical.

   c) Give a regular expression that accepts strings where the third field is non-empty.
      (a field is non-empty if it has at least one symbol).

2. In tutorial 1, we discussed the DFA that determines whether a *binary string* is divisible by three or not. The state diagram is depicted below. Convert it to a corresponding regular expression.
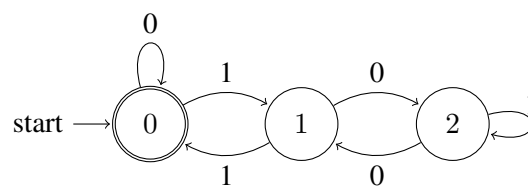

Figure 1: DFA to check whether a binary number is divisible by 3.

3. Consider the ternary number system.

   a) Draw a state diagram for a DFA that accepts ternary strings that are *not* divisible by three.

   b) What is the corresponding regular expression?

   c) Draw a state diagram for a DFA that accepts ternary strings that are *not* divisible by nine.

   d) What is the corresponding regular expression?

4. Let $w = x_k \ldots x_0$ be a string of ternary digits (MSB first on the left).

   a) Draw a state diagram for a DFA that accepts strings that are divisible by two.

   b) Convert the given DFA to a regular expression.

   c) Let $n_i(x)$ denote the number of digits in x that have value i. For example, for $x = 1120$, corresponding to the decimal number $2 \cdot 3 + 3^2 + 3^3 = 42$, we have $n_0(x) = 1$, $n_1(x) = 2$ and $n_2(x) = 1$. Analyze the DFA and determine a simple rule based on the counts $n_i(x)$ for the divisibility by two.

Answer on the back side and/or separate paper. Do not forget your contact details!