Oblig 1

IN2080

Deadline: February 7, 2021

Hand-in and deadline

Hand in a single PDF file in Devilry. The deadline is **February 7, at 23:59**.

We recommend LaTeX, but all major text editors allows exporting to PDF. You can get help with LaTeX at the group sessions. You can also download the LaTeX source (`.tex`) for this assignment at the assignments page.

Problem 1: Regular languages

Let A and B be regular languages defined by DFAs $\mathcal{A}$ and $\mathcal{B}$. Let $n_{\mathcal{A}}$ and $n_{\mathcal{B}}$ be the number of states in $\mathcal{A}$ and $\mathcal{B}$, respectively.

Problem 1a

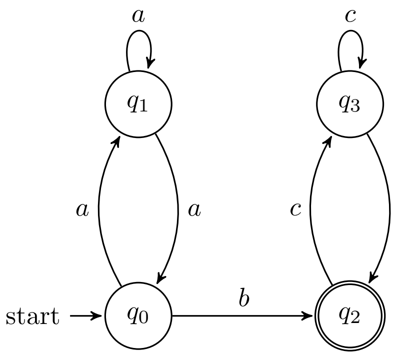
What are the worst-case (highest) number of states in **DFAs** for the languages $A \cap B$ and A^*?

Problem 1b

What are the worst-case (highest) number of states in **NFAs** for the languages $A \cap B$, AB and A^*?

Problem 1c

Create a regular expression defining the same language as the NFA



Problem 1d

Create a DFA for the language

$$\{w \mid w \text{ contains equally many occurrences of the substrings 01 and 10}\}.$$

Problem 2: all-NFAs

An all-NFA is defined in Sipser, problem 1.43 as a 5-tuple $(Q, \Sigma, \delta, q_0, F)$ that accepts $x \in \Sigma^*$ if *every* possible state that M could reach after reading input x is in F (as opposed to *at least one*).

If any brach in an all-NFA computation reaches an implicit or explicit sink state, the input is not accepted.

Show how an all-NFA can be converted to an equivalent DFA.

Hint: Adjust the conversion from NFA to DFA shown in the lectures.