Problem Set 3
Weighted Automata 2020

CHENNAI MATHEMATICAL INSTITUTE

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Problem 1. Construct a weighted automata $\mathcal{A}$ over the tropical semiring$(\mathbb{Z}\cup\{+\infty\}, \min, +, +\infty, 0)$, which realises the following function,

$$[\![\mathcal{A}]\!] : \Sigma^* \to \mathbb{Z} \cup \{+\infty\}$$

$$[\![\mathcal{A}]\!](w) = \begin{cases} 0 & \text{if } w \text{ is of the form } b(a^k b)^l, \text{ where } k, l \in \mathbb{N} \\ \leq -1 & \text{otherwise} \end{cases}$$

Notice that all the a-blocks are of same size in $b(a^k b)^l$.

Problem 2. Show that $Det(Rev(Det(Rev(\mathcal{A}))))$ yields the minimal DFA of an NFA $\mathcal{A}$, where Det is the determinisation operation on an NFA, and Rev is the reversal operation on an NFA, i.e. reversing the edges of the NFA and interchanging the initial and final states.

Problem 3. Minimise the following weighted automata on the rational semiring.