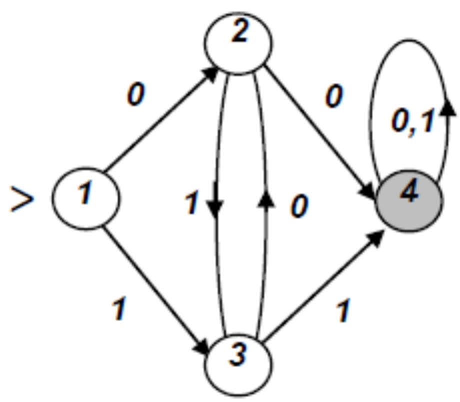
Homework #3 *due November 15, 2022, Tuesday before recitation*

(1) Consider the regular expression $\boldsymbol{E = (1+(0+101)^*)^*}$. Draw an ε-*NFA* accepting the language corresponding to $\boldsymbol{E}$ above using as little number of states as possible; compute and sketch the equivalent *NFA* without ε-transitions ; and finally compute the equivalent *DFA* accepting the language corresponding to $\boldsymbol{E}$ above.

(2) Convert the following *DFA* to ***RE*** using the state elimination technique. Try to simplify the regular expression using the equivalence relations stated in class.



(3) For following languages,prove or disprove the statement that the language is ***regular***.

(a) $\{ww^R \mid w \in (0+1)^*\}$, where w^R stands for the string w written in reverse (backwards)

(b) $\{w \mid w$ *has same number of occurrences of* **01** *and* **10** *as substrings*$\}$

(4) Consider the *Deterministic Finite Automata*,

$A = (Q_A, \Sigma_A, \delta_A, q_{0A}, F_A)$ *and* $B = (Q_B, \Sigma_B, \delta_B, q_{0B}, F_B)$

where

$Q_A \cap Q_B = \varnothing$, $\Sigma_A \cap \Sigma_B = \varnothing$ where $\varnothing$ stands for the null set.

Let $L_A \subseteq \Sigma_A^*$ and $L_B \subseteq \Sigma_B^*$ be the languages accepted by A and B respectively and define the interleaved language:

$L_A \,||\, L_B := \{s \in (\Sigma_A \cup \Sigma_B)^* \mid s\uparrow_A \in L_A$ *and* $s\uparrow_B \in L_B\}$

where $s\uparrow_A$ and $s\uparrow_B$ stand for the projection of s on Σ_A and Σ_B respectively, obtained by erasing all the symbols of s in Σ_B and Σ_A respectively.

(a) Define the *interleaving product* $A \,||\, B$ of A and B as a *DFA* that accepts the language $L_A \,||\, L_B$

(b) Compute a *DFA* that accepts the language $L = (01)^* \,||\, (ab)^*$

(6) Problems from the main textbook

Exercise 4.1.2 ((b),(c),(h))

Exercise 4.3.3, 4.3.4

Exercises 4.4.2, 4.4.3