

COT 4210 Final Exam Part A: Regular Languages 5/4/2021

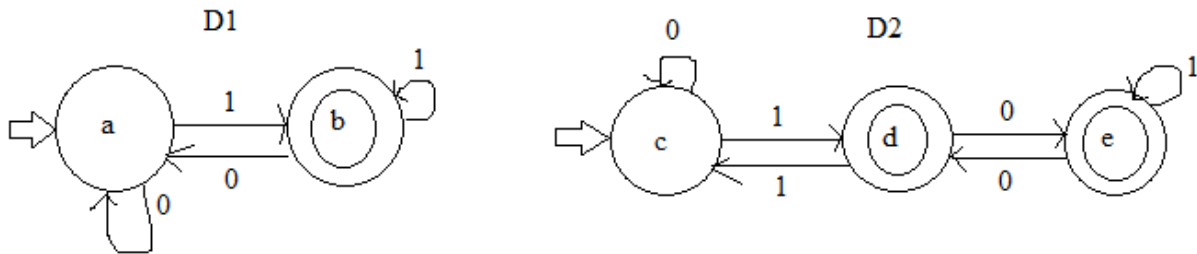
Regular Start Time: 1:00 pm (EDT)

Regular End Time: 1:40 pm (EDT)

Regular Late Time: 1:50 pm (EDT)

1) (5 pts) Design a DFA over the alphabet $\Sigma = \{a, b\}$ that accepts all strings that have no more than 2 a's in a row, and no other strings. Either draw the resulting DFA or give the formal result clearly specifying each portion of the 5-tuple definition clearly typed.

2) (10 pts) Below are the drawings of two DFAs: D1 and D2, both over the alphabet $\{0, 1\}$. Let $L(D1)$ and $L(D2)$ represent the language described by D1 and the language described by D2, respectively. Use the construction algorithm mentioned in class to design a DFA for the language $\overline{L(D1)} \cap L(D2)$. The states in D1 are $\{a, b\}$ and the states in D2 are $\{c, d, e\}$. Please label the states in your answer as $\{ac, ad, ae, bc, bd, be\}$. You may represent your answer as either a drawing or in the formal manner with each item in the 5-tuple definition clearly typed. (Both forms must unambiguously convey the same information.)



3) (10 pts) Let $\Sigma = \left\{ \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix} \right\}$. Define $L = \{ w \mid \text{the binary string read left to right of the top of the tiles is the reverse of the binary string on the bottom of the tiles} \}$. For example, $\begin{bmatrix} 1 \\ 1 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} \in L$, since the top of the tiles reads "11001" and the bottom of the tiles reads "10011". If we reverse "11001", we obtain "10011". Prove, via the pumping lemma for regular languages, that L is not regular.