School for Computer Science and Information Technology

Machines and their languages (G51MAL) Spring 2004

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1st Coursework

2/2/2004

Deadline: 6/2/2004 - 1530 (A39)

1. We use the alphabet $\Sigma = \{\mathrm{a}, \mathrm{b}\}$ and consider the following DFAs A, B:

$$\begin{aligned} A &= (Q_A = \{0,1,2,3\}, \Sigma, \delta_A, q_0^A = 0, F_A = \{1,2\}) \\ \delta_A &= \{((0,\mathrm{a}),1),((0,\mathrm{b}),2),((1,\mathrm{a}),0),((1,\mathrm{b}),3),((2,\mathrm{a}),3),((2,\mathrm{b}),0), \\ &\quad ((3,\mathrm{a}),2),((3,\mathrm{b}),1)\} \\ B &= (Q_B\{0,1,2,3\}, \Sigma, \delta_B, q_0^B 0, F_B = \{2,3\}) \\ \delta_B &= \{((0,\mathrm{a}),1),((0,\mathrm{b}),0),((1,\mathrm{a}),2),((1,\mathrm{b}),3),((2,\mathrm{a}),2),((2,\mathrm{b}),3), \\ &\quad ((3,\mathrm{a}),1),((3,\mathrm{b}),0)\} \end{aligned}$$

   For both DFAs do the following:

   (a) Draw their transition diagrams.

   (b) Determine which of the following words belong to $L(A), L(B)$:

      i. ϵ
      ii. aabb
      iii. aaab
      iv. bbb

   (c) Explicitely calculate $\hat{\delta}_A(0, \mathrm{bab})$ and $\hat{\delta}_B(0, \mathrm{bab})$.

   (d) Try to describe the languages these two automata recognize with your own words.

2. This time we use $\Sigma = \{0,1,2\}$. Construct a DFA C which precisely recognizes those words which only contain decreasing sequences of digits, i.e. the 01,02 or 12 should not occur. Hence $210 \in L(C)$, $\epsilon \in L(C)$, $222 \in L(C)$ but $001 \notin L(C)$, $012 \notin L(C)$, etc.