Concordia University
Department of Electrical and Computer Engineering
Discrete Event Systems (ELEC 6091)
Midterm Exam
3 Questions, 5 pages
October 20, 2016

Family name:

Given name:

Student ID:

Time allotted: 50 min.

Instructions:

- The exam is closed–book.
- No crib sheet is permitted.
- No calculator is permitted.
- Answer each question within the space provided.
- You may use the last blank sheet if necessary.

1.

2.

3.

1. (30%) Consider the nondeterministic automaton **G** (Fig. 1).

2.25 (i) Find a deterministic automaton $\mathbf{G_{det}}$ such that $L_m(\mathbf{G_{det}}) = L_m(\mathbf{G})$ and $L(\mathbf{G_{det}}) = L(\mathbf{G})$.

0.5 (ii) With η denoting the transition function of **G**, find $\eta(1, \alpha\gamma\alpha)$. Explain.

0.25 (iii) Determine if $\alpha\gamma\alpha \in L_m(\mathbf{G})$. Explain.

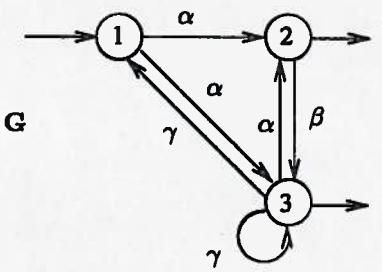
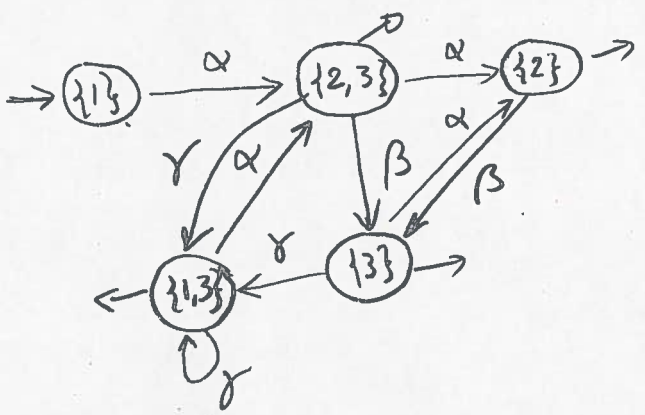


Figure 1: Problem 1.

(i)



(ii) $\eta(1,\alpha) = \{2,3\}$

$\eta(1,\alpha\gamma) = \eta(2,\gamma) \cup \eta(3,\gamma) = \{1,3\}$

$\eta(1,\alpha\gamma\alpha) = \eta(1,\alpha) \cup \eta(3,\alpha) = \{2,3\}$

(iii) $\{2,3\} \cap X_m \neq \emptyset \Rightarrow \alpha\gamma\alpha \in L_m(G)$

2. (30%) Consider the alphabet $\Sigma = \{\alpha, \beta, \gamma\}$ and a language $L \subseteq \Sigma^*$, with

$$L = \{s \mid s \text{ contains at least one } \beta \text{ and ends in } \gamma\}.$$

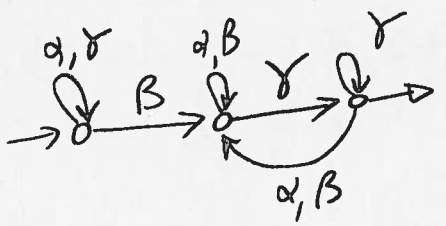
1.5 (a) Find a regular expression for L.

1.5 (b) Construct a complete deterministic finite-state *automaton* to mark L.

(a) $L = \{s \mid s_1 \beta s_2 \gamma\}$

$L = \Sigma^* \beta \Sigma^* \gamma$

(b)



3. (40%) Consider the two automata $\mathbf{G_1}$ and $\mathbf{G_2}$ in Fig. 2.

(i) Find $\mathbf{sync(G_1, G_2)}$.

(ii) Find a complete automaton to mark $P_1^{-1}(L_m(\mathbf{G_1}))$ where P_1^{-1} is the inverse projection from $\Sigma_1 = \{\alpha, \beta, \gamma\}$ onto $\mathrm{Pwr}(\Sigma_1 \cup \{\lambda, \delta\})$.

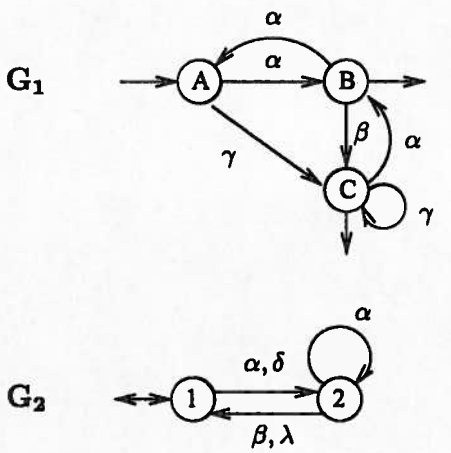
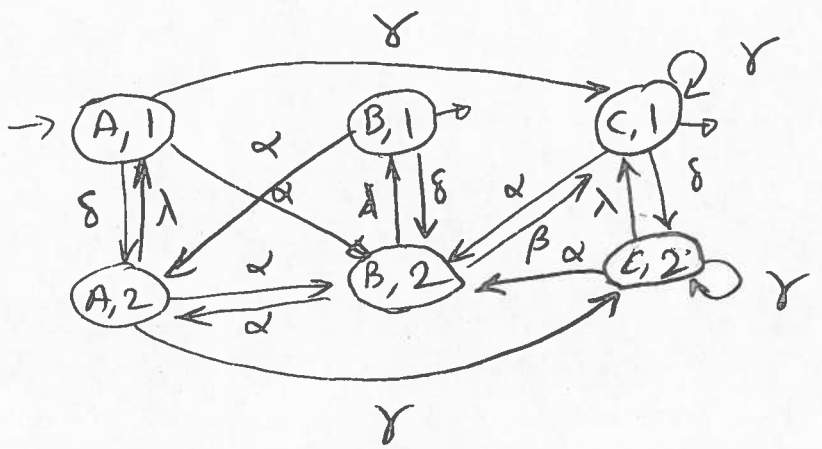


Figure 2: Problem 3.

(i)



(ii)

selfloop $(G_1, \{\lambda, \delta\})$