RA

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

Department of Mathematics

Date: Feb., 2013 Time: 2 Hrs Full Marks: 30 No. of Students: 75

Mid (Spring) SEMESTER EXAMINATION (2012–2013)

Subject: Switching and Finite Automata Theory (MA60036/MA30006/MA61002)

Answer **ALL QUESTIONS**. Marks are indicated at the end of each question.

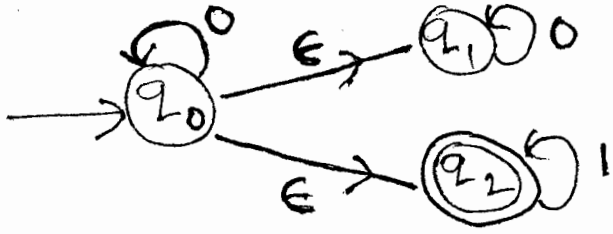
1. a) Let L be the set of all strings over the alphabet $\{0,1\}$ that end in 0 and do not contain the substring 11. Describe a DFA whose language of accepted strings is L. Justify your answer.

   b) Suppose that L_1 and L_2 are regular language (over the same alphabet Σ) accpeted by DFA M_1 and M_2 respectively. Show that there is a DFA M such that for all strings u over Σ, M accepts u if and only if $u \notin L_1$ or $u \in L_2$.

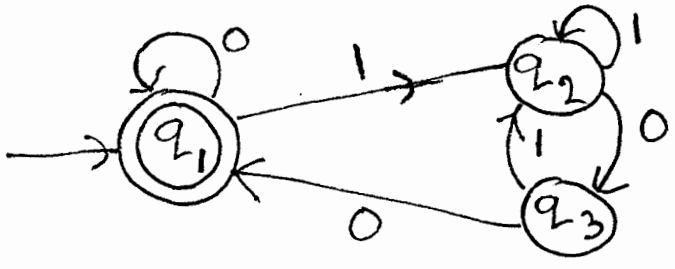
   c) Show that if L is a regular language then the set of strings in L of odd length is also a regular language. Is the same true of strings of even lenghth? Justify your answer. [3 + 3 + 4]

2. a) Define (i) an ϵ-NFA; (ii) Extended transition ($\hat{\delta}(q,w)$, where w is a string) and the language accepted by an ϵ-NFA.

   b) Convert the following ϵ-NFA into an equivalent DFA [3 + 3]



3. Consider the following DFA over the alphabet $\{0,1\}$:



   Find the regular expression corresponding to the above DFA. [5]

4. a) Convert the regular expression $011(0+1)^*$ to NFA's with ϵ-transition.

   b) Suppose that L is a language over a finite alphabet Σ with the property that for each number $l \geq 1$ there is some string $w \in L$ with $length(w) \geq l$ such that no matter how w is split up into three pieces $w = u_1vu_2$ with $length(u_1v) \leq l$ and $length(v) \geq 1$, there is some $n \geq 0$ for which $u_1v^nu_2 \notin L$. Prove that L cannot be a regular language.

   c) Prove that $\{0^n1^{2n} : n \geq 1\}$ is not a regular language. [3 + 3 + 3]