Department of Computer Science & Engineering,
Motilal Nehru National Institute of Technology, Allahabad.

B.Tech IV Semester CS
MID Semester Examination 2017

Subject: Automata Theory
Duration: 1:30 HRS

Paper code: CS 1404
Max. Marks: 20

Note: Attempt all questions. Be specific in your answers. Make assumptions wherever necessary and quote it. Do all the questions serially.

1. Prove or disprove each of the following statements: [3]
   (a) It is possible that the intersection of an infinite number of regular languages is not regular.
   (b) Every subset of a regular language is regular.
   (c) Let L4 = L1L2L3. If L1 and L2 are regular and L3 is not regular, it is possible that L4 is regular.

2. If L1 and L2 are languages, define a new language: INTERLACE $(L_1, L_2) = \{w_1v_1w_2v_2w_3v_3 \dots \dots \dots w_nv_n \mid w_1w_2w_3 \dots \dots \dots w_n \in L_1, v_1v_2v_3 \dots \dots \dots v_n \in L_2\}$. for example, if abc $\in L_1$ and 123 $\in L_2$, then a1b2c3 $\in$ INTERLACE (L_1, L_2). Show that if L_1 and L_2 are regular languages, then INTERLACE (L1, L2) is a regular language. [3]

3. (a) Construct a mealy machine for binary adder and convert into the equivalent moore machine [1]

   (b) Construct a mealy machine which take binary input and produce 2's compliment as output. Assume that string is read from LSB to MSB and end carry is discarded. As a sum of present and previous bit. [1]

4. (a) Design Deterministic Finite Automata that recognize
   $L = \{x \in \{(0,1)^* : |x| \geq 3 \text{ and the } 3rd \text{ symbol from the right is } x = 1\}$ [2]

   (b) Suppose L is regular, $L \subseteq \{0,1\}^*$, we define new language, $L_1 = \{y \in \{0,1\}^* \mid$ *There is an* $x \in L$, *exactlly one bit of which is flipped to obtain* $y\}$ *is also regular.* [2]

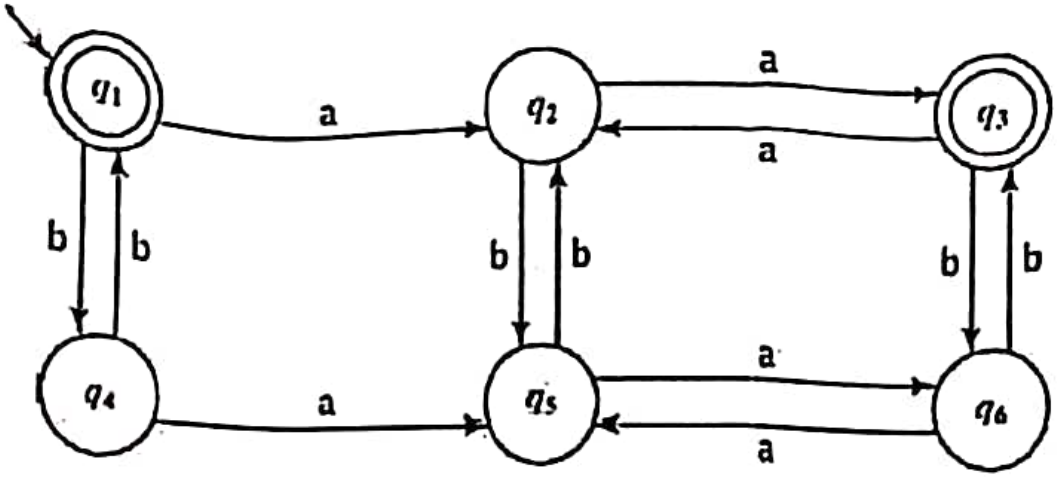
5. (a) Using the pumping lemma show that the following language is not regular. [2]

   L(M) = {w = vz : v∈{a,b}* and z = all a's in v replaced by b's and vice versa}

   (b) Construct the CFG, G, for the language. [2]

   $L(G) = \{a^i b^j c^k : i = j \text{ or } i = k \text{ or } j = k\}$

6. (a) Let M be the following DFA. [2]



Minimize M by set partitioning

(b) Obtain regular expression for the language accepted by following automata. [2]