THEORY OF COMPUTATION - Integrated M.Tech II
Assignment - 1 Submit by February 27th August 2018

Two problems are being assigned to each student. Building a DFA for the first one given in (a) and proving that the language given in (b) is NOT regular.

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a) Build a DFA by taking the alphabet as $\{a, b\}$ if not specified according to the given steps

   1. Express the given language as a regular expression(RE) or $\epsilon-$NFA whichever is most intuitive. Provide justification that your constuction is correct.
   2. Convert to an equivalent NFA
   3. Convert the NFA to an equivalent DFA
   4. Minimize the DFA

b) Prove that the given language is NOT regular using the Pumping lemma for regular languages.

16MCME01 (a) The set of all strings with at most one pair of consecutive a's and at most one pair of consecutive b's.

(b) The set of strings with twice as many a's as b's.

16MCME02 (a) All strings on $\{0, 1\}^*$ such that when interpreted as a binary integer is a multiple of 5.

(b)
$$\{a^n b^n c^n : n \geq 1\}$$

16MCME03 (a) All strings in which any b's that occur are found in groups of an odd number at a time (Eg: *abaabbbaba*)

(b)
$$\{a^i b^j c^k : j = i \ or \ j = k, i, j, k \geq 0\}$$

16MCME04 (a) All strings in which the total number of a's is divisible by 3.

(b)
$$\{a^i b^j c^k : j = i + ki, j, k \geq 0\}$$

16MCME09 (a) All words that do not have both the substrings *bba* and *abb*

(b)
$$\{a^i b^j c^k : i < j \ ori > ki, j, k \geq 0\}$$

16MCME10 (a) The set of all strings that do NOT begin and end in the same symbol for strings in $\Sigma = \{a, b, c\}$.

(b) $$\{a^i b^j : i \leq 2ji, j \geq 0\}$$

16MCME11 (a) The set of all strings whose first two letters match with the last two letters.

(b) $$\{a^i b^j : i \leq j \leq 2i, i, j \geq 0\}$$

16MCME13 (a) The set of all strings whose 4th symbol from the right is b

(b) $\{ww : w \in a, b^*\}$

16MCME14 (a) $(1 + 10 + 110)^*$

(b) $\{w \in \{a, b\}^* :$ the number of a's is $<$ number of b's in w $\}$

16MCME15 (a) $1(01 + 10)^* + 0(11 + 10)^*$

(b) $\{w\#x|w^R$ is a substring of x; w, $x \in \{a, b\}^*\}$