Assignment 1

Released: 18 Sep - Due: 25 Sep | *TA: Manoj M P*

Some of the problems are from the textbook (Sipser).

1. Problem 1.4 - parts a, i, j (page 84)
2. For the following languages, give a DFA if possible. If you think it is not possible, just state so (no need to prove it).
   (a) Multiples of 3
      i. when the input is in binary (alphabet being $\{0, 1\}$)
      ii. when the input is in ternary (alphabet being $\{0, 1, 2\}$).
   (b) The input alphabet is binary. Let a be the number of 1's and b the number of 0's.
      i. $|a - b|$ is even
      ii. $a > b$
3. Problem 1.8 - part b (page 85)
4. Problem 1.11 (page 85)
5. For the following problems, be brief but precise in your answers.
   (a) Given an NFA M_1 for recognizing a language L, how would you construct an NFA M_2 to recognize the language $L^R = \{w | w^R \in L\}$? Here w^R stands for the reverse of the string w (for e.g., if $w = 100$, $w^R = 001$).
   * (b) For a language L define a related language $L_{\frac{1}{2}}$ as follows:

$$L_{\frac{1}{2}} = \{w | \exists x \text{ st } wx \in L, \text{ and } |w| = |x|\}$$

   (i.e., $L_{\frac{1}{2}}$ consists of exactly those strings which appear as the first half of a string in L). Given an NFA recognizing L, how would you construct one for $L_{\frac{1}{2}}$?