Assignment 1

Instructions:

1. This assignment can be done in groups comprising 1 student - 3 students

2. Each student must attach a signed plagiarism declaration to their submission

3. One submission per group

4. Write legibly or (preferably) typeset your assignment using LaTeX

1. Draw DFAs for the following languages over $\Sigma = \{0,1\}$

   (a) $\{0^n \vee 1^m \mid n$ is even, m is odd $\}$

   (b) Any string that does not contain the substring 01

[10 marks]

2. Draw NFAs for the following languages over $\Sigma = \{0,1\}$

   (a) Strings end in 1011

   (b) $\{101x101 \mid x \in \Sigma^*\}$

   (c) $\{x(ab)^n \mid x \in \Sigma^*, n$ is even $\}$

[10 marks]

3. Formally state the DFA for 1b

[10 marks]

4. Fomrally state the NFA for 2b

[10 marks]

5. Consider the case of a vending machine. Each item in the vending machine costs $1.00 TTD. The machine accepts 5¢, 10¢, 25¢, $1.00. The machine dispenses snacks once a sequence of legal tender adds up to a sum greater than or equal to $1.00. Draw a DFA that captures the functionality of this machine.

[10 marks]

6. Consider the following alphabet

$$\Sigma = \{[\begin{smallmatrix}0\\0\end{smallmatrix}], [\begin{smallmatrix}0\\1\end{smallmatrix}], [\begin{smallmatrix}1\\0\end{smallmatrix}], [\begin{smallmatrix}1\\1\end{smallmatrix}]\}$$

An example of a string over this alphabet is $[\begin{smallmatrix}0\\0\end{smallmatrix}][\begin{smallmatrix}1\\0\end{smallmatrix}]$.

Each row in such a string can be considered a binary number. Show that

Show that $C = \{w \mid w \in \Sigma^*,$ the first row in w is greater than the second$\}$ is a regular language.

[10 marks]

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Due: 24th October 2019   COMP 3602

7. Consider the set difference operation as applied to regular languages. Show that if L_1 is a regular language and L_2 is a regular language, then $L_1 - L_2$ is also regular. (Hint: You may assume that union, intersection, and complement are all closed under the set of regular languages)

[10 marks]

8. Let $\Sigma = \{0, 1, +, =\}$. The language ADD is defined as follows:

$$\{x = y+z \mid x, y, z \text{ are binary integers and } x \text{ is the sum of } y \text{ and } z\}$$

Prove using the Pumping Lemma that ADD is not regular

[20 marks]

9. Consider the following regular expressions over $\{a, b\}$. List for each two strings that will be recognized and two strings that will not be recognized

- a^*b^*
- $a(ba)^*bb$
- $a^+ \cup b^*$
- $(\epsilon \cup a)b$

[10 marks]