CSE3064 Homework #1 – Due to May 17, 2020.

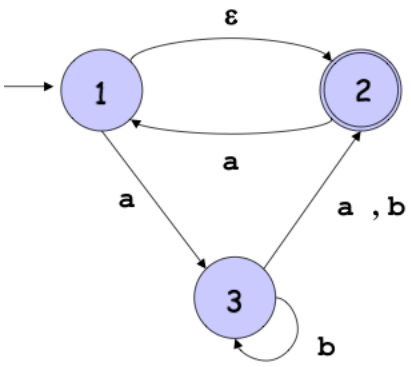
1. (8 pts) Give the state diagrams of DFAs recognizing the following languages (Σ={a,b}):

   L = {*w* | *w* contains at least four **b**s and at most one **a**}

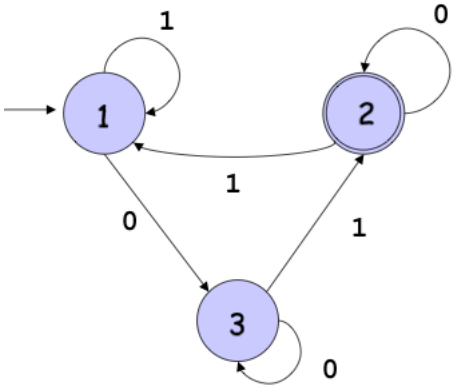
2. (10 pts) Design an NFA for the following language over an alphabet Σ = {0,1,2}:
   L = { y2z | y, z ∈ {0, 1}, the last symbols of both y and z are 1, and both y and z contain 010 as substring}

3. (10 pts) Given two regular languages L_1 and L_2 over an alphabet Σ = {0,1,2}, prove or disprove that the following languages are regular:
   a. L_3 = { w ∈ Σ* | w ∈ L_1 but w ∉ L_2 }
   b. L_4 = { w ∈ Σ* | w is in exactly one of L_1 and L_2 }

4. (10 pts) Convert the following NFA to an equivalent DFA following the steps described in class (see Theorem 1.39 in Sipser).



5. (10 pts) Convert the following DFA to an equivalent regular expression following the steps described in class (see Lemma 1.60 in Sipser).



6. (10 pts) Convert the regular expression $(0+(11^*))(01)^*$ to an equivalent NFA following the steps described in class (see Lemma 1.55 in Sipser).

7. (15 pts) Over the alphabet Σ={a,b}, prove or disprove that the language {w|w contains equal number of substrings **ab** and **ba**} is a regular language.

8. (15 pts) Prove that the following language is not a regular language:
   $L = \{ 0^x 1^y \mid x, y \geq 1, (x \geq y) \text{ or } (x < y \text{ and } y \text{ modulus } x = 0)$

9. (12 pts) Write the context-free grammars which generate the following language:

   a. $L_1 = \{w \in \{a,b\}^* \mid \text{the middle symbol of } w \text{ is } b \text{ and the length of } w \text{ is odd}\}$
   b. $L_2 = \{ 0^a 1^b 2^c \mid a, b, c \geq 0 \text{ and } a + 2b = c \}$

Notes:

- You need to create only one pdf file with high resolution. Make sure that your pdf file is readable. (You can use a smartphone application for this purpose)

- Make sure that the pdf file's name contains your number. (yourNumber_HW1.pdf)

- Make sure that the all pages of your pdf file also contain your number. (for example, on upper right corner)

- Note that in case of cheating, all parties involved will get zero grade.

- If you submit your assignment late, for every day after the due date, your grade will be decreased by 10%. (If you submit the day after the due date, you will get 90% of your actual grade, if you submit 2 days after, you will get 80% of your actual grade, etc.)

- Due date of the assignment is May 17, 2020, 23:59.

- Send your assignments to cse364.projects@gmail.com