CS375 Homework Assignment 2 (40 points)

Due Date: January 28, 2025

(The red boxes are text boxes. You can put your answers into the boxes directly)

1. For each of the following regular expressions find a language (i.e., a set of strings) over A = {a,b,c} that can be represented/described by that expression. (8 points)

   a. $ab^* + a^*bc$ b. a^*bbbc^*

a.

b.

2. Find a regular expression to describe the following language. If it has no regular expression, say so and explain why.

   $\{ a, b, bac, bc, b^2ac^2, bc^2, \ldots, b^nac^n, bc^m, \ldots \}$ (2 points)

3. A regular expression for the language over the alphabet {a, b} with each string containing exactly one 'ab' substring is b*a*abb*a*. Use this result to find regular expressions for the following languages

   a. a language over the same alphabet with each string containing two 'ab' substrings. (2 points)

   b. a language over the alphabet {a, b, c} with each string containing exactly one 'abc' substring. (6 points)

4. If a regular expression for the language over the alphabet {a, b} with no string containing the substring aa is (b+ab)*(Λ+a), then what is the regular expression for the language over the alphabet {a, b, c} with no string containing the substring aaa? (4 points)

5. The following proof shows that

$$b(a + b)^* + bb(a + b)^* + bbb(a + b)^* = b(a + b)^*$$

Put the reason for each step in the blank on the right-hand side of that step. If an example in the notes can be used for a step, quote that example. (5 points)

$b(a+b)^* + bb(a+b)^* + bbb(a+b)^*$

$= b(a+b)^* + (bb+bbb)(a+b)^*$ _____

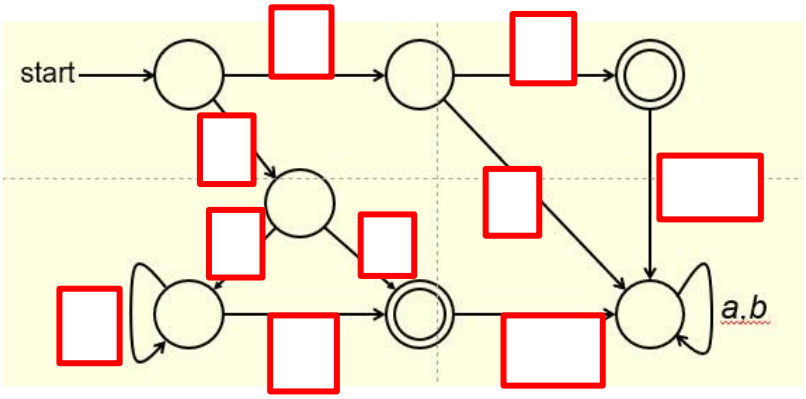
$= b(a+b)^* + b(b+bb)(a+b)^*$ _____

$= b(a+b)^* + bb(a+b)^*$ _____

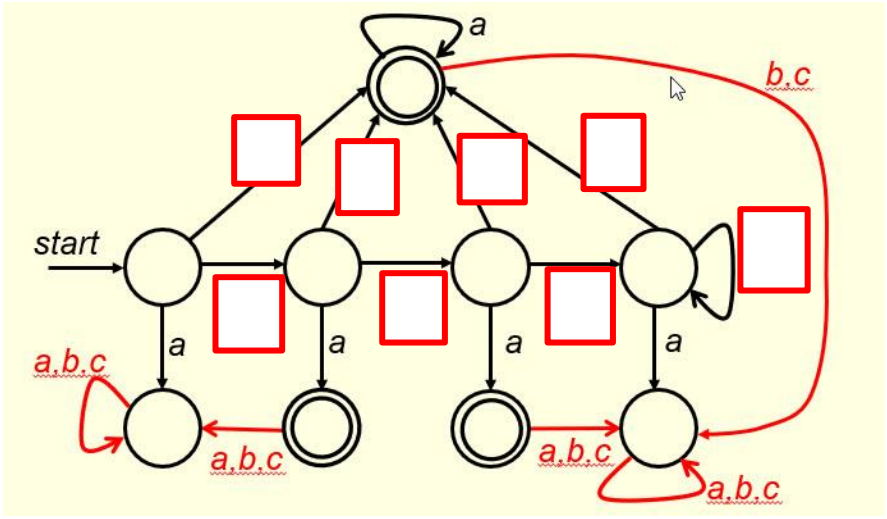
$= (b+bb)(a+b)^*$ _____

$= b(a+b)^*$ _____

6. Fill out the blanks in the following figure to make it a DFA that recognizes the expression ab + bb*a. (5 points)



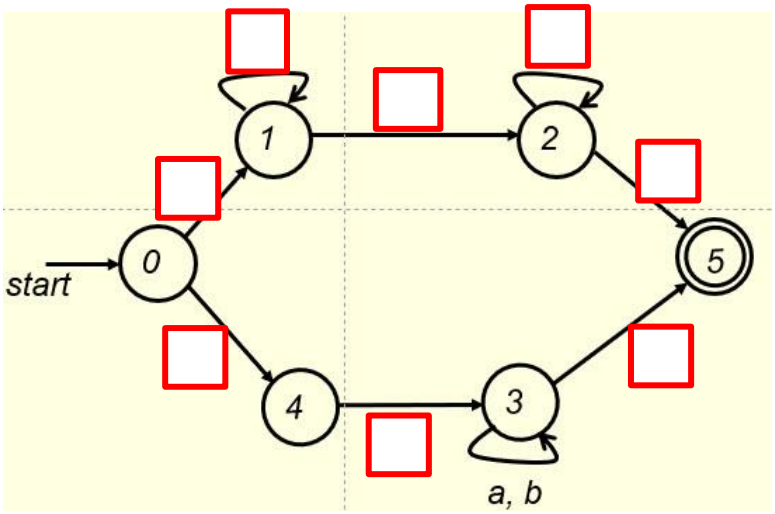
7. Fill out the blanks in the following figure to make it a DFA for the expression b*ac* + bbc + bc (4 points)



8. Fill out the blanks in the following figure to make it an NFA for the expression

a* + b*a* + b(a+b)*

If it is possible, simplify the given expression first. (4 points)



- Solutions must be typed (word processed) and submitted to Canvas both as a pdf file and a word doc (or docx) file before 23:59 on 01/28/2025.
- Please name your files the following way:

  CS375_2025s_HW2_LastName.docx / CS375_2025s_HW2_LastName.pdf