COMPSCI 2AC3
Instructor: Hassan Ashtiani
Midterm Exam I
February 2022

First Name: _____

Last Name: _____

Student Number _____

Note that

- The time limit is 45 minutes.

- This examination paper includes 5 pages (including this cover page and the last blank page) and 4 questions. You are responsible for ensuring that your copy of the papers is complete. Bring any discrepancy to the attention of your invigilator.

- Total of points is 100 .

Special Instructions:

1. You are not allowed to bring additional resources (notes, books, etc.) to the exam. You will not need a calculator either.

2. If you need more space, you can use the back of the papers to write your solutions.

3. If you think there is an issue with one of the questions or something is unclear, then make an assumption based on your judgement and include it in your solution.

Grade Table

Question	Points	Score
1	25	
2	20	
3	25	
4	30	
Total:	100	

1. (25 points) Assume $A \subseteq \Sigma^*$ and $B \subseteq \Sigma^*$ are regular sets, and $C \subseteq \Sigma^*$ is another set (not necessarily regular). Let $D = (A \cap B)C$? From the following choices, check **ALL** of the correct choices, leaving the rest unchecked. [should you accidentally check an option by mistake, then clearly indicate your mistake by writing FALSE beside that option]

   ◯ If C is regular, then D is also regular.

   ◯ If C is not regular, then D cannot be regular.

   ◯ If C is regular, then $D = (AC \cap BC)$ always holds.

   ◯ If C is regular, then $D = (AC \cap BC)$ never holds.

   ◯ If C is not regular, then $D = (AC \cap BC)$ never holds.

2. (20 points) Check **ALL** of the correct choices, leaving the rest unchecked.

   ◯ The language corresponding to some NFAs cannot be represented using DFAs.

   ◯ Some regular sets are easier to be represented by NFAs (than DFAs) since any equivalent DFA will have exponentially many more states.

   ◯ Some regular sets are easier to be represented by regular expressions (than patterns) since any equivalent pattern will have more length.

   ◯ Any regular set can be represented using a DFA, an NFA, or a regular expression.

3. (25 points) Let $A = L((aa(a+b)^*bb)+(bb(a+b)^*aa))$ be a language defined over alphabet $\Sigma = \{a, b\}$. Draw an NFA (or an NFA with ϵ-transitions) for A. You don't need to prove that your automaton is equivalent to the language.

4. (30 points) Give a regular expression for the following NFA using the approach that was discussed in the class (based on $\alpha_{u,v}^R$). Show your work.
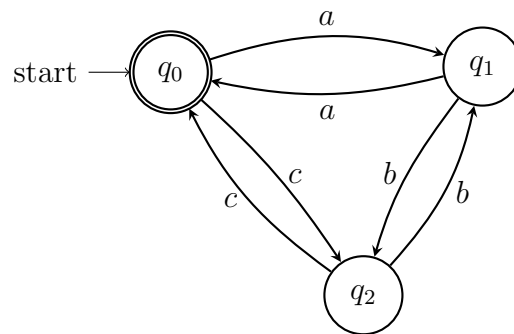
You can use this page as a scratch paper. Return this page with your exam papers.