

**Max Point: 20**

**Time Allowed: 90 Min**

**Obtained Marks:**

Department of Computer Science | School of Arts & Sciences

**Course: Theory of Automata**

**Mid Term Exam, Fall 2021**

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| **Student Name:** | **ID:** |

**[Question 1].**

i**.** Write a regular expression for a language defined over ∑ = {a, b} of all words containing odd number of a’s and ending with an a.

ii. Write a regular expression for a language defined over ∑ = {a, b} of all words containing an ‘a’ and zero or more b’s.

iii. Write a regular expression for a language defined over ∑ = {a, b, c, d} of all words divisible by 4.

iv. Write a regular expression defined over ∑ = {a, b, c} of all words starting and ending with same letters.

**[Question 2].**

1. Construct a Finite Automata for the Following Regular Expression.

Regular Expression = (a + b + c) ((a + b + c)(a + b + c))\*

1. Construct Finite Automata for the Following Regular Expression

Regular Expression = b\*(b\*ab\*ab\*)\* + a\*ba\*(ba\*ba\*)\*

**[Question 3].** Convert the following NFA to DFA.



**[Question 4].** Find the Union of DFA1 and DFA2



DFA1



DFA2

**[Question 5].** Find the Concatenation of DFA1 and DFA2



DFA1



DFA2

Appendix

* **Rules for Union of Two DFAs**
* Let FA3 be an FA corresponding to r1+ r2, then the initial state of FA3 must correspond to the initial state of FA1 and the initial state of FA2.
* Since the language corresponding to r1+ r2 is the union of corresponding languages L1 and L2, consists of the strings belonging to L1or L2 or both, therefore a final state of FA3 must correspond to a final state of FA1 or FA2 or both.
* **Rules for Union of Two DFAs**
* Let FA3 be an FA corresponding to r1r2, then the initial state of FA3 must correspond to the initial state of FA1 and the final state of FA3 must correspond to the final state of FA2.
* The moment a final state of first FA1 is entered, the possibility of the initial state of second FA2 will be included as well.