National University of Computer and Emerging Sciences

School of Computer Science **Fall 2019** **Islamabad Campus**

CS 301 & Theory of Automata

Serial No:

Mid Exam

Total Time: 2 Hours

Total Marks: 75

Thursday, November 07, 2019

Course Instructor

Dr. Waseem Shahzad

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Signature of Invigilator

Student Name	Roll No	Section	Signature

DO NOT OPEN THE QUESTION BOOK OR START UNTIL INSTRUCTED.

Instructions:

1. Attempt on question paper. Attempt all of them. Read the question carefully, understand the question, and then attempt it.
2. No additional sheet will be provided for rough work. Use the back of the last page for rough work.
3. If you need more space write on the back side of the paper and clearly mark question and part number etc.
4. After asked to commence the exam, please verify that you have Eleven (11) different printed pages including this title page. There are total of (7) questions.
5. Calculator sharing is strictly prohibited.
6. Use permanent ink pens only. Any part done using soft pencil will not be marked and cannot be claimed for rechecking.

	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7	**Total**
Marks Obtained								
Total Marks	10	10	10	10	10	15	10	**75**

Question 1:- **Marks 5+5.**

a. Give recursive definitions of the of the powers of Two.

b. Give recursive definitions for the following language over the alphabet *{a, b}*. The language EVENSTRING of all words of even length.

Question 2:- **Marks 5+5.**

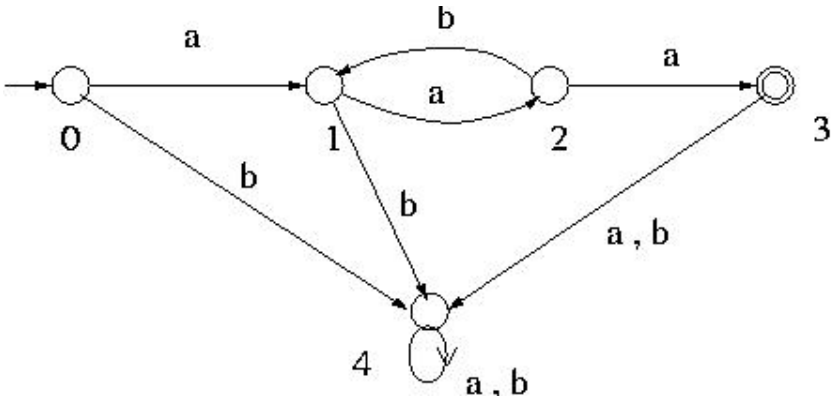
Draw the DFA accepting the following languages:

a. ***(ab + bb)****

b. ***b* + b*a(ba)****

Question 3:- **Marks 10.**

Determine the regular expression of the languages accepted by following FA's.



Question 4:- **Marks 5+5.**

Consider the language over the alphabet $\sum$ = { a,b }

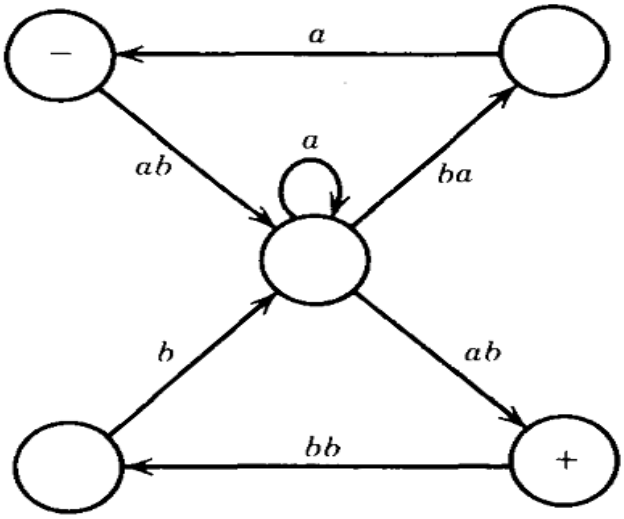
a. Construct a regular expression in which the total number of 'b' is divisible by 4 no matter how they are distributed and 'a' are only found in clumps that is divisible by 3.

e.g. - b b a a a b a a a a a a a a b
- a a a a a a b b b b a a a b a a a b b b

b. All strings with even number of b's

Question 5:- **Marks 10.**

Convert the following TGs to REs. Do show the necessary steps.



Question 6:- **Marks 5+5+5.**

For the Regular Expression **(a+b)*aa**, apply the following transformations using the method studied in the class:

a. From RE to NFA

b. The resultant NFA from part (a) to DFA

c. Minimize the resultant DFA from part (b)

Question 7:- **Marks 10.**

Make CFG for the following language.

$$\{a^n b^{2m} c^{4n} : m, n >= 0\}$$