National University of Computer and Emerging Sciences

School of Computing **Spring 2017** **Islamabad Campus**

CS301-Theory of Automata

Saturday, Sept 16, 2017

Course Instructor

Dr Waseem Shehzad, Dr Labiba Fahad, Ms. Mehreen Alam

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Signature of Invigilator

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Student Name Roll No Section Signature

DO NOT OPEN THE QUESTION BOOK OR START UNTIL INSTRUCTED.
Instructions:
1. In all questions, use the algorithms studied in the class and show all steps to get full credit.
2. Understanding the question paper is also part of the exam, so do **not** ask any clarification.
3. The question paper is printed on both sides of the pages.
4. Attempt all questions on the same sheets/pages and within the space provided with each question. You may lose marks if you write in extra space.
5. Make sure that this question paper contains eight **(08)** pages including title page. Be brief, smart and efficient!
6. Use permanent ink pens only. Any part done using soft pencil will not be marked and cannot be claimed for rechecking.

Question	1	2	3	4	5	6	**Total**
Marks Obtained							
Total Marks	5	10	10	5	10	10	**50**

Vetted By: _____Vetter Signature: _____

Q1. [5 pts] Give recursive definition of language defined over alphabet Σ = {a, b}, having all strings not having the substring aa.

Q2. [5 pts] Give recursive definition of language of POWERS-OF-THREE

Q3. [= pts]Write regular expression , make FAs or TGs of the following for each of the following language defined over alphabet Σ ={a, b}
   a. language of all odd length strings defined over $\sum$ = {a, b}?

   R.E = (a+b) (aa+bb+ab+ba)*

   b. Language of strings not having bb or aa at any place
   c. Write the Regular expression for the language of all even length strings but starts with a defined over $\sum$ = {a, b}?

   R.E = (ab + aa) (aa+bb+ab+ba)*

   d. Regular expression for the strings with even number of a's and odd number of b's where the character set={a,b}.
   e. All strings of a's and b's that contain no three consecutive b's

(a | ba | bba)* (e | b | bb)
   a. All strings of a's and b's that contain an odd number of a's or an odd number of b's

 b*ab*(ab*ab*)* | a*ba*(ba*ba*)*