National University of Computer and Emerging Sciences

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

CS301-Theory of Automata

Serial No:

Sessional II

Total Time: 60 minutes

Total Marks: 70

Saturday, Oct 21, 2017

Course Instructor

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

_____

Signature of Invigilator

_____ _____

Student Name Roll No Section Signature

DO NOT OPEN THE QUESTION BOOK OR START UNTIL INSTRUCTED.

Instructions:

1. Understanding the question paper is also part of the exam, so do **not** ask any clarification.
2. The question paper is printed on both sides of the pages.
3. 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.
4. Make sure that this question paper contains five **(05)** pages including title page. Be brief, smart and efficient!
5. 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	**Total**
Marks Obtained						
Total Marks	20	10	10	20	10	**70**

Vetted By: _____Vetter Signature: _____

Q1. [5+5+10 = 20 pts] Kleene's Theorem

a. Convert the following TG to an RE.

b. Convert the following RE to FA using the method studied in the class.

a+(b+ab)*

c. Minimize the following FA using the method studied in the class.

Q2. [10 pts] Use Pumping Lemma to prove if the following language is regular.

$$\{a^n\ b^m\ a^m\ b^n : m, n > 0\}$$

Q3. [10 pts] Convert the following Moore Machine to its equivalent Mealy Machine.

Q4. [2+4+4+6+4= 20 pts] Perform the following steps on the grammar given below in the order mentioned.

S -> aS | bS | B
B -> bb | C | λ
C -> aC
D -> aC | CC | b
F -> SS | BC | b

a) Augment
b) Kill null-productions
c) Kill unit-productions
d) Remove useless symbols/productions (both methods)
e) Convert the resultant grammar to CNF

Q5. [5+5 = 10 pts] Design CFGs for the following languages.

a) $a^n a^m b^{4m} b^n$

b) EQUAL-EQUAL where every word has equal number of a's and b's