National University of Computer and Emerging Sciences

School of Computer Science **Fall 2020** **Islamabad Campus**

CS 301 & Theory of Automata

Serial No:

Sessional 2

Total Time: 1 Hour

Total Marks: 45

November 28, 2020

Course Instructor

Dr. Waseem Shahzad, and Ms. Mehreen Alam

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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 (08) different printed pages including this title page. There are total of (5) 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	**Total**
Marks Obtained						
Total Marks	05	10	10	10	10	**45**

Q1. [5 pts] Design CFG for the language of balanced parenthesis = {null, (), ()(), (()), (())()….}

Q2. [10 pts] Design PDA for the language EQUAL-EQUAL = {null, ab, ba, aabb, bbaa, abab, baba, baab, abba, aaabbb, ….}

Q3. [1+2+2+3+2 = 10 pts] Convert to CNF and you must show all the intermediary four steps in the order studied to score full marks:

S -> SS | AB | B
A -> aAAa
B -> bBb | bb | null
C -> CC | a
D -> aC | bb

Q4. [5+5 = 10 pts] Convert to GNF. You must convert to intermediary grammar to get full marks.

S -> AB
A -> AB | a
B -> AB | a

Q5. [10 pts] Prove if $a^n b^n c^n d^n$ is a non-CFL.