National University of Computer & Emerging Sciences, Karachi
Spring 2022 Department of Computing
Lab Midterm Examination
March 30, 2022, 1:30 – 3:00 PM

Course Code: EL1005	**Course Name: Digital Logic Design**
Instructor Names: Mr. Syed Waqar Ahmed	
Student Roll No:	**Section No:**

Instructions:

- The question paper consists of one page.
- You must return the question paper after finishing the exam. Use the back of the paper for rough work.
- Internet should be disconnected during the exam.
- You will construct a word file containing all the answers, upload it on GCR under the assigned "Midterm". Internet connection will be available for the last 10 minutes.
- The circuit should be neat enough and well labeled, or you might end up losing points.

Time: 90 minutes. **Max Marks: 30 points**

Question 1 [5 + 5 Points]

(a) Using Boolean algebra, construct a logic function, minimized Karnaugh map and a logic circuit for the following truth table:
(You can use the Combinational Analysis tool here)

A	B	C	X
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

(b) Construct a Full adder using NAND gates only.

Question 2 [10 Points]

Construct a 4-bit full subtractor circuit (1 $Borrow_{in}$ and two inputs A & B each made of 4 bits) using logic gates. The circuit has two outputs, Diff (difference) and Bout (Borrow out.)
(Here, you cannot use the subtractors from the Arithmetic folder in the left pane.)

Question 3 [10 Points]

A security lock is to be designed such that it inputs two 4-bit binary codes from the user. Upon adding the two numbers if the result is 01111 (LSB is the right-most bit) the lock opens (represent it by an output pin) while for any other result it remains locked.
{if you try to use any assumption then do not forget to mention that or else marks will be deducted.}.