Department of Computer Engineering
Faculty of Engineering, University of Peradeniya

CO221: Digital Design | Lab 05 (with Proteus)

Deadline - 09/05/2020 11:55PM

Instructions for Completing Online Labs:

- You're required to implement the lab tasks using Proteus software.
- You should create a separate Proteus project for each lab task and each project should be placed inside a separate folder with the name **LabXX_TaskYY** where XX is the lab number and YY is the task number (e.g. if Lab 05 contains 4 tasks, you should have 4 Proteus projects in 4 folders named Lab05_Task01, Lab05_Task02, Lab05_Task03, Lab05_Task04).
- You should put all the above folders containing lab tasks into a single folder named **E17XXX_LabYY** where XXX is your E-number and YY is the lab number (e.g. if your E-number is E/17/001 and the lab is Lab 05, the folder should be named E17001_Lab05).
- Finally, you should create a .zip file by compressing the above lab folder E17XXX_LabYY and submit it via the link in FEeLS before the deadline mentioned in the lab sheet above.
- Note that any form of plagiarism will result in zero marks for the entire lab.

Lab Tasks:

1. Show the validity of the following theorems by implementing the left hand side and the right hand side of the following theorems in Proteus and then observing the output for all possible inputs. Please note that, if the theorem has two versions, you should implement them both.
    a. DeMorgan's theorem
    b. Distributive law
    c. Absorption law

2. Implement an odd number indicator for a 3-bit binary number. Output is 1 for odd numbers and 0 otherwise.

3. Implement a circuit for a 3-bit binary input value, that outputs a 1 if the input is less than 3 or greater than 5.

4. Design a binary to gray code converter for a 4-bit binary number. Input ABCD is a 4-bit binary value and the output PQRS is a 4-bit gray code value.

In gray code, only one bit changes when going from one number to the next. Table below shows gray codes and their decimal and binary equivalents.

Decimal	Binary	Gray code
0	0000	0000
1	0001	0001
2	0010	0011
3	0011	0010
4	0100	0110
5	0101	0111
6	0110	0101
7	0111	0100
8	1000	1100
9	1001	1101
10	1010	1111
11	1011	1110
12	1100	1010
13	1101	1011
14	1110	1001
15	1111	1000

a. Draw the truth table.
b. Draw the Karnaugh maps.
c. Derive the simplified Boolean equations using the Karnaugh map.
d. Draw the logic circuit.
e. Implement a binary to gray code converter.

Note: It is possible to implement the converter only using XOR gates.

All calculations must be done on paper or any other digital media and need to be included inside the lab task folder - Lab05_Task04.