



School of Electrical Engineering and Computer Science
National University of Sciences & Technology (NUST)

Home Assignment No-4[CLO3]

Subject: **Digital Logic Design**

Course: **BEE-12CD**

Teacher: **Engr. Arshad Nazir**

Marks: **50**

Issue: **19 Nov 2021**

Due: **26 Nov 2021**

Note:

(3:00 PM)

- ✓ Attempt the given problem set in a sequential order. Show all the design steps.
- ✓ Make an index showing summary of the problems solved with page numbers and also specify the missing ones.
- ✓ No late submissions will be accepted unless a prior approval from the teacher is obtained under extremely genuine reasons. The assignments submitted after the due date/time will be graded **zero**.
- ✓ University has zero tolerance for plagiarism and serious penalties apply. All assignments found mutually copied will be marked **zero**.
- ✓ The students will submit a certificate with the assignment work stating the originality of their efforts and no copying from others.
- ✓ **Five** marks are reserved for neat and clean work, table of contents, and certificate to be attached with the assignment work.

Problem No-1

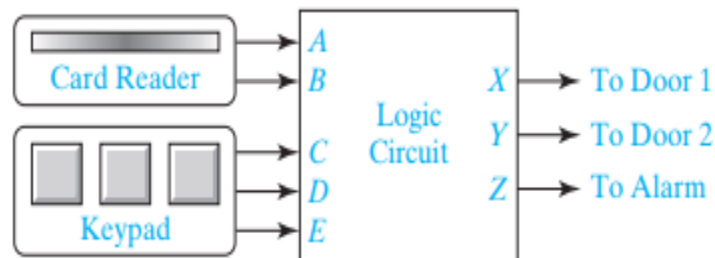
Design a Gray code converter to drive a seven-segment indicator. The four inputs to the converter circuit (A, B, C, and D) represent a decimal digit coded using the Gray code. Assume that only input combinations representing the digits 0 through 9 can occur as inputs, so that the six unused combinations are don't care terms.

Use **6** (not **b**) for 6. Use **9** (not **q**) for 9.

Implement your design with Two-Level NAND-NAND form. Try to minimize the number of gates and inverter as required. The variables A, B, C and D will be available from the toggle switches.

Problem No-2

A simple security system for two doors consists of a card reader and a keypad.



A person may open a door if he or she has a card containing the corresponding code and enters an authorized keypad code for that card. The outputs from the card reader are as follows:

	<u>A</u>	<u>B</u>
No card inserted	0	0
Valid code for door1	0	1
Valid code for door2	1	1
Invalid card code	1	0

To unlock a door, a person must hold down the proper keys on the keypad and, then, insert the card in the reader. The authorized keypad codes for door1 are 3-bit odd numbers whereas authorized keypad codes for door2 are the 3-bit even numbers. If the card has an invalid code or if the wrong keypad code is entered, the alarm will ring when the card is inserted. If the correct keypad code is entered, the corresponding door will be unlocked when the card is inserted.

Design the logic circuit for this simple security system. Your circuit inputs will consist of a card code AB, and a keypad code CDE. The circuit will have three outputs XYZ (if X or Y=1, door1 or 2 will be opened; if Z=1, the alarm will sound).

- Implement the output function **X** with a **5:32 decoder** constructed from four **3:8 decoders** using **NAND** gates with enable input **E**, one **2:4 decoder**, and an external logic gate.
- Realize the output function **Z** with a single **8-to-1 MUX** and external NOR gates connected to the multiplexer inputs. Take **A**, **B**, **C** as selection inputs. Remember that **A** is the most-significant variable in the truth table.
- Realize the function **Y** with four **three-state buffers**, one **2:4 decoder**, and other logic gates as required. Take **D** and **E** as decoder inputs.

Note: Use blocks for Decoders/De-multiplexers and Multiplexers (internal schematics not required)

“Good Luck”