

Assignment#	Date	Title	Due Date	Grade Release Date
Lec 10	Week 10	Binary Codes	March 30, 2022, Wednesday 4 AM EDT	April 4, 2022

The objectives of the lecture (weekly) assignments are to practice on topics covered in the lectures as well as improve the student's critical thinking and problem-solving skills in ad hoc topics that are closely related but not covered in the lectures. Lecture assignments also help students with research skills, including the ability to access, retrieve, and evaluate information (information literacy.)

### Deliverables

You should answer 2 of the below questions based on your preference using an editor like MS Word, Notepad, and the likes or pen in papers. In the latter case, you have to write and scan the papers clearly and merge them into a single file. In the end, you have to submit all your answers in one **single pdf** file **lec10\_UWinID.pdf** containing the question ids for the answer. Please note that if your answers cannot be read, you will lose marks. Please follow the naming convention as you lose marks otherwise. Instead of UWinID, use your own UWindsor account name, e.g., mine is hfani@uwindsor.ca, so my submission would be: lec10\_hfani.pdf


### Lecture Assignments

**(Select Only 2 Questions based on your preference)**

1. Design an Excess3-to-BCD decoder. *Hint: Since Excess-3 code starts at 3 and ends at 12, the binary input for 0,1,2 and 13,14,15 can be used as don't care conditions.*
2. Design an Excess3-to-Aiken decoder in the form of product of sums.
3. Design an Aiken-to-Excess3 decoder in the form of product of sums.
4. Design an Aiken-to-Gray decoder. *Hint: while Gray code can code 0 to 15, Aiken code is able to code 0 to 9. Hence, the Gray codes from 10 to 15 can be used as don't care conditions.*
5. Design a Gray-to-Aiken decoder. *Hint: while Gray code can code 0 to 15, Aiken code is able to code 0 to 9. Hence, the Aiken codes from 10 to 15 must be generated by concatenating the Aiken code for 1 and the Aiken codes for 0 to 5.*
6. Design a 7-segment decoder for Excess-3.
7. Design a 7-segment decoder for Aiken.
8. Draw the logic diagram of a 2-to-4-line decoder using (a) NOR gates only and (b) NAND gates only. Include an enable input.
9. Construct a 5-to-32-line decoder with four 3-to-8-line decoders with enable and a 2-to-4-line decoder. Use block diagrams for the components.
10. Construct a 4-to-16-line decoder with five 2-to-4-line decoders with enable.
11. A combinational circuit is specified by the following three Boolean functions using one decoder:

$$F_1(A, B, C) = \sum(1, 4, 6)$$

$$F_2(A, B, C) = \sum(3, 5)$$


$$F_3(A, B, C) = \sum(2, 4, 6, 7)$$

12. Using a decoder and external gates, design the combinational circuit defined by the following three Boolean functions:
- a.  $F_1 = x'yz' + xz$   
 $F_2 = xy'z' + x'y$   
 $F_3 = x'y'z' + xy$
  - b.  $F_1 = (y' + x) z$   
 $F_2 = y'z' + x'y + yz'$   
 $F_3 = (x + y) z$
13. Design a four-input priority encoder with input  $D_0$  having the highest priority and input  $D_3$  the lowest priority.