COL215 Assignment 1

Date of announcement: 9th October, 2020

Suppose your entry number is as follows, where *d*'s are digits and *l*'s are letters.

d_8	d_7	d_6	d_5	l_1	l_0	d_4	d_3	d_2	d_1	d_0

Define a 2-digit number *N* and an 8-digit number *M* as follows.

$N =$ | d_1 | d_0 | if $d_1 \neq 0$

$N =$ | d_2 | d_0 | if $d_1 = 0$

$M =$ | d_8 | d_7 | d_6 | d_5 | d_3 | d_2 | d_1 | d_0 |

Problem 1: Check if the tuple < *B* , . , + ,' , I+ , I. > forms a Boolean Algebra, given the following definitions.

B = set of all divisors of *N*, including 1 as well as *N* itself
a . *b* = greatest common divisor of *a* and *b*
a + *b* = least common multiple of *a* and *b*
a' = *N* / *a*
I+ = 1 { identity of + operation }
I. = *N* { identity of . operation }

Submit your answer in two parts – (i) description of the procedure followed to find the solution and (ii) the actual solution (final answer as well as the work-out). The first part must be typed, whereas the second part may be typed or hand-written. Convert both parts into pdf files for submission.

Problem 2: Let *S* = set of distinct digits of *M*. You will find |*S*| in the range 5 to 7. A binary to 7-segment convertor (Ref: slide 26 of Lecture 04) is to be designed for displaying the digits in set *S* only, using the usual 4-bit representation of the digits. The unused 16 - |*S*| input combinations are to be treated as don't cares. Do two designs – one considering each output separately (that is, 7 separate circuits, each with 4 inputs and one output) and the other considering all outputs together with maximum sharing of gates (that is, a single 4-input, 7-output circuit). Use only AND, OR and NOT gates. Cost function is simply the number of AND and OR gates. You are not expected to find "the optimum" solution, just try to reduce the cost as much as possible.

Submit your answer in two parts – (i) description of the procedure followed to find the best designs and (ii) the actual designs including the work-out. The first part must be typed, whereas the second part may be typed or hand-written. Convert both parts into pdf files for submission.