Binary Arithmetic and Boolean Algebra-I
Practice Problems

Submission Deadline: 17/09/18

1. Obtain the 1's and 2's complements of the following binary numbers:
   (a) 00010000 (b) 11011010 (c) 10101010 (d) 10000101

2. Find the 9's and the 10's complement of the following decimal numbers:
   (a) 25,478,036 (b) 63, 325, 600 (c) 25,000,000 (d) 00,000,000.

3. Perform subtraction on the given unsigned numbers using the 10's complement method:
   (a) 4,637 - 2,579 (b) 125 - 1,800 (c) 2,043 - 4,361 (d) 1,631 – 745

4. Perform subtraction on the given unsigned binary numbers using the 2's complement method:
   (a) 10011 – 10010 (b) 100010 – 100110 (c) 1001 – 110101 (d) 101000 – 10101

5. Represent the decimal number 6,248 in:
   (a) BCD (b) excess-3 code (c) 2421 code

6. Find the 9's complement of decimal 6,248 and express it in 2421 code. Show that the result is the 1's complement of the answer to 5(c).

7. Simplify the following Boolean expressions using algebraic manipulation. Draw logic diagrams of the circuits that implement the original and simplified expressions.
   (i) $xyz + \sim xy + xy\sim z$
   (ii) $\sim(A + B)\,.\sim(\sim A + \sim B)$
   (iii) $(a + b + \sim c)(\sim a\sim b + c)$
   (iv) $\sim abc + ab\sim c + abc + \sim ab\sim c$

8. Obtain the truth table of the following functions and use it to express each function in sum-of-minterms and product-of-maxterms form:
   (i) $(b + cd)(c + bd)$
   (ii) $(cd + \sim bc + b\sim d)(b + d)$
   (iii) $(\sim c + d)(b + \sim c)$
   (iv) $b\sim d + ac\sim d + a\sim bc + \sim a\sim c$

9. Simplify the following Boolean functions, using three-variable maps and draw the circuit for the minimized expression using NAND gates:
   (i) $F\,(x, y, z) = \sum(0, 1, 5, 7)$
   (ii) $F\,(x, y, z) = \sum(1, 2, 3, 6, 7)$
   (iii) $F(x, y, z) = \sum(2, 3, 4, 5)$
   (iv) $F(x, y, z) = \sim x\sim y + yz + \sim xy\sim z$

10. Simplify the following Boolean functions, using four-variable maps and draw the circuit for the minimized expression using NOR gates:
    (i) $F(w, x, y, z) = wxy + xz + w\sim xz + \sim wx$
    (ii) $F\,(A, B, C, D) = \sum(2, 3, 6, 7, 12, 13, 14)$
    (iii) $F\,(A, B, C, D) = \prod(11, 3, 5, 7, 13, 15)$
    (iv) $F\,(A, B, C, D) = \prod(1, 3, 6, 9, 11, 12, 14)$