EC211 – ELECTRICAL SCIENCES-2

Tutorial Sheet – 4

1. Convert the following numbers to decimal:
   (a) $1F3_{16}$ (b) $A0F_{16}$ (c) 372_8 (d) 156_8 (e) $(0.1011)_2$ (f) $(0.2143)_8$

2. Convert the following decimal number to the bases indicated.
   a) 65477 to octal   b) 65477 to hexadecimal   c) 1231 to binary

3. Perform the following operations using 2's complement method –
   (a) 48 + 23, (b) 48 – 23, (c) 23 – 48, (d) - 48 - 23

4. Subtract the following decimal numbers using 9's complement method –
   (a) 72532 – 3250, (b) 3250 – 72532

5. Subtract the following unsigned binary numbers using 1's complement method –
   (a) 1010100 – 1000100, (b) 1000100 – 1010100

6. Simplify the following Boolean Expressions -
   A'BC + B'CD +AC + A'B'CD'→C
   [AB' (C+BD) + A'B']C → B'C

7. Prove that
   a) A + A'B = A+B
   b) (A+B)(A+C) =A+BC
   c) A (A' +C) (A'B +C') =0

8. Simplify the following Boolean expressions
   a) AB +A (B+C) +B (B +C)
   b) ABC +A'B'C' +ABC' +A'BC
   c) A'BC +B'CD+AC+A'B'CD'

9. Reduce the following expressions
   a) A + B (C + (DE)')'
   b) ((AB)' + A' +AB)'

10. Implement the original and minimized Boolean expression for the given functions
    a) f = A'B'C + BC' + A'BC +ABC
    b) F = BC'D' + A'BD +ABD +BCD' +B'CD +A'B'C'D + AB'C'D

11. Express the following functions in a sum of minterms and a product of maxterms form
    a) F (A, B, C, D) = D (A'+ B) + B'D
    b) F (w, x, y, z) = y'z + wxy' + wxz' + w'x'z
    c) F (A, B, C, D) = (A + B' + C) (A + B') (A + C' + D')
    d) F (A. B, C) = (A' + B) (B' + C)

12. Obtain the simplified expressions in product of sums:
    a) F(x, y, z) = Π M (0, 1, 4, 5)
    b) F (A, B, C, D) = Π M (0, 1, 2, 3, 4, 10, 11)

c) F (w, x, y, z) = Π M (1, 3, 5, 7, 13, 15)

13. Simplify each of the following functions and implement them with NAND gates
    a) F = ac' + ace + ace' + a'cd' + a'd'e'
    b) F = AB' + A'B

14. Implement the following gates using Universal gates
    a) XOR   b) XNOR   c) AND   d) OR   e)NOT

15. Use Karnaugh maps to simplify the following expressions
    a) f (A,B,C,D) = A'BC +B'CD + AC + A'B'CD'
    b) f (A,B,C,D) = ABC +BCD + AC + BC

16. Find out the minimal Boolean expression for the function given below by K-map
    a) f (A,B,C,D) = Σ m (1,3, 6,7,9,13,14,15)
    b) f (W,X,Y,Z) = Σ m (0,1,2,3,4,7,8,11,12,14,15)

17. Find out the minimal Boolean expression for the function given below by K-map
    a) f (A,B,C,D) = Π M (4,6,12,13,14,15)
    b) f (A,B,C,D) = Π M (0,1,2,3,4,7,8,11,12,14,15)

18. Implement Sum and carry function of
        a) Half Adder   b) Full adder   using NAND gates.

19. Realize a full Subtractor using NAND gates only.

20. Implement the four Boolean functions using three half-adder circuits.
        D= AθBθC, where θ is XOR gate.
        E= A'BC +AB'C
        F= ABC' + (A' + B') C
        G= ABC