1. Inputs of MUX A,B and select line is S
   {A,B,S}
   {1,0,S} – NOT gate
   {0,B,S} – AND gate
   {1,B,S} –OR gate
   {A,0,S }- NOR gate
   {1,B,S} – NAND gate
   {1,A',S} – EXOR gate
   {B',0,S} – EXNOR gate
   Note there can be more than one ways to obtain functional completeness
2.
   a. P=0, use EXNOR gates.
   b. P=1, use EXOR gates.

3. Take A=1, then
   B=0, C=0, D=1

4. {A,A,C} – NOR gate. Therefore universal operation
5. ….
6. F=xy'z+y'z+xyzw'+xyw+xyz'w'
7.
   a. use distributive law a+(bc)=(a+b)(a+c)
   b. Start with b=b+aa' and solve
   c. Start with b=b+ab and solve

8. a. prime implicants- yz,wxy,w'z,x'z,w'xy'

   essential prime implicants –wxy,w'xy'

   b. T=yz+wxy+w'z+w'xy'
      T=w'z+x'z+wxy+w'xy'
      T=yz+wxy+xz'+w'xy'

   c. T'=Σm(3,5,6,11,13)

9. a. Get the function T from the K map. Now try to obtain functional completeness similar to Question 1.
   c. Try to obtain function similar to T using complement of T (T') from the given K map and then functional completeness can be achieved.

10. a. True minterms in the truthtable $Z=\Sigma m(1,2,3,5,6,12,15)$ (Draw the truthtable)
    b. $Z= C_1'X_1X_2'+C_1'X_1'X_2+C_1'C_2'X_1+C_1X_1X_2+C_1C_2X_1'X_2'$

11. a. $\Sigma m(5,6,9)$, F= a'bc'd+a'bcd'+ab'c'd
    b. $\Pi M(0,1,2,3,4,7,8,10,11,12,13,14,15)$, F=(c+d)(a+b)(a'+b')(b+c')(a+b'+c'+d')

12. y5=a5exor(p+a4+a3+a2+a1+a0)
    y4= a4exor(p+a3+a2+a1+a0)
    y3= a3exor(p+a2+a1+a0)
    y2= a2exor(p+a1+a0)
    y1= a1exor(p+a0)
    y0=a0

13. a. y0=a0
    y1=a1'
    y2=a2 exor (p.a1)
    y3=a3 exor (p.a2.a1)
    y4=a4 exor (p.a3.a2.a1)

    b. y3=a3 exor a2.a1(a0+p)
       y2=a2 exor a1(a0+p)
       y1=a1 exor (a0+p)
       y0 needs to written separately in two cases
     for increment by 2, y0=a0
    for increment by 1, y0=a0'

14. Already done in lab.

    Practice sheet 2
    Q13
    (c) Write the complement of f1 and f2 in "little m" notation and as canonical minterm expressions.
    Little m means as $\Sigma m(2,5,7)$
    Canonical minterms means f(x,y,z) = x'yz'+xy'z+xyz
    Please note this is only an example and not the actual answer
    (d) Write the complement of f1 and f2 in "big M" notation and as canonical maxterm expressions.
    Big M means as $\Pi_M(0,1,3,4,6)$