Digital Systems HW3

1. Simplify the following terms as much as possible:
   a. X'y'z+yz+xz
      = z(x'y'+y+x)
      = z(x'+y+x)
      = **z**

   b. (x'+xyz')+(x+x'y'z)(x(x'+y'+z'))'
      = (x'+yz')+(x+y'z)(x'+(x'+y'+z)')
      = (x'+yz')+(x+y'z)(x'+xyz')
      = x'+yz'+(x+y'z)(x'+yz')
      = **x'+yz'**

   c. (x+xy)(x+x'z)(y'+yz')+(x(y'+z'))'
      = (x+xy)(x+x'z)(y'+yz')+(x'+(y'+z')')
      = (x+xy)(x+x'z)(y'+yz')+(x'+yz)
      = (x+z+xy)(y'+z')+x'+yz'
      = xy'+xz'+zy'+1+xyz'+x'+yz'
      = **1**

2. Find the dual expression and the complementary expression for the following function: Y=(x+y)[x'y'+z']
   Dual: **Z = xy+z'(x'+y')** // Dual is only for identities... Z has no relation to Y
   Complementary: **Y' = x'y'+z(x+y)**

3. Find the values of the following Boolean variables A, B, C for which the following expressions hold true:
   AC=A'
   CB+A=1
   B'(C+C')=C
   A=1, B=1, C=0

4. Build a truth table for the following expressions:
   a. F=(AB·CB')'(C'+A')B

A	B	C	F
0	0	0	**0**
0	0	1	**0**
0	1	0	**1**
0	1	1	**1**

1	0	0	**0**
1	0	1	**0**
1	1	0	**1**
1	1	1	**0**

b. F=(x'+zy')(xyz)'

x	**y**	**z**	**F**
0	0	0	**1**
0	0	1	**1**
0	1	0	**1**
0	1	1	**1**
1	0	0	**0**
1	0	1	**1**
1	1	0	**0**
1	1	1	**0**

c. F=(A+AB+BC'+C)C'

A	**B**	**C**	**F**
0	0	0	**0**
0	0	1	**0**
0	1	0	**1**
0	1	1	**0**
1	0	0	**1**
1	0	1	**0**
1	1	0	**1**
1	1	1	**0**

5. Prove that the following function forms a complete set

   f(x,y,z) = x’(y’+z)

   f(a,a,a) = a’(a’+a) = a’

   f(f(a,a,a),a,b) = f(a’,a,b) = a’’(a’+b) = a(a’+b) = aa’ + ab = ab

6. Which of the following expressions are the in POS form and which ones are in the SOP form? (There may be some which are neither.)
   a. F1=m+m'n+mn'o
      SOP
   b. F2=A'+B
      SOP
   c. F3=x+x'y'+y(x'+z)
      Neither
   d. F4=A(BC'+B'C)
      Neither

7. Fill in the following table:

F(A,B,C)	**Σ(0,1,3)**	m0+m1+m3	**Π(2,4,5,6,7)**	M2M4M5M6M7
F(A,B,C,D)	∑(0,2,4,5,10,11,13,14)	**m0+m2+m4+m5+m10+m11+m13+m14**	**Π(1,3,6,7,8,9,12,15)**	**M1M3M6M7M8M9M12M15**
F(Δ,Ω,μ)	**Σ(0,2,3,5,6,7)**	m0+m2+m3+m5+m6+m7	**Π**(1,4)	**M1- 1M4**

8. Express the following functions as SOP expressions or as POS expressions:
   a. F(A,B,C,D)=D(A'+B)+B'DC

CD\AB	00	01	11	10
00	0	0	0	0
01	1	1	1	0
11	1	1	1	1
10	0	0	0	0

F(A,B,C,D) = D(A'+B+C)

   b. F(x,y,z)=(xy+z)(y+xz)
      = xyy + xxyz + zy + xzz
      = xy + xyz + zy + xz

z\xy	00	01	11	10
0	0	0	1	0
1	0	1	1	1

F(x,y,z) = (x+y)(z+x)(z+y)