EEE119 Digital Systems – N.J.Powell Problem Sheet 2 - Solutions

1. $X + 1 = 1$ $X + X = X$ $X.0 = 0$ $X.1 = X$ $X + 0 = X$ $X + \overline{X} = 1$

2.

X Y Z	X'	X.Y	X'.Z	Y.Z	X.Y + X'.Z + Y.Z	X.Y + X'.Z
0 0 0	1	0	0	0	0	0
0 0 1	1	0	1	0	1	1
0 1 0	1	0	0	0	0	0
0 1 1	1	0	1	1	1	1
1 0 0	0	0	0	0	0	0
1 0 1	0	0	0	0	0	0
1 1 0	0	1	0	0	1	1
1 1 1	0	1	0	1	1	1

Columns 6 and 7 are the same, proving the concensus theorem.

3. $(X + Y)(X + Z) = XX + XZ + XY + YZ = X + XZ + XY + YZ = X(1 + Z + Y) + YZ = X + YZ$

4.

X Y Z	X.Y	Y'	X.Y'	Z'	Y.Z'	X.Y + X.Y' + Y.Z'
0 0 0	0	1	0	1	0	0
0 0 1	0	1	0	0	0	0
0 1 0	0	0	0	1	1	1
0 1 1	0	0	0	0	0	0
1 0 0	0	1	1	1	0	1
1 0 1	0	1	1	0	0	1
1 1 0	1	0	0	1	1	1
1 1 1	1	0	0	0	0	1

$F = X'.Y.Z' + X.Y'.Z' + X.Y'.Z + X.Y.Z' + X.Y.Z$

$F = (X + Y + Z).(X + Y + Z').(X + Y' + Z')$

5. $F(A,B,C) = \Pi\ (0,1,2,3,4,5)$ Hint: Find an expression for F, then draw a truth table.

6. $F = \overline{A.\overline{B}} + \overline{(C + \overline{D})} = \overline{A} + B + \overline{C}.D$

7. $F = X.Y.\overline{Z} + \overline{\overline{X}.Y.Z + \overline{X.Y}} = X.Y.\overline{Z} + (\overline{X}.Y.Z).X.Y = X.Y.\overline{Z} + (X + \overline{Y} + \overline{Z}).X.Y$

$= X.Y.\overline{Z} + X.X.Y + X.Y.\overline{Y} + X.Y.\overline{Z} = X.Y.\overline{Z} + X.Y = X.Y.(1 + \overline{Z}) = X.Y$

8.

X Y Z	W
0 0 0	0
0 0 1	1
0 1 0	1
0 1 1	0
1 0 0	0
1 0 1	1
1 1 0	1
1 1 1	0

$F = (X + Y + Z)(X + \overline{Y} + \overline{Z})(\overline{X} + Y + Z)(\overline{X} + \overline{Y} + \overline{Z})$

9. $F = \overline{A}.B + A.\overline{B}$

10. $F = (A + \overline{B})(\overline{A} + B)$