ELEC 2607 ('14) **Assignment 1** 15 Marks

1. Using the method of exhaustive proof show whether $\overline{a+b+c}$ is equal to $\overline{(a+b)} \cdot \bar{c}$. 2 marks

2. Draw the simplest logic gate or circuit for the following descriptions. The inputs are a, b, c. The output is z. 3 marks

   (a) $z = 1$ only if $abc = 110$

   (b) $z = 0$ unless $abc = 010$

   (c) $z = 0$ only if "$abc = 110$ or $abc = 011$"

3. Simplify the following 3 marks

   (a) $(X + Y + \bar{Y}Z)(Y + X)(Y + \bar{X})$ to 1 literal

   (b) $(BCD + C)CD$ to 2 literals

   (c) $A\bar{B} + AC + \bar{C}B$ to 3 literals

4. Prove algebraically that $(a + b)(b + c)(c + a) = ab + bc + ca$ 1 mark

5. Use duality on $\bar{a}\bar{b} + ab = (a + \bar{b})(\bar{a} + b)$ to find an alternate expression for $\bar{a}b + a\bar{b}$. 1 mark

6. Convert the expression $\overline{a(b\bar{c} + de) + \overline{(d + a)}cg}$ to a form where the bar is over single variables only. 2 marks

7. Derive the equations for y and z from the following table and simplify the answer as much as possible. Then implement y and z using a minimum number of 2-input and 3-input gates (note: inverters (bubbles) don't count). Also identify the function obtained by y and z (eg. is the function an 'and', 'xor', 'or', 'majority gate' etc.?) 3 marks

c	b	a	y	z
0	0	0	1	1
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	0	0