Tutorial Sheet 2 – *Boolean Algebra & Minimisation*

1. Express each of the following Boolean expressions in a minimal Sum of Product (SOP) form. Draw out the resulting logic circuit in each case.

(i) $A(B + C)$ **(ii)** $A + (BC)(C+\overline{D})$ **(iii)** $(AB)(\overline{B} + C)(D + E)$

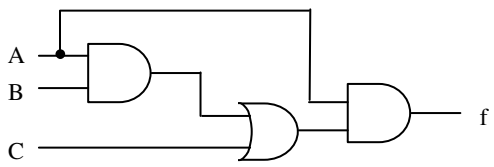
2. Show that the following expressions are equivalent:

(i) $X + \overline{X}YZ = X + YZ$ **(ii)** $(P + Q)(P + R) = P + QR$

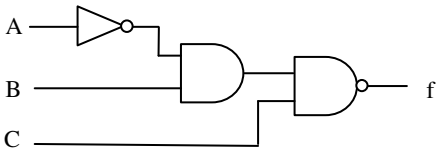
(iii) $\overline{C}E + E(A + \overline{B}) + C = C + E$ **(iv)** $AB + B(B + \overline{C}) + \overline{B}C = B + C$

3. Obtain a Boolean expression for each of the following circuits and simplify where possible. Express your final answer as in SOP form.

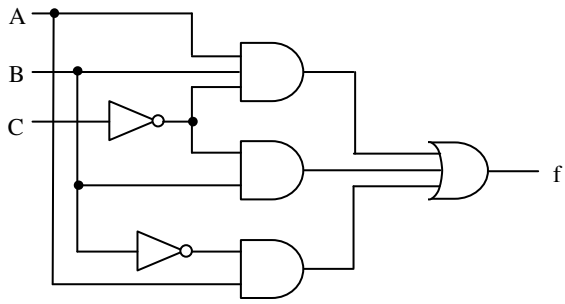
(i)



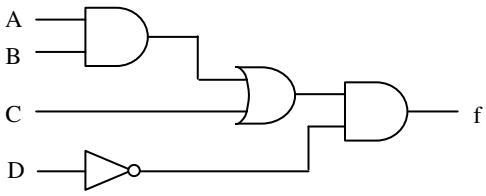
(ii)



(iii)



(iv)



4. Obtain a minimal SOP Boolean expression for each of the following truth tables:

(i)

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

(ii)

A	B	C	F
0	0	0	**1**
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. Simplify the following expressions using Boolean algebra:

(i) $WXYZ\,(WXY\overline{Z} + W\overline{X}YZ + \overline{W}XYZ + WX\overline{Y}Z)$

(ii) $AB + AB\overline{C}D + ABD\overline{E} + AB\overline{C}E + \overline{C}DE$

(iii) $uvw + \overline{y}x\overline{v} + xzu + \overline{y}wu\overline{x} + uz$

ANSWERS

1. (i) $AB + AC$ (ii) $A + BC$ (iii) $ABCD + ABCE$
3. (i) $AB + AC$ (ii) $A + \overline{B} + \overline{C}$ (iii) $A\overline{B} + B\overline{C}$ (iv) $AB\overline{D} + C\overline{D}$
4. (i) $\overline{A} + B$ (ii) $\overline{C}$
5. (i) 0 (ii) $AB + \overline{C}DE$ (iii) $uvw + \overline{y}x\overline{v} + uz$