Digital Electronics

Answer Sheet 4

1 $A + B = \overline{\overline{A} \cdot \overline{B}}$

2 $\overline{\overline{\overline{(\overline{A}.\overline{B})}}.\overline{\overline{(\overline{C}.\overline{D})}}}$

3 a) $= \overline{((A + B) + C)} = \overline{(A + B + C)}$

b) $= A.B + A.C + C + \overline{A}.B.\overline{C} = A.B + C + \overline{A}.B = B.(A + \overline{A}) + C = B + C$

c) $= A.\overline{A}.B + \overline{B}.\overline{A}.B = 0$

d) $= A.(\overline{B}.C + \overline{C}) + B.C = A.(\overline{B} + \overline{C}) + B.C = A.(\overline{B.C}) + B.C = A + B.C$

4.

$$
\begin{aligned}
\overline{A}\,\overline{C} + A\overline{C} + BC &= \overline{C}(A + \overline{A}) + BC \\
&= \overline{C} + BC \\
&= \overline{C}.\overline{B} + \overline{C}B + BC \\
&= \overline{C}.\overline{B} + \overline{C}B + \overline{C}B + BC \\
&= \overline{C}(\overline{B} + B) + B(\overline{C} + C) \\
&= \overline{C} + B
\end{aligned}
$$

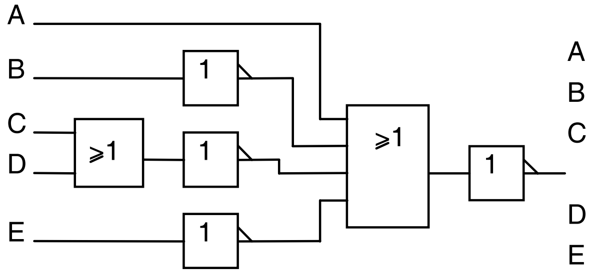
of you might be able to see that $\overline{C} + BC = \overline{C} + B$ directly or from a truth table.

5. To show this, we need to simplify the logic, using Boolean Algebra, so as to write the expression in the form XYZ where X, Y and Z are each one of the variables or its complement.

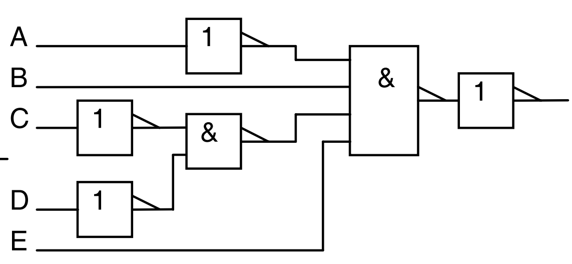
$$
\begin{aligned}
&A(\overline{\overline{B} + A\overline{C}}) = A.B.\overline{A.\overline{C}} \\
&= AB(\overline{A} + C) \\
&= \cancel{AB\overline{A}} + ABC \\
&= ABC
\end{aligned}
$$

Always false
for any A.

6. The first thing to notice is that the two AND gates can be merged to form a four input AND gate. The solutions are then obtained by shuffling INVERTORS so that pairs of INVERTORS cancel and by applying (in a schematical sense) the laws of Boolean algebra.



(a)



(b)