

## COMPUTER SCIENCE TRIPOS Part IA – 2018 – Paper 2

### 1 Digital Electronics (IJW)

(a) Use Boolean algebra to minimise the following expressions. Give your answers in sum-of-products form.

(i)  $W = (X + Y) \cdot (\overline{X} + Z)$

(ii)  $F = (A + B + \overline{C}) \cdot (A + B + D) \cdot (A + B + E) \cdot (A + \overline{D} + E) \cdot (\overline{A} + C)$

[8 marks]

(b) There may be more than one way of minimising a given Boolean expression into sum-of-products form. Demonstrate this by drawing a four-variable Karnaugh map that has two different minimised forms for the same Boolean expression, each with the same number of terms and literals. [4 marks]

(c) Simplify the following function  $f(A, B, C, D, E)$  specified using the decimal representation of its minterms (where  $A$  represents the most significant bit of the equivalent binary representation) using the Quine-McCluskey (Q-M) method:

$$f(A, B, C, D, E) = \sum(0, 2, 3, 5, 7, 9, 11, 13, 14, 16, 18, 24, 26, 28, 30)$$

[8 marks]