

COMPUTER SCIENCE TRIPOS Part IA – 2015 – Paper 2

1 Digital Electronics (IJW)

(a) Write down simplified sum of products (SOP) and product of sums (POS) expressions for the following Boolean functions:

(i) $X = A \oplus B \oplus C$ [3 marks]

(ii) $Y = (A + \overline{B} + \overline{C}).(\overline{A} + \overline{D}).(A + C)$ [3 marks]

(b) Using a four variable Karnaugh map, fill it with 1s and 0s to find a function that illustrates each of the following situations. Write down the number of terms and the number of literals for each situation.

(i) The minimised SOP and POS forms have the same number of terms and literals. [3 marks]

(ii) The minimised POS form has fewer terms and literals than the minimised SOP form. [3 marks]

(c) For the following Boolean function,

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

show how it may be implemented using:

(i) one 16:1 multiplexor

(ii) one 8:1 multiplexor and one or more NOT gates

[8 marks]