

COMPUTER SCIENCE TRIPOS Part IA – 2021 – Paper 2

1 Digital Electronics (ijw24)

(a) Show that

$$(i) \quad (X + Y).(X + \bar{Y}) = X$$

$$(ii) \quad (X + Y).(\bar{X} + Z) = (X + Y).(\bar{X} + Z).(Y + Z)$$

[5 marks]

(b) With the help of the results in Part (a) or otherwise, simplify the following Boolean expression for W in to a product of sums (POS) form having 3 product terms, each having 3 literals

$$W = (A + \bar{C} + \bar{F} + G).(A + \bar{C} + F + G).(A + B + \bar{C} + \bar{D} + G) \\ .(A + C + E + G).(\bar{A} + B + G).(B + \bar{C} + F + G)$$

[10 marks]

(c) (i) Using a Karnaugh map, simplify the following Boolean expression for V into a product of sums (POS) form

$$V = A.B.C.\bar{D} + A.\bar{B}.C.\bar{D} + \overline{(A + B + C + D)}$$

(ii) Implement the simplified expression for V obtained in Part (c)(i) using only NOR gates. Assume 2 and 4 input gates are available. Also assume complemented input variables are available. [5 marks]