COMPUTER SCIENCE TRIPOS Part IA – 2021 – Paper 2

1 Digital Electronics (ijw24)

(a) Show that

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

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

[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

$$\begin{aligned} W &= (A + \overline{C} + \overline{F} + G).(A + \overline{C} + F + G).(A + B + \overline{C} + \overline{D} + G) \\ &\quad .(A + C + E + G).(\overline{A} + B + G).(B + \overline{C} + F + G) \end{aligned}$$

[10 marks]

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

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

(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]