COMPUTER SCIENCE TRIPOS Part IA – 2020 – Paper 2

1 Digital Electronics (ijw24)

(*a*) Use Boolean algebra to simplify the following functions:

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

[6 marks]

(*b*) Implement the Boolean function

$$X = \overline{A}.\overline{B}.\overline{C} + B.\overline{C} + B.C$$

using

(*i*) an 8:1 Multiplexor;

(*ii*) a 4:1 Multiplexor, plus a NOT gate;

(*iii*) a 2:1 Multiplexor, plus a NOT gate, plus an OR gate.

[6 marks]

(*c*) A *priority encoder* has 2^N inputs. It produces an N-bit binary output indicating the most significant bit of the input that is TRUE, or 0 if none of the inputs is TRUE. It also produces an output NONE that is TRUE if none of the inputs is TRUE.

(*i*) Write down the Truth Table showing all inputs and all outputs for an eight-input priority encoder. [2 marks]

(*ii*) Give simplified Boolean expressions for all outputs of the eight-input priority encoder. [6 marks]