

## 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]