

# COMPUTER SCIENCE TRIPOS Part IA – 2024 – Paper 2

## 1 Digital Electronics (ijw24)

- (a) Show that the Boolean function  $F$  can be represented as the exclusive OR operation of two terms, where each term comprises the AND operation of 2 variables appearing in either complemented or uncomplemented form.

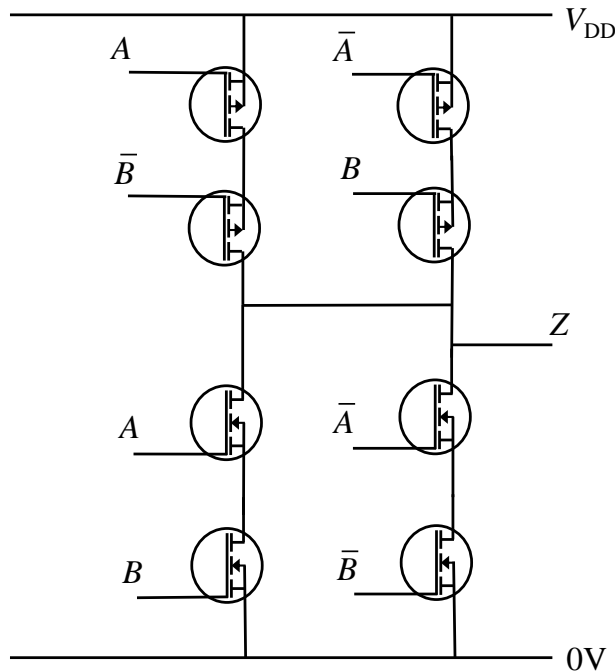
$$F(X, Y, Z) = X.Y \oplus \bar{X}.Z + Y.Z$$

[5 marks]

- (b) Consider the Boolean function

$$G(A, B, C, D) = (A + B + \bar{C} + \bar{D}).(A + \bar{B} + C + D).(\bar{A} + \bar{B} + C).(\bar{A} + \bar{C} + \bar{D})$$

- (i) Write down the minterms of  $G$  using decimal notation, where  $A$  represents the most-significant bit of the equivalent binary representation. [3 marks]
- (ii) Simplify  $G$  into sum of products form using the Quine-McCluskey (Q-M) method. [7 marks]
- (c) Briefly explain the operation of the following circuit and determine the Boolean function that relates the input variables,  $A$  and  $B$ , to the output  $Z$ ? Assume that complemented input variables are available for use.



[5 marks]