1.4 Data Types, Data Structures and Boolean Algebra: 10-minute Pack

Total Marks

OCR H446 · Calculators not allowed · about 10 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Q = (A AND B) OR (NOT C) is a Boolean expression with three inputs, A, B and C.

(a) Complete a truth table for Q, showing the output for all 8 possible combinations of A, B and C (using the standard ordering 000 to 111). **(4)**

(b) State the number of rows required in a truth table for a Boolean expression with n input variables, and explain why this formula applies. **(2)**

(c) Describe a logic circuit that implements Q = (A AND B) OR (NOT C), stating the logic gates required and how they are connected. **(2)**

(d) A different logic gate has the property that its single output is 1 only when its two inputs, A and B, have different values. Identify this logic gate. **(1)**

(Total for Question 1 is 9 marks)

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Mark scheme · 1.4 Data Types, Data Structures and Boolean Algebra: 10-minute Pack

Question 1

(a) A=0,B=0 rows (C=0 then C=1) correctly give Q=1, Q=0 **B1**

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(a) Answer: Q values (A,B,C from 000 to 111): 1, 0, 1, 0, 1, 0, 1, 1

(b) 2^n rows **B1**

(b) because each of the n variables can independently take one of 2 values (0 or 1), giving 2 x 2 x ... (n times) = 2^n possible combinations **B1**

(b) Answer: 2^n rows, since each of the n inputs can independently be 0 or 1.

(c) an AND gate with inputs A and B, and a NOT gate with input C **B1**

(c) the outputs of the AND gate and the NOT gate are connected as the two inputs to an OR gate, whose output is Q **B1**

(c) Answer: AND gate (inputs A, B) and NOT gate (input C) feed into an OR gate, whose output is Q.

(d) XOR (exclusive OR) **B1**

(d) Answer: XOR

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