

- 1(a). The logic diagram below (Fig. 2) shows a system made up of two connected logic gates.

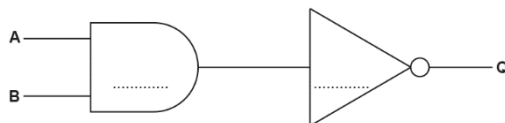


Fig.2

[2]

- (i) Label the names of the two gates on the diagram above.

- (ii) Complete the truth table below to show the output from this logic system.

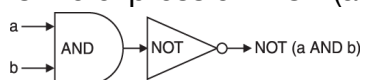
A	B	Q
0	0	
0	1	
1	0	
1	1	

[4]

- (b). Draw the logic diagram represented by $Q = A \vee \neg B$

[2]

2. The following logic diagram shows the expression NOT (a AND b).



Complete the missing boxes in the truth table below to show the value of NOT (a AND b) that will be output for each possible set of values of a and b.

a	b	NOT (a AND b)
0	0	1
0		1
1	0	

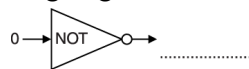
[4]

3. Complete the truth table below for the Boolean statement $p = \text{NOT } (A \text{ AND } B)$.

A	B	P
FALSE	FALSE	TRUE
FALSE	TRUE	
TRUE	FALSE	
TRUE	TRUE	FALSE

[2]

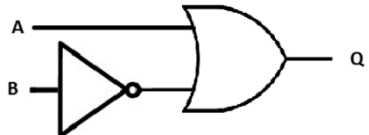
4. State the output of each of the following logic circuits for the inputs given.



[2]

END OF QUESTION PAPER

Mark scheme

Question			Answer/Indicative content	Marks	Guidance															
1	a	i	1 mark per bullet, max 2 • AND / conjunction • NOT / negation	2	Allow Boolean notation.															
		ii	<table><tr><th>A</th><th>B</th><th>Q</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table>	A	B	Q	0	0	1	0	1	1	1	0	1	1	1	0	4	1 mark per row Examiner's Comments Candidates and centres are obviously extremely comfortable with the use and understanding of logic gate symbols. The vast majority of responses on part (i) achieved 2 marks. The most common incorrect answer was to mix up AND and OR for the first gate. For part (ii) candidates were able to apply their knowledge successfully with the majority of all candidates achieving marks. This topic has been covered successfully by centres and that this work is reflected in examination responses.
A	B	Q																		
0	0	1																		
0	1	1																		
1	0	1																		
1	1	0																		
	b		1 mark per bullet, max 2  • OR gate with two inputs / NOT gate on B input • Logic system as above with no other gates, with labelled inputs of A and B.	2	First mark can be awarded if candidate has either a NOT gate from B, or an OR gate with two inputs anywhere in their answer. Second mark is only awarded if the logic system as shown is given with no other additional gates. Correct logic diagrams needed for OR and NOT, including a circle on NOT. Use professional judgement. Ignore labelling. No need to label Q output. Examiner's Comments Boolean symbols and notations that may be used in examinations are shown in appendix 5f of the specification. Candidates will never be expected to use these symbols in their own responses (AND, OR and NOT are perfectly acceptable) but they must be aware of how questions on papers may be written. For this question, it was obvious that some groups of candidates did not understand the symbols in the question and so were not able to provide a suitable response. However, it was pleasing to see that this was not at all the majority and that large numbers of candidates were able to not only understand the question but also provide a correct or partially correct response. Where responses were incorrect, a common mistake was to utilise the NOT gate after the output from the OR gate when in fact the NOT gate should be applied to the input from B before this feeds into the OR gate. Another common mistake was to forget to label up inputs as A and B, therefore not allowing the examiner to award the mark for the NOT gate on the correct input.															
Total				8																
2			<table><tr><th>A</th><th>b</th><th>NOT(a AND b)</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table>	A	b	NOT(a AND b)	0	0	1	0	1	1	1	0	1	1	1	0	4	No follow through on row 4. Examiner's Comments This part was well answered by the majority of candidates, indicating that logic and truth tables – a core concept in computer science – is understood by most candidates.
A	b	NOT(a AND b)																		
0	0	1																		
0	1	1																		
1	0	1																		
1	1	0																		

			1 mark for row two and three. For row 4, 1 mark for correctly identifying 1 1 as the inputs, and 1 mark for the correct output 0)														
			Total	4													
3			<table><tr><td>A</td><td>B</td><td>P</td></tr><tr><td></td><td></td><td>TRUE</td></tr><tr><td></td><td></td><td>TRUE</td></tr><tr><td></td><td></td><td></td></tr></table>	A	B	P			TRUE			TRUE				2	1 mark for each correct answer in table.
A	B	P															
		TRUE															
		TRUE															
			Total	2													
4			• 1 • 0. (respectively)	2	Examiner's Comments Most candidates answered correctly. As expected, some weaker candidates were less able to work with the logic gates in combination												
			Total	2													