G.C.E. O/L Grade 10 ICT · Lesson 4

Lesson 4 O/L Exam Practice: Questions and Answers

These questions are in the style of the O/L ICT exam. Paper I has multiple choice questions. Paper II has structured questions with parts, model circuits, truth tables and marking points. They cover all of Lesson 4 (4.1 and 4.2): Boolean operators, gate symbols, truth tables, circuit outputs and real-world logic problems. Try them first, then check the answers.

Paper I – Multiple choice questions (25)

1. Which value is used for “true” in Boolean logic?

A. 0
B. 1
C. 2
D. 10

2. In O/L notation, A+B represents:

A. A NAND B
B. Decimal addition
C. A OR B
D. A AND B

3. Which expression is the NAND of A and B?

A. (A+B)'
B. A.B
C. A'.B'
D. (A.B)'

4. Which expression is the NOR of A and B?

A. A+B
B. (A+B)'
C. (A.B)'
D. A'+B'

5. A gate symbol has a curved back, a pointed front and a bubble. It is:

A. NOR
B. NOT
C. NAND
D. OR

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6. A gate symbol has a flat back and a round front with no bubble. It is:

A. NOR

B. OR

C. AND

D. NAND

7. How many inputs does a NOT gate have?

A. 1

B. 3

C. 2

D. 0

8. The output of a 2-input NAND gate when A = 1 and B = 1 is:

A. 1

B. 11

C. 2

D. 0

9. The output of a 2-input NOR gate when A = 0 and B = 1 is:

A. 01

B. 0

C. 1

D. 2

10. A truth table has 8 rows. How many inputs are there?

A. 8

B. 2

C. 3

D. 4

11. In a 3-input OR truth table, how many rows give output 0?

A. 3

B. 0

C. 7

D. 1

12. Which gate gives the outputs 1, 1, 1, 0 for inputs 00, 01, 10, 11?

A. NAND

B. OR

C. NOR

D. AND

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13. Which gate gives the outputs 1, 0, 0, 0 for inputs 00, 01, 10, 11?

A. NAND
B. AND
C. NOR
D. NOT

14. What is X = A'.B when A = 0 and B = 1?

A. 0
B. 1
C. 01
D. 2

15. What is X = A.B + C when A = 1, B = 0, C = 0?

A. 10
B. 2
C. 0
D. 1

16. What is X = (A+B).C' when A = 0, B = 1, C = 0?

A. 2
B. 0
C. 3
D. 1

17. In a circuit, an OR gate joins A and B, and its output goes into a NOT gate. The circuit works like:

A. A NAND gate
B. An AND gate
C. An OR gate
D. A NOR gate

18. Why are NAND and NOR called universal gates?

A. They never give 0
B. Any gate can be built using only one of them
C. They work in every country
D. They have three inputs

19. “The machine starts only if the guard is closed AND the start button is pressed.” Which gate?

A. AND
B. NOT
C. OR
D. NOR

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20. A lamp must switch on when it is NOT bright. Light sensor L = 1 when bright. Which expression?

A. X = L.L
B. X = L'
C. X = L
D. X = L+1

21. Siren = S.(D+W). Which input makes the siren sound?

A. S=1, D=0, W=1
B. S=0, D=1, W=1
C. S=1, D=0, W=0
D. S=0, D=0, W=0

22. A student gets a place if she has passed (P) and has either a recommendation (R) or a sports award (S). The expression is:

A. X = P.(R+S)
B. X = (P.R)+S
C. X = P.R.S
D. X = P+R.S

23. In a block diagram for a greenhouse pump, the rain sensor is shown as:

A. An output box
B. A truth table
C. An input box
D. A NOT gate symbol

24. How many rows give X = 1 in the truth table of X = (A.B)'.C'?

A. 4
B. 5
C. 1
D. 3

25. Which is TRUE about the XOR gate in the O/L syllabus?

A. It is extra – the syllabus covers AND, OR, NOT, NAND, NOR
B. It replaces the NOT gate
C. It has only one input
D. It is the same as NOR

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Paper II – Structured questions

1. Gate symbols and actions. *(9 marks)*

(i) Draw the standard symbols of the AND, OR, NOT, NAND and NOR gates. *(5 marks)*
(ii) Write the Boolean expression of each gate using inputs A and B. *(3 marks)*
(iii) State which gate gives output 1 only when all its inputs are 0. *(1 marks)*

2. Truth tables. *(9 marks)*

(i) Draw the truth table for a 2-input NAND gate and a 2-input NOR gate in one table. *(4 marks)*
(ii) How many rows are needed for a truth table with 3 inputs? Explain. *(2 marks)*
(iii) Draw the truth table of a 3-input AND gate. *(3 marks)*

3. Circuit to expression and truth table. A circuit has a NAND gate with inputs A and B. Its output and input C go into an OR gate whose output is X. *(7 marks)*

(i) Draw the circuit. *(2 marks)*
(ii) Write the Boolean expression for X. *(1 marks)*
(iii) Complete the truth table with a column for (A.B)'. *(4 marks)*

4. Three-gate circuit. Study the circuit below. *(9 marks)*

(i) Write the expression at the output of each gate and the final expression for X. *(3 marks)*
(ii) Find X when A = 0, B = 1, C = 0. *(2 marks)*
(iii) Complete the full truth table. *(4 marks)*

5. Alarm system – car seat-belt buzzer. A buzzer sounds when the engine is ON (E = 1) and either the seat belt is NOT fastened (B = 1 when fastened) or a door is open (D = 1). *(8 marks)*

(i) Draw a block diagram for this system. *(2 marks)*
(ii) Write the Boolean expression. *(2 marks)*
(iii) Convert the block diagram into a logic diagram. *(3 marks)*
(iv) Will the buzzer sound when E = 1, B = 1, D = 0? Explain. *(1 marks)*

6. Selection criteria. A sports club selects a player who has good grades (G) and attends practice (A), or who has won a national medal (F). *(7 marks)*

(i) Write the expression for selection X. *(1 marks)*
(ii) Draw the logic circuit. *(2 marks)*
(iii) Complete the truth table and state how many combinations are selected. *(4 marks)*

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7. IoT smart agriculture. A greenhouse fan turns ON when the motor power switch is ON (M) and either the temperature is high (T) or the humidity is high (H). *(7 marks)*

(i) Write the expression for the fan. *(1 marks)*
(ii) Draw the logic diagram. *(2 marks)*
(iii) Complete the truth table. *(3 marks)*
(iv) Give one advantage of using sensors and logic gates in farming. *(1 marks)*

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Exam tips

- Learn the five symbols: AND (D-shape), OR (curved shield), NOT (triangle + bubble), NAND and NOR (add a bubble).
- Use O/L notation: A.B for AND, A+B for OR, A' or Ā for NOT.
- AND → 1 only if all inputs are 1. OR → 0 only if all inputs are 0.
- NAND and NOR are just AND and OR with every output reversed.
- Rows = 2^n: 2 inputs → 4 rows, 3 inputs → 8 rows.
- Write inputs in binary order (000, 001 … 111) so no row is missing.
- Add a column for every middle output (e.g. A.B, C') before the final column.
- In circuits, work from left to right and label each gate output on the diagram.
- Watch brackets: (A.B)' is NAND, but A'.B' is different.
- For word problems, first list the inputs, the output and what 1 and 0 mean.
- “and/both” → AND, “or/either” → OR, “not/dark/unless” → NOT.
- Check your answer by testing one easy row (e.g. all 0s or all 1s) in your head.

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Answers and explanations

Paper I

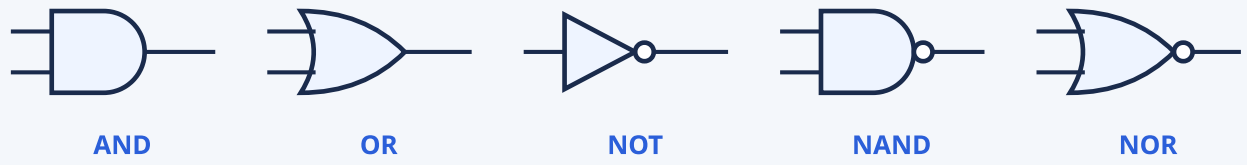
1. **B** – True = 1, false = 0.
2. **C** – + means OR.
3. **D** – NAND = NOT (A AND B).
4. **B** – NOR = NOT (A OR B).
5. **A** – OR shape + bubble = NOR.
6. **C** – Flat back + D-shape = AND.
7. **A** – NOT has exactly one input.
8. **D** – AND = 1, so NAND = 0.
9. **B** – OR = 1, so NOR = 0.
10. **C** – $2^3 = 8$.
11. **D** – Only 000 gives 0.
12. **A** – That is NOT of AND (0,0,0,1).
13. **C** – 1 only when all inputs are 0.
14. **B** – A' = 1; 1.1 = 1.
15. **C** – A.B = 0, C = 0 → 0.
16. **D** – (0+1) = 1, C' = 1, 1.1 = 1.
17. **D** – NOT after OR = NOR.
18. **B** – Only-NAND (or only-NOR) circuits can make AND, OR and NOT.
19. **A** – Both conditions → AND.
20. **B** – Dark = NOT L.
21. **A** – 1.(0+1) = 1.
22. **A** – AND with the OR of R and S.
23. **C** – Sensors are inputs.
24. **D** – C = 0 (4 rows) but not A=B=1 → 3.
25. **A** – XOR is beyond the O/L syllabus.

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Paper II – model answers and marking points

1. *(9 marks)*

(i) (5 marks)
1 mark per correct symbol (bubble needed for NOT, NAND, NOR).



Model answer

(ii) (3 marks)
AND A.B; OR A+B; NOT A'; NAND (A.B)'; NOR (A+B)'. (all 5 = 3 marks, 3–4 = 2, 1–2 = 1)

(iii) (1 marks)
NOR gate (1)

🎯 Examiner tip: draw symbols with a ruler-neat flat back for AND/NAND and a curved back for OR/NOR. A missing bubble loses the mark.

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2. *(9 marks)*

(i) (4 marks)

Inputs 00, 01, 10, 11 (1); NAND 1,1,1,0 (1.5); NOR 1,0,0,0 (1.5).

A	B	(A.B)'	(A+B)'
0	0	1	1
0	1	1	0
1	0	1	0
1	1	0	0

(ii) (2 marks)

2^3 = 8 rows (1), because each input can be 0 or 1 (1).

(iii) (3 marks)

8 rows in binary order (1); output 1 only for 111 (2).

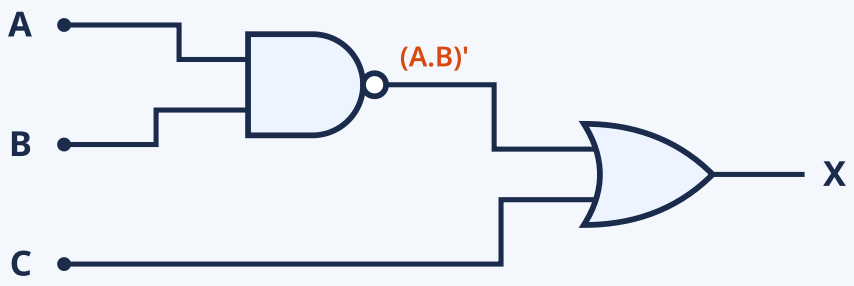
A	B	C	X = A.B.C
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

🎯 Examiner tip: always list the inputs in binary counting order 000 → 111 so no row is missing.

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3. *(7 marks)*

(i) (2 marks)
NAND (A, B) → OR with C → X.



Model circuit

(ii) (1 marks)
X = (A.B)' + C

(iii) (4 marks)
(A.B)' column (1); X column correct (3). X = 0 only when A = 1, B = 1, C = 0.

A	B	C	(A.B)'	X = (A.B)'+C
0	0	0	1	1
0	0	1	1	1
0	1	0	1	1
0	1	1	1	1
1	0	0	1	1
1	0	1	1	1
1	1	0	0	0
1	1	1	0	1

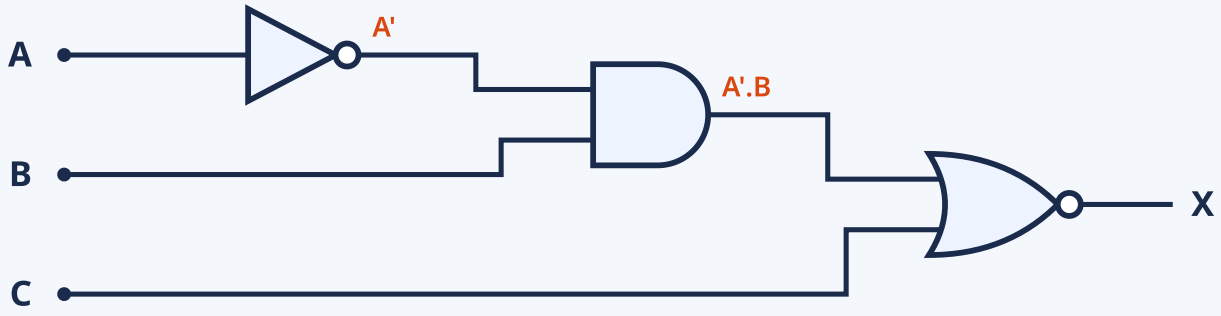
🎯 Examiner tip: write the expression at the output of every gate on the diagram – it shows working and prevents bracket mistakes.

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4. *(9 marks)*

(i) (3 marks)

NOT: A' (1); AND: A'.B (1); NOR: X = (A'.B + C)' (1).



Given circuit: NOT, AND, NOR

(ii) (2 marks)

A' = 1, A'.B = 1, 1 + 0 = 1, NOR → X = 0.

(iii) (4 marks)

X = 1 in 3 rows (see table). Middle columns 1 mark, X column 3 marks.

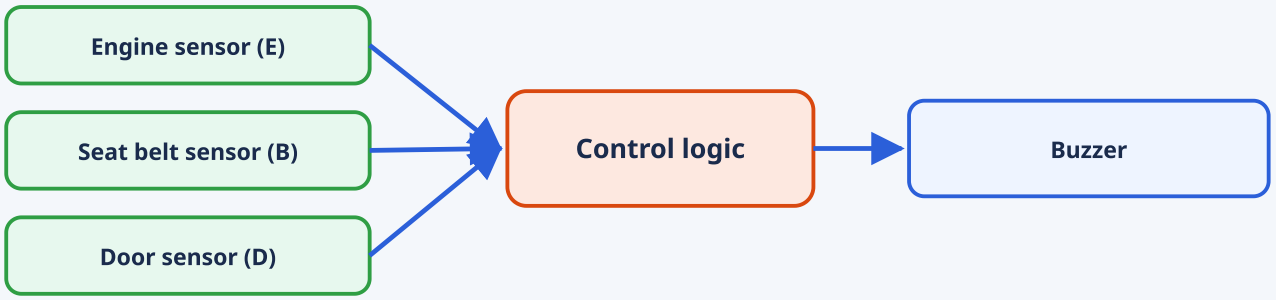
A	B	C	A'	A'.B	X = (A'.B+C)'
0	0	0	1	0	1
0	0	1	1	0	0
0	1	0	1	1	0
0	1	1	1	1	0
1	0	0	0	0	1
1	0	1	0	0	0
1	1	0	0	0	1
1	1	1	0	0	0

🎯 Examiner tip: a bubble at the end of an OR shape means NOR – apply NOT to the whole OR result, not to each input.

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5. *(8 marks)*

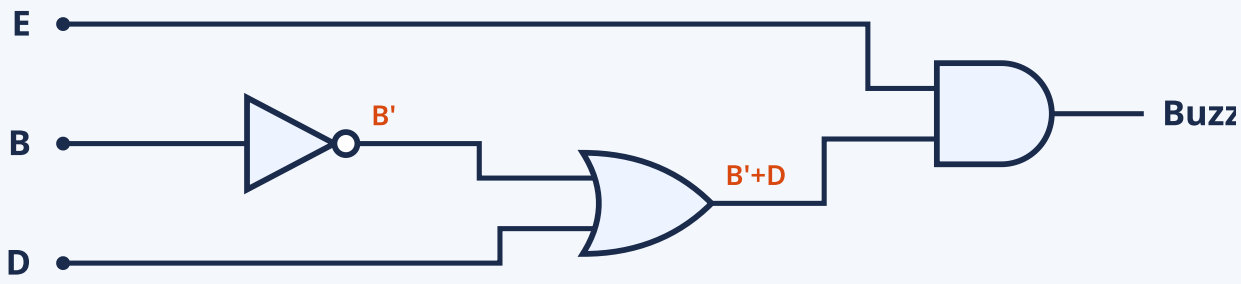
(i) (2 marks)
Inputs E, B, D → control logic → buzzer.



Block diagram

(ii) (2 marks)
Buzzer = E.(B' + D) (B' 1 mark, rest 1 mark)

(iii) (3 marks)
NOT on B (1), OR with D (1), AND with E (1).



Logic diagram

(iv) (1 marks)
No: B' = 0, D = 0 → OR = 0 → Buzzer = 0.

🎯 Examiner tip: read the sensor meaning carefully – if the sensor gives 1 for the SAFE state, you need a NOT gate.

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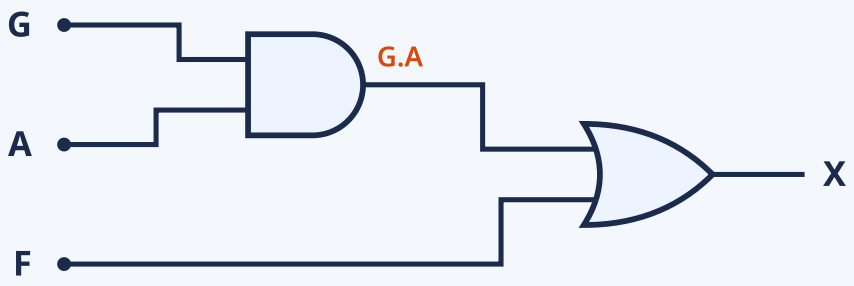
6. *(7 marks)*

(i) (1 marks)

X = G.A + F

(ii) (2 marks)

AND for G and A, then OR with F.



Model circuit

(iii) (4 marks)

Table (3); 5 combinations selected (1).

G	A	F	G.A	X = G.A+F
0	0	0	0	0
0	0	1	0	1
0	1	0	0	0
0	1	1	0	1
1	0	0	0	0
1	0	1	0	1
1	1	0	1	1
1	1	1	1	1

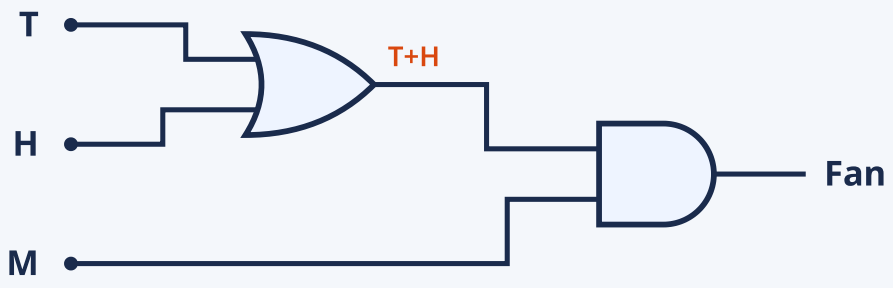
🎯 Examiner tip: underline “and” and “or” in the question first – each becomes one gate.

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7. *(7 marks)*

(i) (1 marks)
Fan = (T+H).M

(ii) (2 marks)
OR for T and H, then AND with M.



Model logic diagram

(iii) (3 marks)
Fan = 1 in 3 rows (M = 1 with T or H = 1).

T	H	M	T+H	Fan
0	0	0	0	0
0	0	1	0	0
0	1	0	1	0
0	1	1	1	1
1	0	0	1	0
1	0	1	1	1
1	1	0	1	0
1	1	1	1	1

(iv) (1 marks)
Works automatically day and night / saves water and electricity / protects crops (any one).

🎯 Examiner tip: brackets matter – (T+H).M is not the same as T+H.M. Draw the OR first because it is inside the brackets.

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