MODULE Q BOOLEAN LOGIC · Q5

# Completing a truth table for a logic circuit

Original practice questions · 21 marks · ~25 minutes · OCR J277 specification 2.4.1

Name _____ Date _____

**Instructions.** Answer all questions in the spaces provided. Use 1 for true / on and 0 for false / off. Shaded cells have been filled in for you. Blank columns between the inputs and the output are for your working. The marks for each part are shown in brackets [ ]. The total for this worksheet is **21 marks**.

## 1

**Total: 2 marks**

**(a)** State the number of rows needed in a truth table for a logic diagram with **three** inputs. Do not count the heading row. **[1]**

**(b)** The truth table below is for a logic diagram with inputs A, B and C. Complete column C so that the inputs count up in binary from 000 to 111. **[1]**

| A | B | C |
|---|---|---|
| 0 | 0 | |
| 0 | 0 | |
| 0 | 1 | |
| 0 | 1 | |
| 1 | 0 | |
| 1 | 0 | |
| 1 | 1 | |
| 1 | 1 | |

**2** Total: 4 marks

A sensor unit on a lift door uses the logic diagram in Fig. 1. It has two inputs, A and B, and one output, Q.

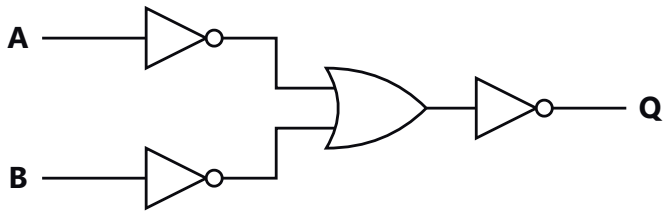



Fig. 1

**(a)** Complete the truth table for the logic diagram in Fig. 1. **[3]**

| A | B | NOT A | NOT B | (NOT A) OR (NOT B) | Q |
|---|---|---|---|---|---|
| 0 | 0 | | | | |
| 0 | 1 | | | | |
| 1 | 0 | | | | |
| 1 | 1 | | | | |

**(b)** Look at your completed Q column. Identify the **single** logic gate that would give the same output as the whole of Fig. 1. **[1]**

**3** Total: 4 marks

In the logic diagram in Fig. 2, D and E label the outputs of the first two gates.

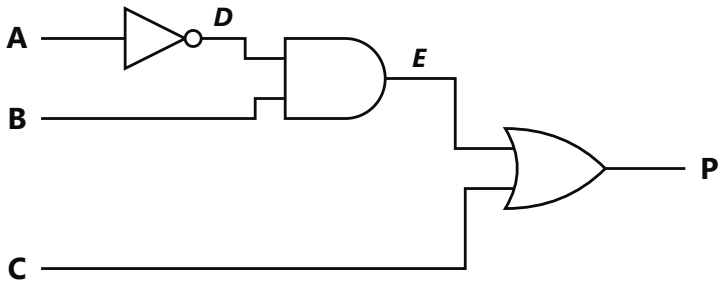



Fig. 2

Complete the truth table for Fig. 2. Columns D and E are for working. **[4]**

| A | B | C | D | E | P |
|---|---|---|---|---|---|
| 0 | 0 | 0 | | | |
| 0 | 0 | 1 | | | |
| 0 | 1 | 0 | | | |
| 0 | 1 | 1 | | | |
| 1 | 0 | 0 | | | |
| 1 | 0 | 1 | | | |
| 1 | 1 | 0 | | | |
| 1 | 1 | 1 | | | |

**4** **Total: 4 marks**

A warehouse has an automatic loading-bay door. The door opens (O = 1) when a lorry is detected at the door **and** the bay is **not** full, **or** when the manager presses the override button.

| Input | Meaning when 1 | Meaning when 0 |
|---|---|---|
| L | Lorry detected | No lorry detected |
| F | Bay is full | Bay is not full |
| M | Override button pressed | Override button not pressed |

Complete the truth table to show when the door opens. Use the blank column for any working. **[4]**

| L | F | M | | O |
|---|---|---|---|---|
| 0 | 0 | 0 | | |
| 0 | 0 | 1 | | |
| 0 | 1 | 0 | | |
| 0 | 1 | 1 | | |
| 1 | 0 | 0 | | |
| 1 | 0 | 1 | | |
| 1 | 1 | 0 | | |
| 1 | 1 | 1 | | |

**5** Total: 3 marks

An engineer completed the truth table for the logic diagram in Fig. 3. **Three** of the values in column P are wrong.

Circle the **three** incorrect values in column P. **[3]**

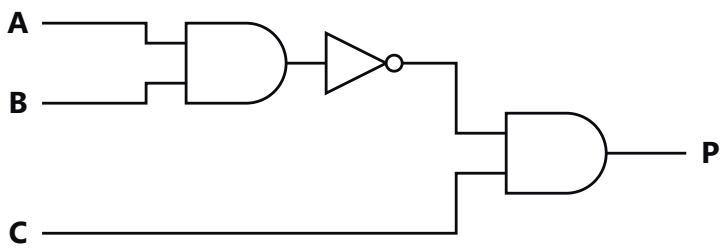



Fig. 3

| A | B | C | P |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |

**6** Total: 4 marks

A logic system uses this expression:

```
P = (A AND C) OR (NOT B)
```

Complete the truth table for this expression. You may use the two blank columns for working, and write your own headings for them. **[4]**

| A | B | C | | | P |
|---|---|---|---|---|---|
| 0 | 0 | 0 | | | |
| 0 | 0 | 1 | | | |
| 0 | 1 | 0 | | | |
| 0 | 1 | 1 | | | |
| 1 | 0 | 0 | | | |
| 1 | 0 | 1 | | | |
| 1 | 1 | 0 | | | |
| 1 | 1 | 1 | | | |

**Total for this worksheet: 21 marks**