MODULE Q BOOLEAN LOGIC · Q4

Reading logic circuits with more than one gate

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

Name _____ Date _____

Instructions. Answer all questions in the spaces provided. The marks for each part are shown in brackets [ ]. In every circuit, 1 means on / True and 0 means off / False. Draw logic gates in pencil using the standard symbols. The total for this worksheet is **21 marks**.

1

Total: 4 marks

Fig. 1 shows a logic circuit. The output of gate 1 is labelled X.

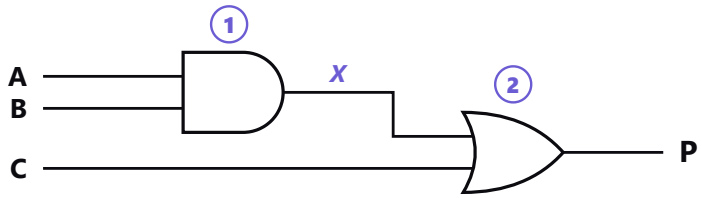


Fig. 1

(a) Identify the logic gate labelled **1** and the logic gate labelled **2** in Fig. 1. **[2]**

Gate 1	
Gate 2	

(b) The inputs are A = 1, B = 0 and C = 1. State the value of X and the value of P. **[2]**

X = ... **P =** .....

2

Total: 4 marks

Fig. 2 shows a logic circuit with three inputs. D, E and F are the outputs of the first three gates. P is the final output.

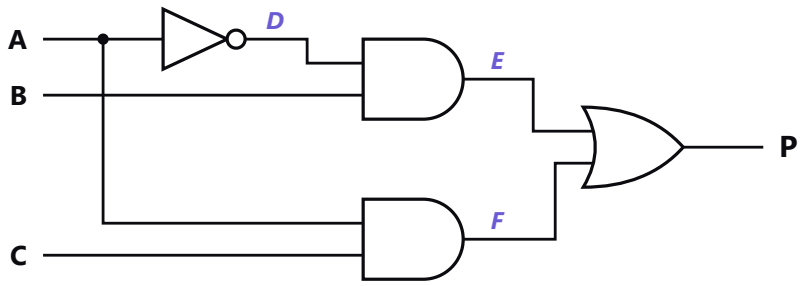


Fig. 2

(a) Complete the table to show the values of D, E, F and P for each set of inputs. **[4]**

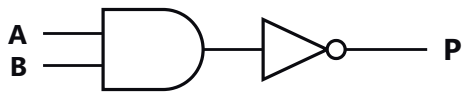
A	B	C	D	E	F	P
0	1	0				
1	1	0				
1	0	1				
0	0	1				

3

Total: 2 marks

Fig. 3 shows two different logic circuits. Each circuit uses one AND gate and one NOT gate.

Circuit 1



Circuit 2

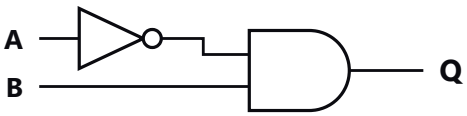


Fig. 3

(a) The inputs to both circuits are A = 1 and B = 0. State the output P of circuit 1 and the output Q of circuit 2. **[2]**

P = ... **Q =** .....

4 **Total: 4 marks**

The heater in a bakery oven is controlled by the logic circuit in Fig. 4. The inputs and output are:

Input / output	Meaning
D (door sensor)	1 = door closed, 0 = door open
T (timer)	1 = timer running, 0 = timer finished
K (temperature sensor)	1 = oven too hot, 0 = oven not too hot
H (output)	1 = heater on, 0 = heater off

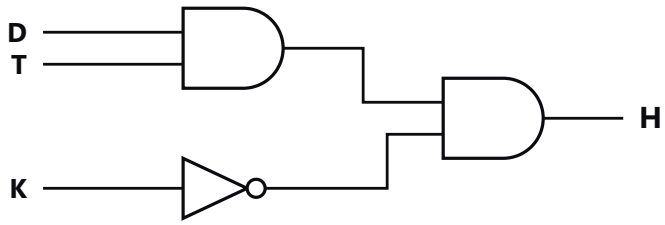


Fig. 4

(a) The door is closed, the timer is running and the oven is too hot. State the value of H. **[1]**

(b) Describe the conditions that make the heater switch on. **[3]**

5 **Total: 4 marks**

A garden watering system has a pump (P = 1 means the pump runs). The pump must run when the soil is dry and it is not raining, **or** when the manual button is pressed.

Input / output	Meaning
S (soil sensor)	1 = soil dry, 0 = soil wet
R (rain sensor)	1 = raining, 0 = not raining
M (manual button)	1 = pressed, 0 = not pressed

Fig. 5 shows the logic diagram for the pump. One gate is missing from the dashed box.

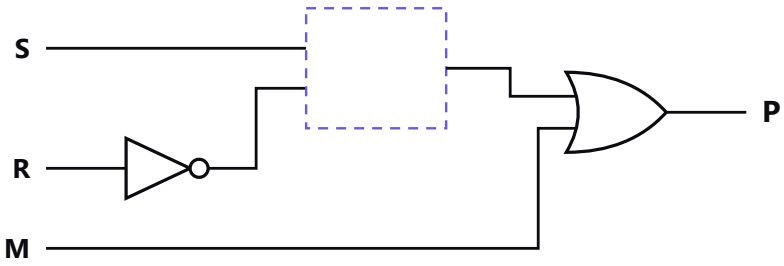


Fig. 5

(a) Complete the logic diagram in Fig. 5 by drawing the missing gate in the dashed box. **[1]**

(b) The owner changes the rule. The pump must now run only when it is **not** raining **and** either the soil is dry or the manual button is pressed. **[3]**

Draw the logic diagram for the new rule. Use the inputs S, R and M and the output P.

6 **Total: 3 marks**

Fig. 6 shows another logic circuit.

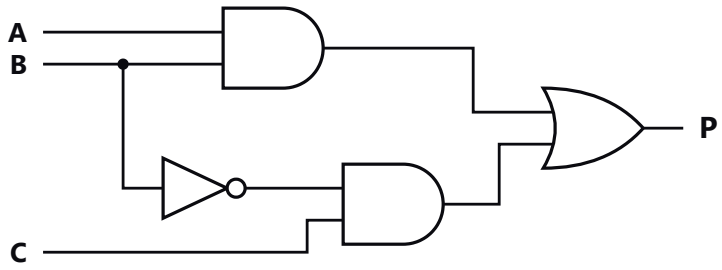


Fig. 6

A technician says: "Whenever input C is 1, the output P is 1."

(a) Explain, using the circuit in Fig. 6, whether the technician is correct. **[3]**

Total for this worksheet: 21 marks