MODULE Q BOOLEAN LOGIC · Q7

From problem statement to logic circuit

Original practice questions · 19 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 [ ]. Use only AND, OR and NOT gates, drawn with the standard symbols. The total for this worksheet is **19 marks**.

1

Total: 4 marks

Each statement describes a system with one output. Tick (✓) **one** box in each row to show the single logic gate needed for that system. **[4]**

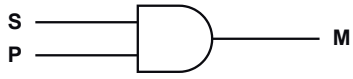
Statement	AND	OR	NOT
A paper shredder runs only when the waste bin is in place and there is paper in the slot.			
A doorbell sounds when the front button or the side button is pressed.			
A freezer door sensor gives 1 when the door is closed. A warning light is on when the door is not closed.			
A lift alarm sounds when the alarm button is pressed or the lift has stopped between floors.			

2

Total: 4 marks

A motor closes an automatic pool cover (M = 1) when the close switch is on (S = 1) **and** nobody is detected in the pool. A sensor gives P = 1 when a person is detected in the pool, and P = 0 when nobody is detected.

A technician drew this logic diagram for the pool cover.



(a) Give **one** set of input values for which the technician's diagram gives the wrong output. State the output the diagram gives and the output it should give. **[2]**

S	P	Output the diagram gives	Output it should give

(b) Draw a correct logic diagram for the pool cover. **[2]**



3 **Total: 6 marks**

A pottery studio has an electric kiln. Its heater is on only when the start switch is on, the lid is locked, **and** the kiln has **not** yet reached its target temperature. A temperature sensor gives T = 1 when the kiln has reached its target temperature.

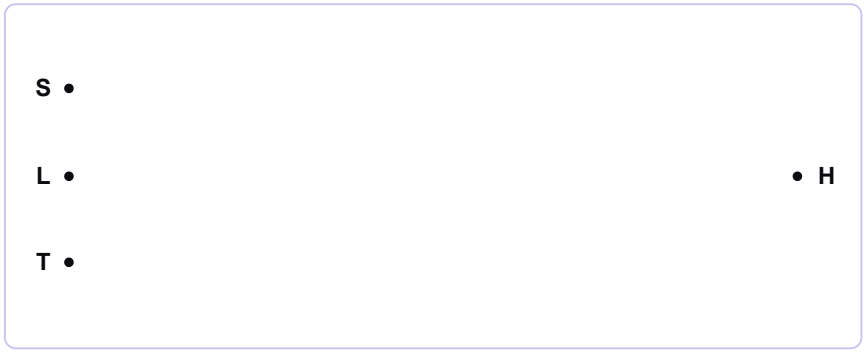
(a) Complete the table to show what 1 and 0 mean for output H. **[1]**

	Letter	1 means	0 means
Input	S	the start switch is on	the start switch is off
Input	L	the lid is locked	the lid is not locked
Input	T	the kiln has reached its target temperature	the kiln has not reached its target temperature
Output	H		

(b) Write the logic expression for H, using S, L and T. **[2]**

H =

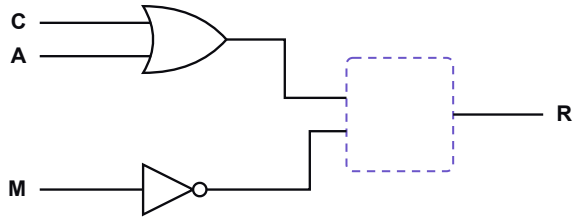
(c) Draw the logic diagram for the kiln heater. **[3]**



4 **Total: 5 marks**

A bike-share dock releases a bike (R = 1) when a member taps a valid card (C = 1) **or** enters an accepted app code (A = 1). A bike is never released while the dock is in maintenance mode (M = 1).

An engineer has started the logic diagram for the dock. One gate is missing.



(a) Draw the missing gate in the dashed box. **[1]**

(b) Complete the truth table for the dock. **[4]**

C	A	M	R
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: 19 marks