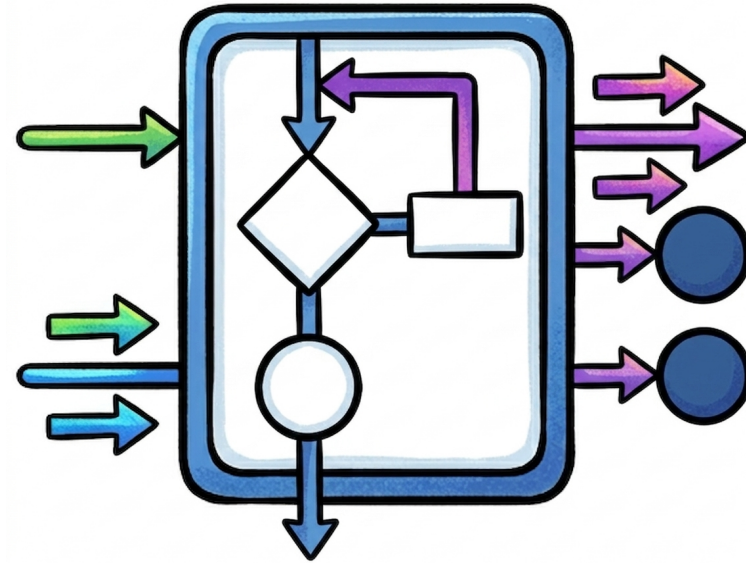


Topic 106 Microcontrollers Flowcharts Question Pack

for

Eduqas GCE A-Level Electronics



Student Name:

Class / Group:

Question 1

4

Examiner
only

3. A design brief for an electronic safety warning system in a car uses the following information regarding the inputs and outputs of the system.

- sensor, A, outputs a logic 1 when the ignition key is turned.
- microswitch, B, on the seatbelt outputs a logic 1 when the belt is fastened.
- microswitch, C, on the door outputs a logic 1 if the door is opened.
- the buzzer sounds when Q is logic 1.

The truth table for the logic system is shown below.

Door switch C	Seatbelt switch B	Key sensor A	Q
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

- (a) (i) Use the truth table to write down the **unsimplified** (3 term) Boolean expression for output Q in terms of C, B and A. [1]

Q = ...

- (ii) Simplify the expression using either a Karnaugh map or the rules of Boolean algebra. [3]

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C	B.A			
	00	01	11	10
0				
1				



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- (b) Complete the following diagram to show how the output **Q** can be generated using logic gates. [3]

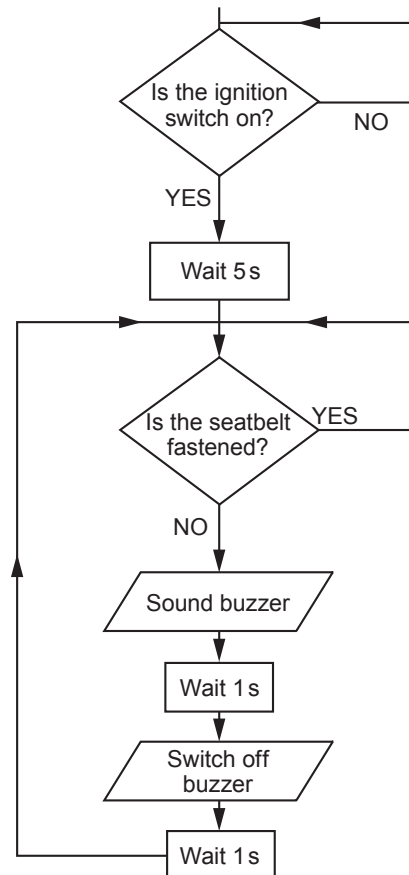


- (c) Redraw the system using NAND gates only. Cross out any redundant gates. [4]

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- (d) The system is replaced by a microcontroller. Part of the system is shown in the flow chart. Explain what is happening whilst the flow chart is run. [4]

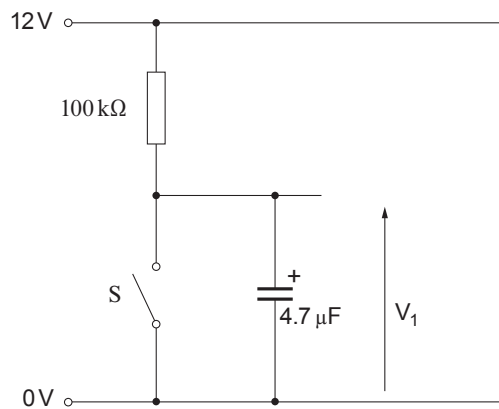
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Question 2

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6. (a) The diagram shows a timing sub-system.



- (i) Switch S is closed then released at time $t = 0$. Determine the time taken for V_1 to reach 6V. [3]

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- (ii) Calculate the value of V_1 at a time of $t = 1$ s. [3]

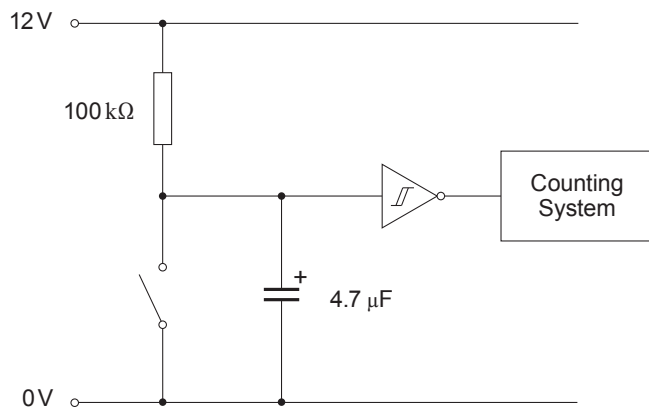
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- (b) A small theatre in a theme park shows a virtual reality presentation every 15 minutes. The following circuit is used in the turnstile. It incorporates the timing sub-system from part (a) in a counting circuit.



What is the combined effect of the timing sub-system and the Schmitt inverter on the signal from the switch and why is it needed in this system? [2]

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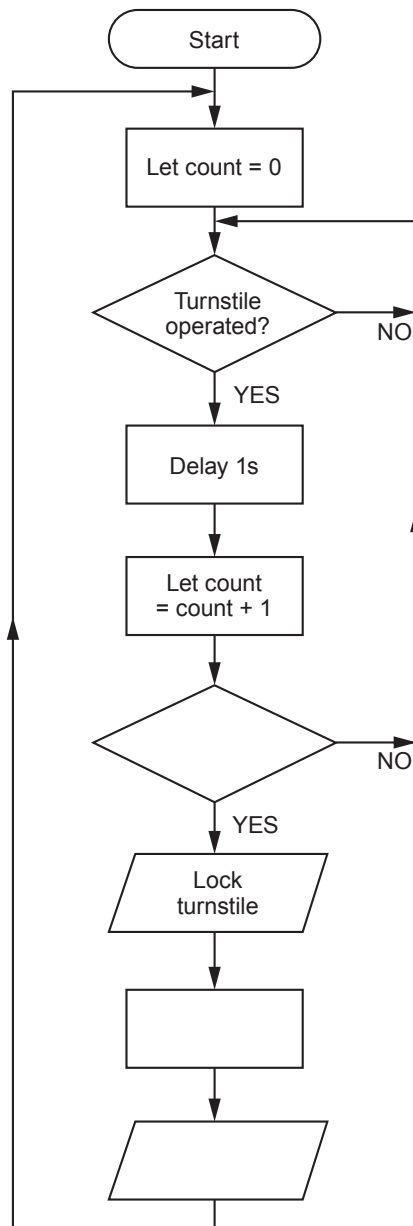
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- (c) An alternative design for the theatre entry system is controlled by a microcontroller that must satisfy the following specification.

- Only 50 people are allowed to enter through the turnstile
- Once 50 people have entered, the turnstile will lock for 15 minutes
- After 15 minutes the system will reset ready for the next presentation

Complete the design for a flowchart for the theatre entry program.

[3]



Question 3

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only

3. (a) Convert the following:

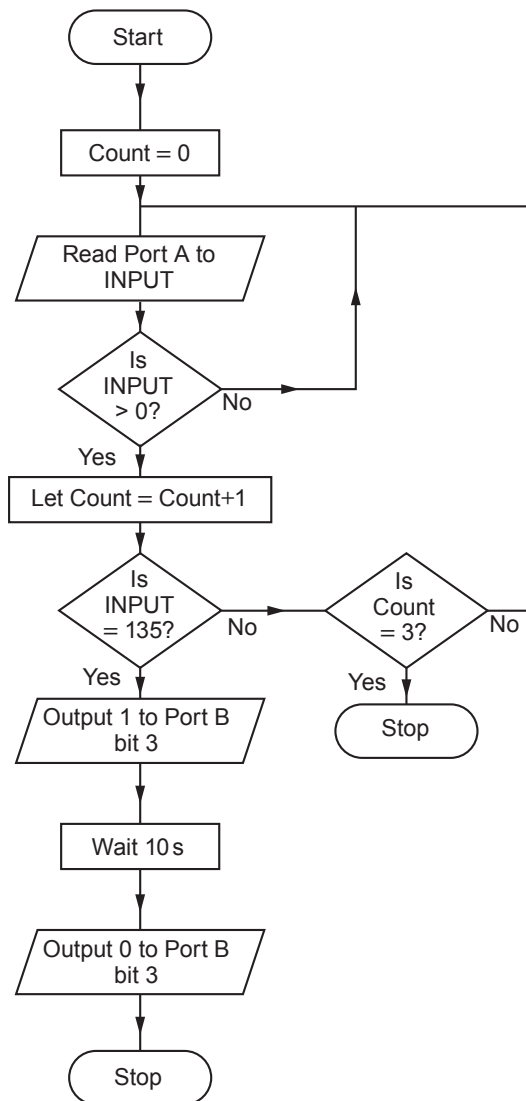
(i) Decimal 135 to Binary (8-bit) [1]

(ii) Binary 01001011 to hexadecimal [1]

The following program forms part of the entry system for a secure room.

An 8-bit binary number corresponding to the decimal 135 is entered via a keypad attached to Port A of a microcontroller.

A solenoid lock is attached to bit 3 of Port B.



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