

Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE
General Certificate of Secondary Education



CYD-BWYLLGOR ADDYSG CYMRU
Tystysgrif Gyffredinol Addysg Uwchradd

294/02

ELECTRONICS
MODULE TEST E2
HIGHER TIER

A.M. THURSDAY, 8 June 2006

(45 minutes)

For Examiner's use only

Total Mark	
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ADDITIONAL MATERIALS

In addition to this examination paper you may need a calculator.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

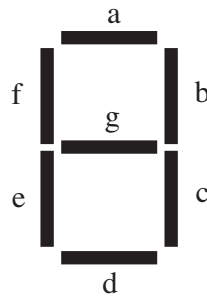
Answer **all** the questions in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

1. The diagram shows the arrangement of the LEDs in a seven-segment display.

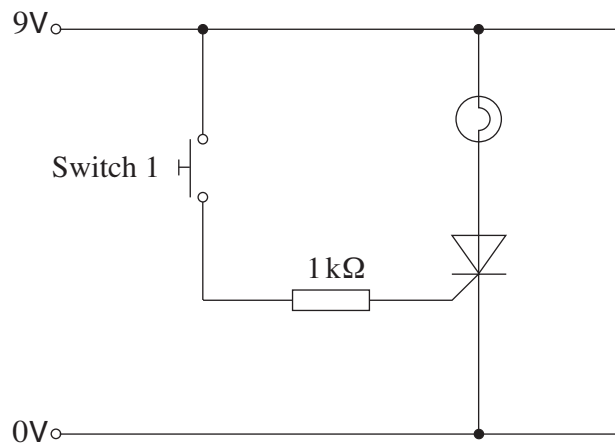


Complete the following table, which shows the number/letter displayed when different segments are lit.

SEGMENT							NUMBER/LETTER
a	b	c	d	e	f	g	DISPLAYED
1	0						6
							C
1	1	0	1	1	0	1	

[3]

2. The following diagram shows a thyristor circuit. Switch 1 is open.



(a) Switch 1 is operated in the sequence shown below. State whether the bulb is *on* or *off* for each step.

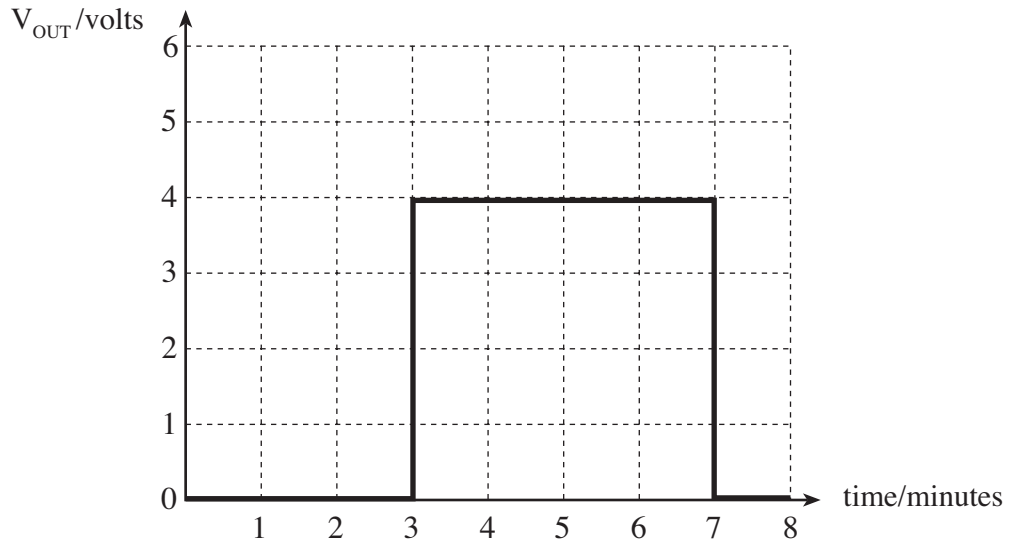
- Switch 1 is closed. The bulb is
- Switch 1 is opened. The bulb is

[2]

(b) Add a reset switch to the circuit diagram.

[1]

3. The graph shows the output from a timer circuit. When its input is triggered, the output goes high for a fixed length of time, to produce this single pulse:



- (a) What is the name of the timer circuit that gives the output shown?

.....
[1]

- (b) For how long is the output of the timer circuit high?

[1]

- (c) What is the amplitude of the waveform shown in the graph?

[1]

- (d) Give a practical application for this timer circuit.

.....
[1]

4. (a) An electronic system has two input sensors **A** and **B**, and three outputs **Q**, **R** and **S**. The truth table showing how the input sensors control the outputs is shown below.

B	A	Q	R	S
0	0	1	1	1
0	1	0	1	0
1	0	0	1	1
1	1	0	0	0

- (i) Study the **Q** output. Which type of logic gate will provide this?
 Logic gate is
- (ii) Study the **R** output. Which type of logic gate will provide this?
 Logic gate is
- (iii) Study the **S** output. Write down an expression to describe this output.
 $S = \dots\dots\dots$

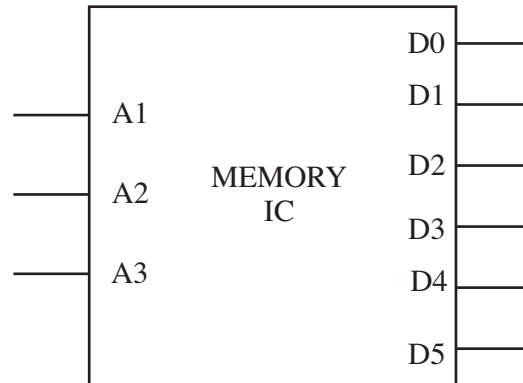
[3]

- (b) You have a selection of AND, OR, NOT, NAND and NOR gates available. Complete the diagram to show how the logic system can be made.



[3]

- (c) Another electronic system uses the following memory IC rather than logic gates. The system controls the lamps in a disco lighting sequence.



The IC has three address lines and six data lines.

- (i) Other than cost, give **one** advantage of using a memory IC instead of logic gates.

.....

- (ii) How many lamps can be controlled separately by this memory IC?

- (iii) What is the maximum number of sequence steps that can be stored in the IC?

.....

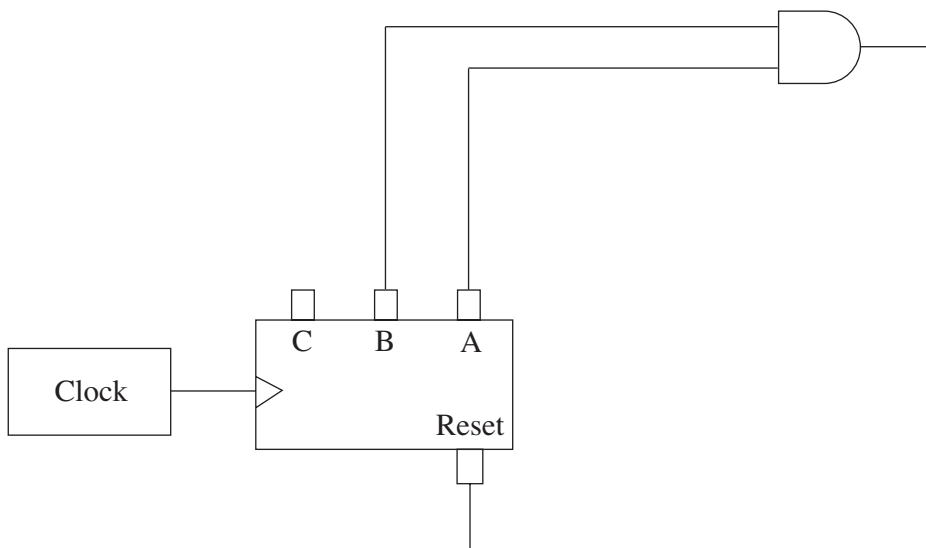
[3]

5. (a) On the diagram below draw the connections required to allow the D-type flip-flops to perform as a 2-bit up counter.



[3]

- (b) In the circuits below, bit A of the 3-bit counter is the least significant bit.



To begin with the counter is reset.

- (i) On which clock pulse will the counter reset again?

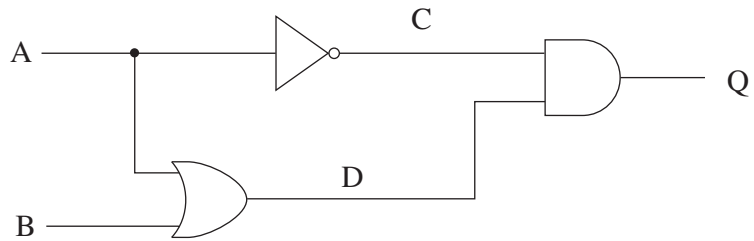
The counter will reset on the clock pulse.

- (ii) The output of **this** counter is decoded and shown on a seven-segment display.

What is the highest number shown?

[2]

6. (a) Complete the truth table for the following logic system.



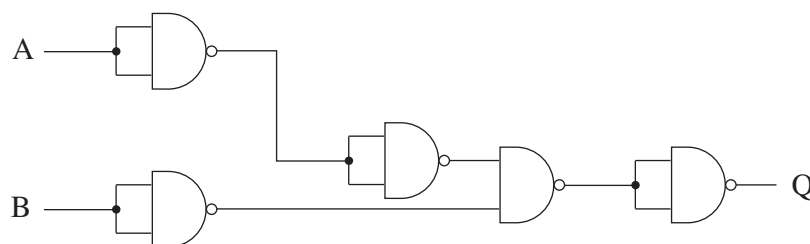
A	B	C	D	Q
0	0			
0	1			
1	0			
1	1			

[3]

(b) Redraw the system using only NAND gates.

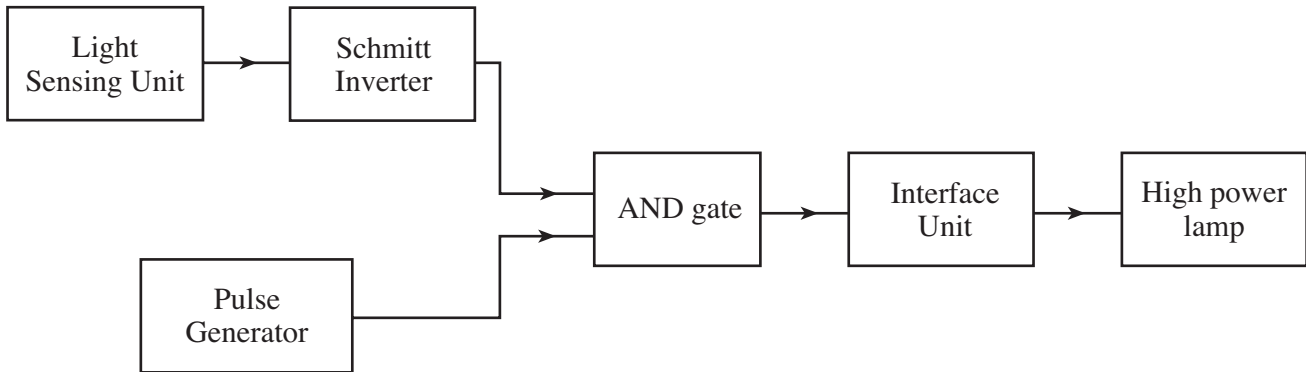
[3]

(c) Here is another system of NAND gates. Simplify it by crossing out any redundant gates.

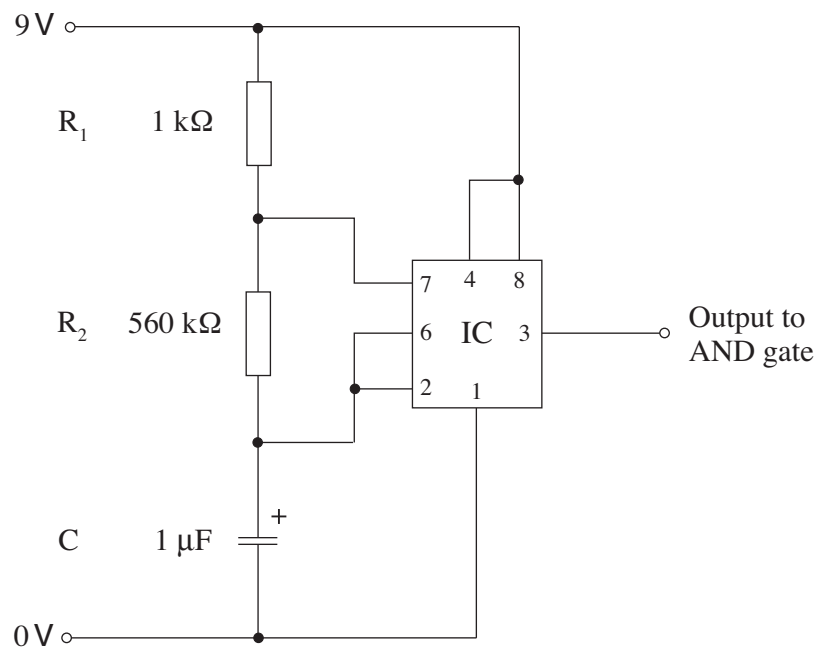


[1]

7. The block diagram below shows a design for a road works warning system that lights a flashing warning lamp when it gets dark.



- (a) Here is the circuit for the pulse generator that uses a 555 timer IC.



- (i) Sketch the shape of the output signal produced by the pulse generator.

[1]



(ii) The **approximate** value of frequency f of the pulse generator is given by the formula:

$$f = \frac{0.7}{R_2 C} \quad (\text{where } R_2 \text{ is in } M\Omega \text{ and } C \text{ is in } \mu F).$$

Use this formula to calculate the frequency of the pulse generator.

.....

.....

[3]

(b) One use for the Schmitt Inverter is to invert the signal from the light sensing unit. What is the other purpose of the Schmitt Inverter in **this** system?

.....

.....

[1]

(c) The lamp is rated at 9V, 3 A.

(i) Choose a suitable device for the interface unit. [1]

(ii) Complete the circuit diagram to show how the interface unit is connected to the AND gate output and the lamp.

9V ○—————

Output from
AND gate ○—

0V ○—————

[3]