

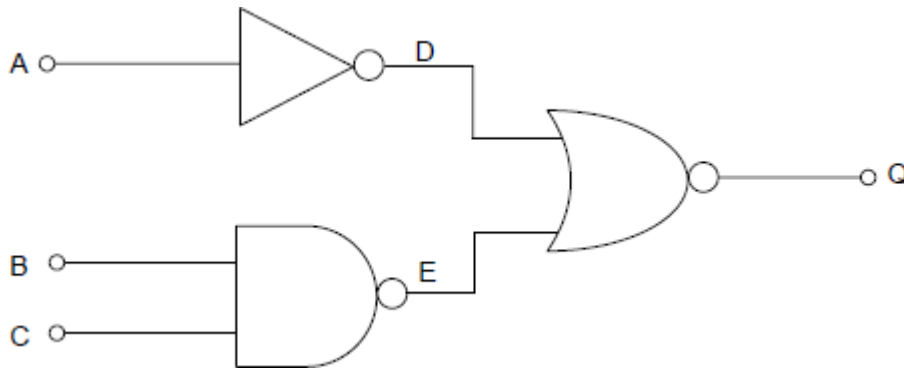
Name of the Student: _____

Max. Marks : 20 Marks

Time : 20 Minutes

Q1.

As part of his project, a student constructs the following logic circuit.



(a) Write down the Boolean expressions for:

D = _____

(1)

E = _____

(2)

(b) Write down the Boolean expression for Q in terms of D and E.

Q = _____

(2)

(c) Complete the truth table below for the logic circuit above.

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

1	1	1			
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(4)

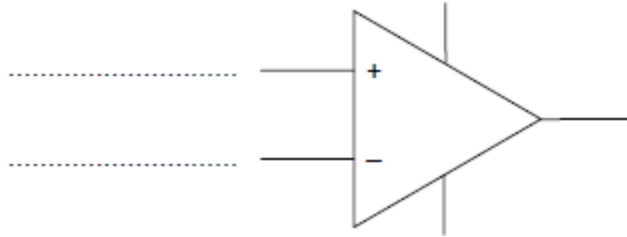
- (d) His supervisor suggests that the logic circuit can be simplified. What single logic gate would have the same function as the whole circuit above?

(1)

(Total 10 marks)

Q2.

- (a) (i) An op-amp has two inputs. Label on the diagram the correct name for each input.

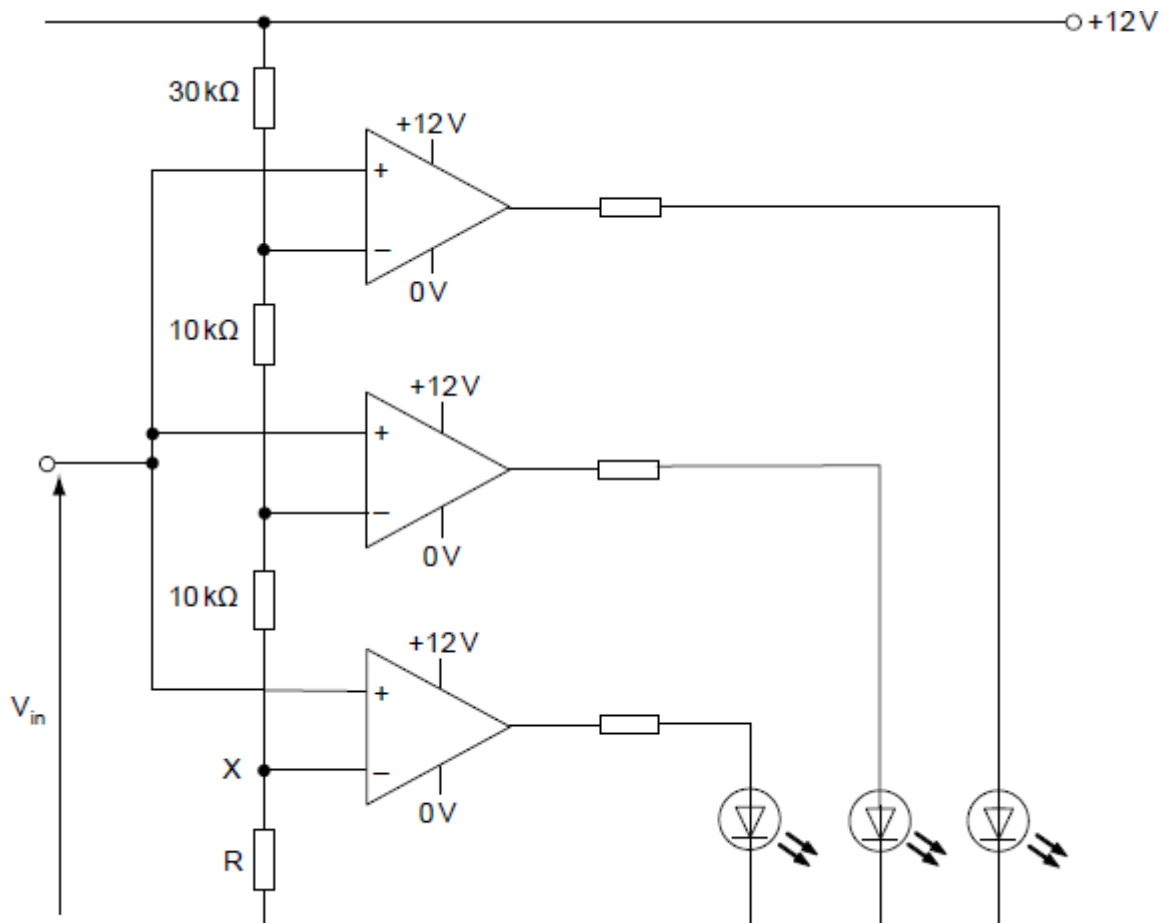


(2)

- (ii) Explain how the op-amp works as a comparator, making reference to the two op-amp inputs.

(2)

- (b) The circuit shown below is a simple tester for 9V batteries. When the input voltage, V_{in} , is below 7 V, all the LEDs should be off. As the input voltage is increased the LEDs come on one at a time until they are all lit.



(i) Calculate the value of R to make the voltage at point X equal to 7 V.

(2)

(ii) Calculate the minimum input voltage, V_{in} , at which all LEDs are lit.

(2)

(c) The circuit is built using red LEDs. When this circuit was tested with the input voltage below 7 V, all LEDs should have been off but remained on dimly. Explain why replacing the red LEDs with blue LEDs solved this problem.

(2)

(Total 10 marks)