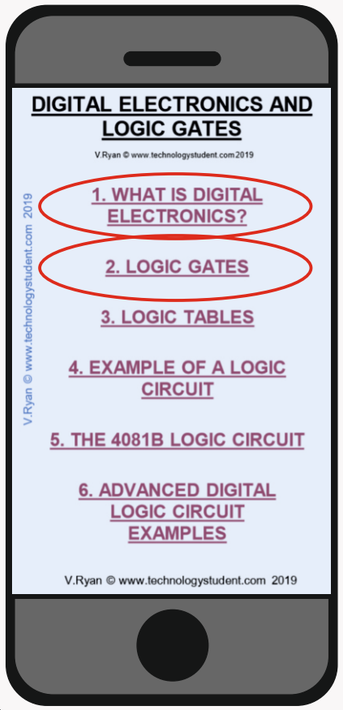
SMART LEARNING - FOR USE WITH THE MOBILE INTERACTIVE PDF Apps FROM www.technologystudent.com

A



DIGITAL ELECTRONICS AND LOGIC GATES

TO ANSWER ALL THE QUESTIONS YOU WILL NEED TO DOWNLOAD THE 'DIGITAL ELECTRONICS AND LOGIC GATES' APP, FROM THE INTERACTIVE MOBILE APP SECTION OF www.technologystudent.com

LINK

http://www.technologystudent.com/mobapps/digital1.pdf

Once you have downloaded the App, you can use it to navigate the website. You may need to follow the links on each page of the App, to research / complete answers to all the questions.

ARE YOU READY?
USE THE MOBILE App!!

1 **BRIEFLY, WHAT IS DIGITAL ELECTRONICS?**

2 **WRITE A LIST OF 'DEVICES' THAT USE DIGITAL ELECTRONICS.**

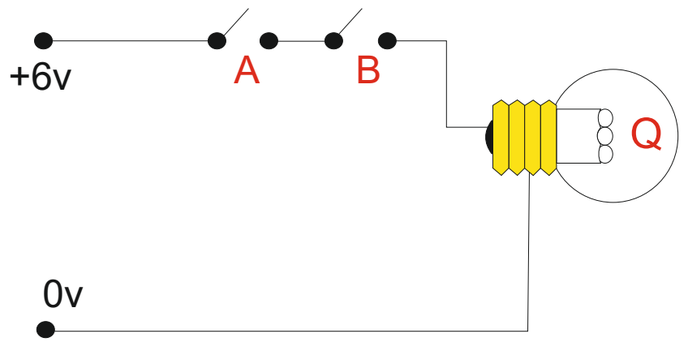
Use the internet to research your answer.

3 **LOGIC CIRCUITS ARE NORMALLY COMPOSED OF G_____**

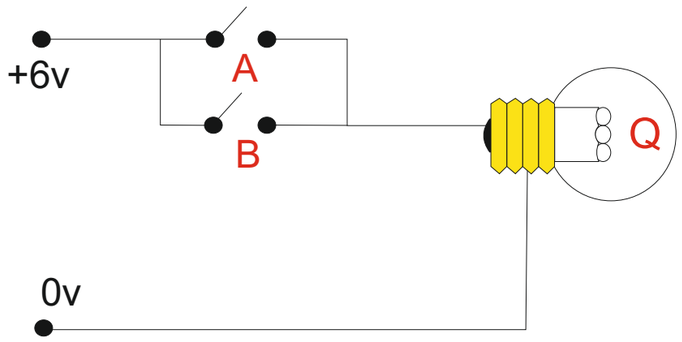
LOGIC CIRCUITS PRODUCE PULSES OF ELECTRICITY. HOW ARE THESE REPRESENTED, WHEN WRITTEN ON PAPER?

NAME THE TWO MOST COMMON TYPES OF GATE FOUND IN LOGIC CIRCUITS

4 **NAME THE GATES REPRESENTED BY THE TWO CIRCUITS BELOW.**

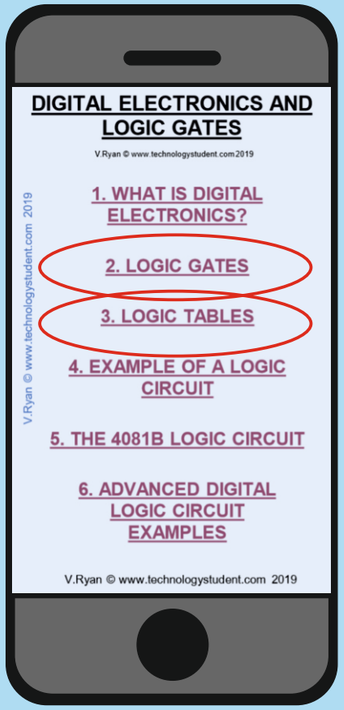


NAME:



NAME:

HELPFUL LINK: http://www.technologystudent.com/mobapps/digital1.pdf



LOGIC GATES AND LOGIC TABLES

TO ANSWER ALL THE QUESTIONS YOU WILL NEED TO DOWNLOAD THE 'DIGITAL ELECTRONICS AND LOGIC GATES' APP, FROM THE INTERACTIVE MOBILE APP SECTION OF www.technologystudent.com

LINK

http://www.technologystudent.com/mobapps/digital1.pdf

Once you have downloaded the App, you can use it to navigate the website. You may need to follow the links on each page of the App, to research / complete answers to all the questions.

ARE YOU READY?
USE THE MOBILE App!!

1

WHAT ROLE DO TRANSISTORS PLAY IN MOST LOGIC CIRCUITS AND INTEGRATED CIRCUITS (ICS /SILICON CHIPS).

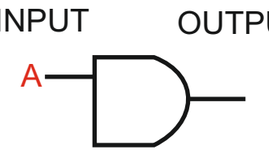
2

B

1. Complete the AND and NAND logic tables and symbols seen below.

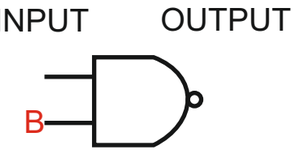
AND gate

A	B	Q
0		0
	1	
1	0	0
1		



NAND gate

A	B	Q
	0	1
0	1	
1		1
	1	

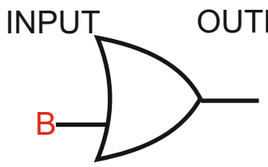


2. How does the NAND gate differ from an AND gate?

3. Complete the OR and NOR logic tables and symbols seen below.

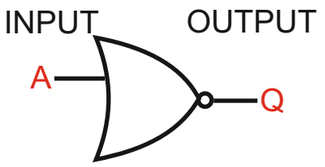
OR gate

A	B	
0		0
	1	1
1		1
1	1	



NOR gate

A		Q
	0	1
0	1	
1		0
	1	0

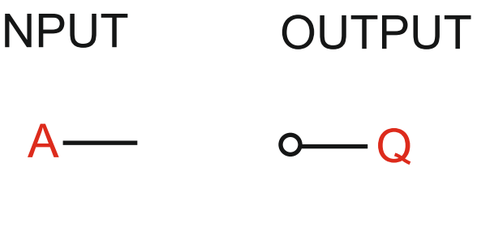


4. How does the NOR gate differ from an OR gate?

5. Complete the INVERTER table and symbols seen below.

INVERTER gate

A	
0	1
	0

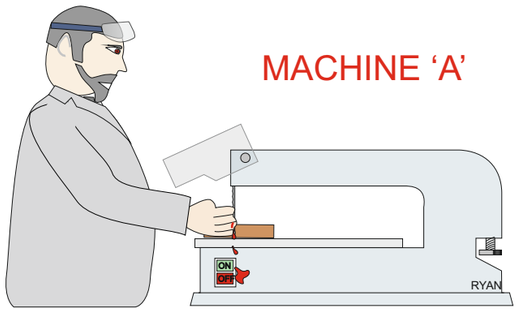


6. What is the function of an INVERTER GATE?

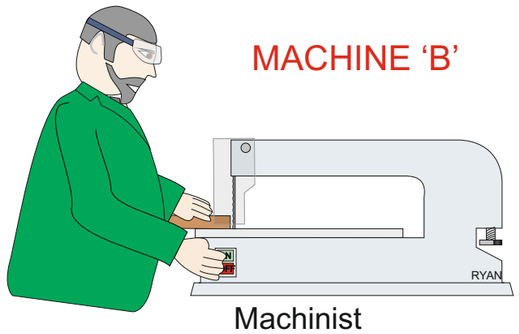
EXAMPLE OF A LOGIC CIRCUIT

C

In manufacturing industry safe use of machines is very important. All machines should be set up in such a way that it is impossible for the machine operator to have an accident. Machine 'A' is unsafe because it can turned on and used when the guard is out of position.
Alternatively, machine 'B' has been fitted with a logic circuit. It is designed to ensure that the guard is in the correct position and the 'ON' switch is pressed simultaneously, before the machine will work.



Machinist
uses an unsafe machine



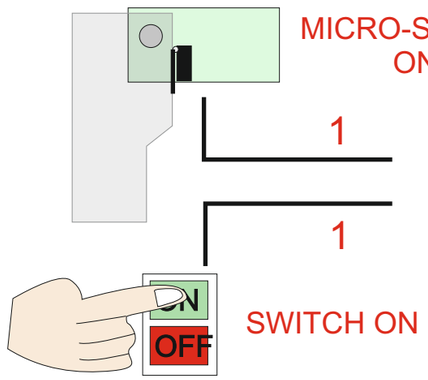
Machinist
uses a safe machine

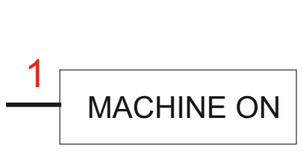
The diagram below shows the micro-switch has been switched on as the guard is in the right position. Also, the 'ON' switch has been pressed simultaneously. This means that the logic states of both inputs are 1 (true, on, high, up).

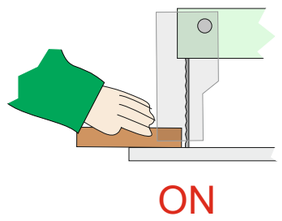
Complete the diagram by drawing the correct logic gate that allows the machine to work.

Complete the Truth Table for the logic gate.

Draw the correct logic symbol alongside the truth table.



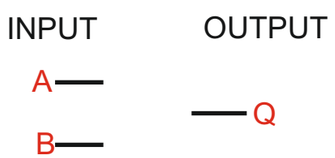




ON

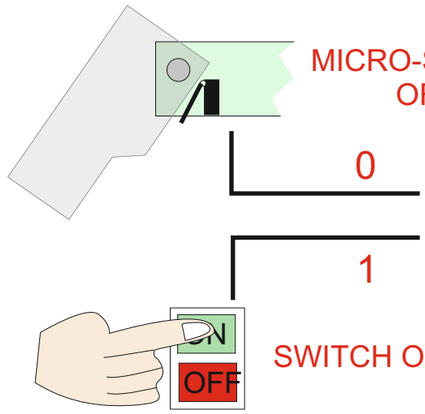
AND gate

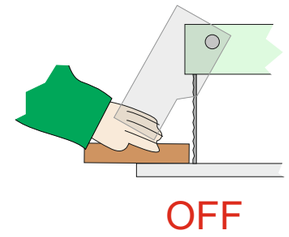
A	B	Q



The diagram below shows the machine not working.

Draw the gate symbol in position.





OFF

Why does the machine not work? Write a detailed answer.

In the space below draw an alternative gate or series of gates that will give the same output. It should allow the machine to work when the guard is in the correct position and the switch is pressed. I should prevent the machine from working when the guard is not in the right position and the switch is not pressed.

DIAGRAM / LOGIC CIRCUIT

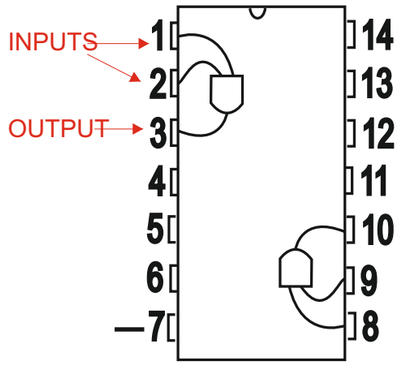
EXPLANATORY NOTES

1

EXAMPLES / QUESTIONS - LOGIC CIRCUITS - 4018B

D

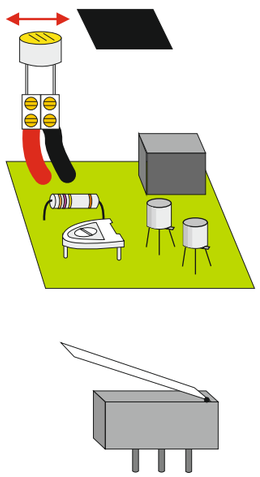
1. The 4081B integrated circuit is an AND GATE. How many pins does it have ?



2. The logic IC drawn opposite is a 4018B. It has four AND gates, two are shown. Add the remaining two AND gates, with their inputs and outputs.

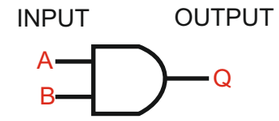
3. A dark sensor and a micro switch have been connected to one of the AND gates of a 4018B logic circuit (see below).

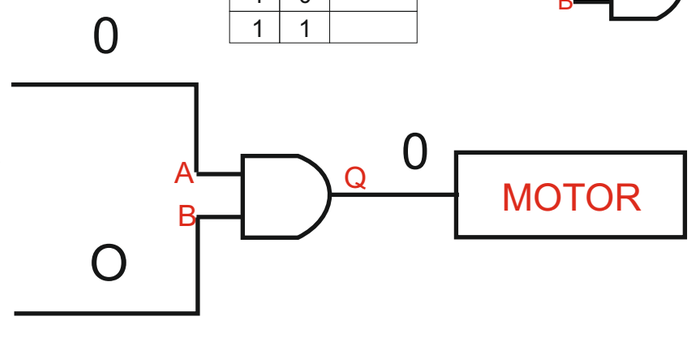
Identify the Dark sensor and micro-switch with arrows and labels.
Complete the logic table.



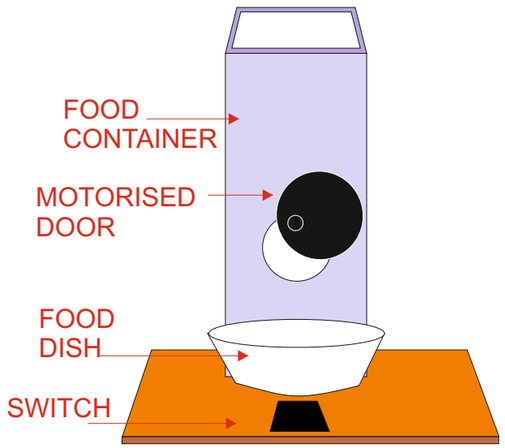
AND gate

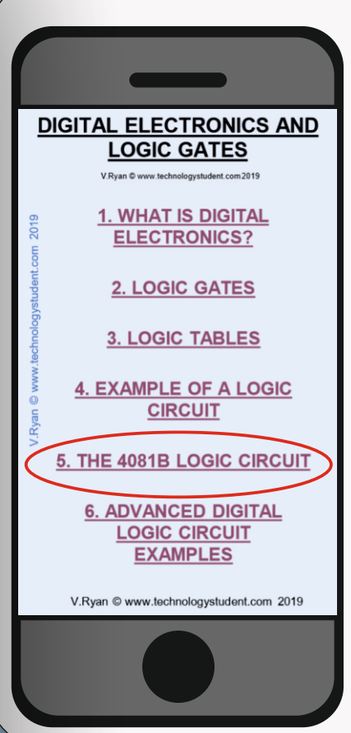
A	B	Q
0	0	
0	1	
1	0	
1	1	





4. A dog owner has built an automatic animal feeder to work at night and when his dog presses a switch (pressure pad). This type of device would automatically feed the dog when the owner is asleep. Draw a circuit diagram that clearly shows how a 4081B could be used to automatically drive a motor, releasing food into the dish.





LOGIC GATES AND LOGIC TABLES

TO ANSWER ALL THE QUESTIONS YOU WILL NEED TO DOWNLOAD THE 'DIGITAL ELECTRONICS AND LOGIC GATES' APP, FROM THE INTERACTIVE MOBILE APP SECTION OF www.technologystudent.com

LINK

http://www.technologystudent.com/mobapps/digital1.pdf

Once you have downloaded the App, you can use it to navigate the website. You may need to follow the links on each page of the App, to research / complete answers to all the questions.

ARE YOU READY?
USE THE MOBILE App!!

2

DESCRIBE ANOTHER POTENTIAL PRACTICAL APPLICATION, OF THE 4081 LOGIC CIRCUIT.

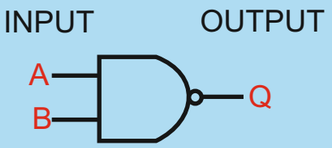
SMART LEARNING - FOR USE WITH THE MOBILE INTERACTIVE PDF Apps FROM www.technologystudent.com

AND gate

A	B	Q
0	0	0
0	1	0
1	0	0
1	1	1

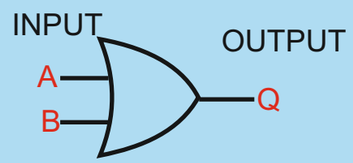
NAND gate

A	B	Q
0	0	1
0	1	1
1	0	1
1	1	0



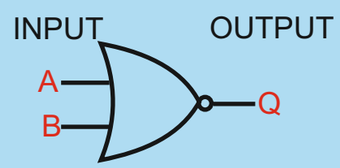
OR gate

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	1



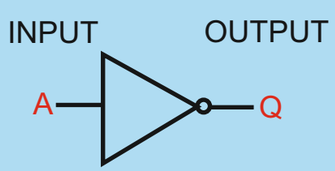
NOR gate

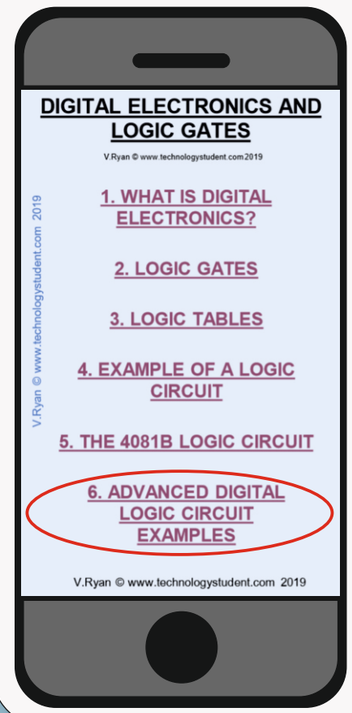
A	B	Q
0	0	1
0	1	0
1	0	0
1	1	0



INVERTER gate

A	Q
0	1
1	0





ADVANCED QUESTIONS

TO ANSWER ALL THE QUESTIONS YOU WILL NEED TO DOWNLOAD THE 'DIGITAL ELECTRONICS AND LOGIC GATES' APP, FROM THE INTERACTIVE MOBILE APP SECTION OF www.technologystudent.com

LINK

http://www.technologystudent.com/mobapps/digital1.pdf

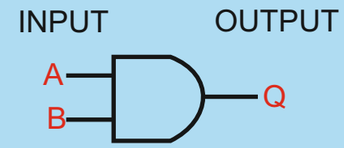
Once you have downloaded the App, you can use it to navigate the website. You may need to follow the links on each page of the App, to research / complete answers to all the questions.

ARE YOU READY? USE THE MOBILE App!!

USE THE APP TO HELP YOU ANSWER THE FOLLOWING ADVANCED QUESTIONS.

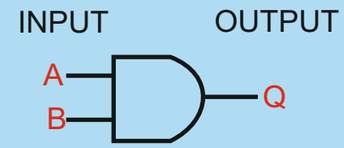
AND gate

A	B	Q
LOW	LOW	LOW
LOW	HIGH	LOW
HIGH	LOW	LOW
HIGH	HIGH	HIGH



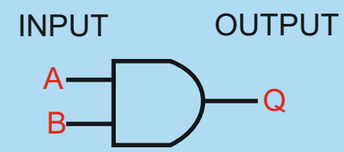
AND gate

A	B	Q
OFF	OFF	OFF
OFF	ON	OFF
ON	OFF	OFF
ON	ON	ON



AND gate

A	B	Q
FALSE	FALSE	FALSE
FALSE	TRUE	FALSE
TRUE	FALSE	FALSE
TRUE	TRUE	TRUE



ADVANCED QUESTIONS - LOGIC CIRCUITS

E

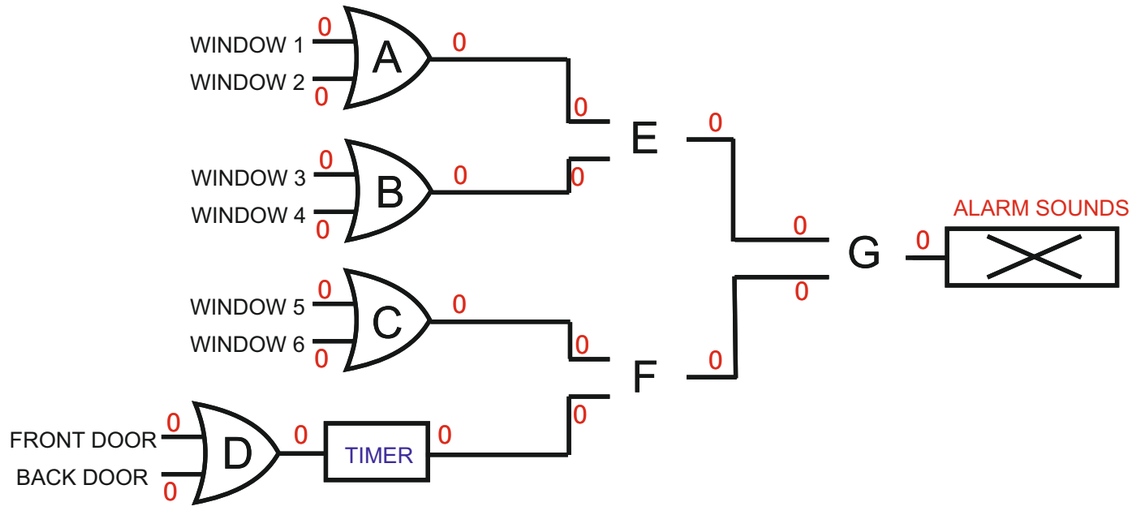
Below is the logic circuit for a simple house alarm. The alarm protects the front and back doors and six windows. Once the alarm is set if any of the doors or windows are opened the alarm will sound. The inputs for each of the gates representing the doors and windows can be connected to a vast range of sensors (eg. movement and magnetic sensors).

On the circuit below the input states of each of the sensors are '0' (false, low, off). This means that they have not detected an intruder. As a result the alarm does not sound.

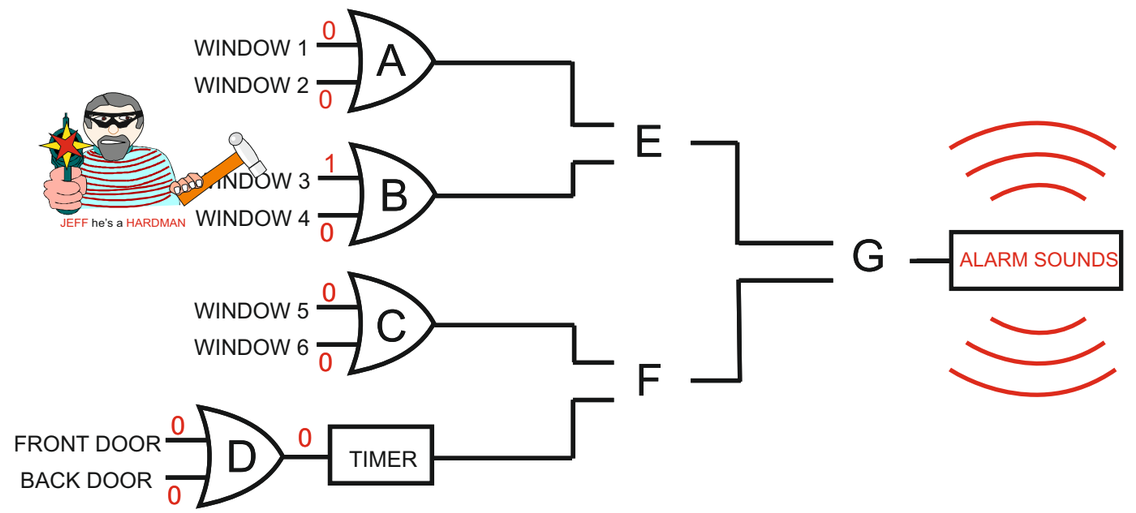
1. What type of gates have been used for the windows? _____

2. Why is a timer needed for the front and back doors? _____

3. Draw the correct symbol for gates E, F and G.



A thief breaks in through window 3. The logic state of the input changes to 1, high, on , True. Write the logic states of all the other inputs and outputs. Draw in the correct logic gates (see previous logic diagram). Remember the alarm must sound.



WORLD ASSOCIATION OF TECHNOLOGY TEACHERS https://www.facebook.com/groups/2549634481928 23/ www.technologystudent.com © 2020 V.Ryan © 2020

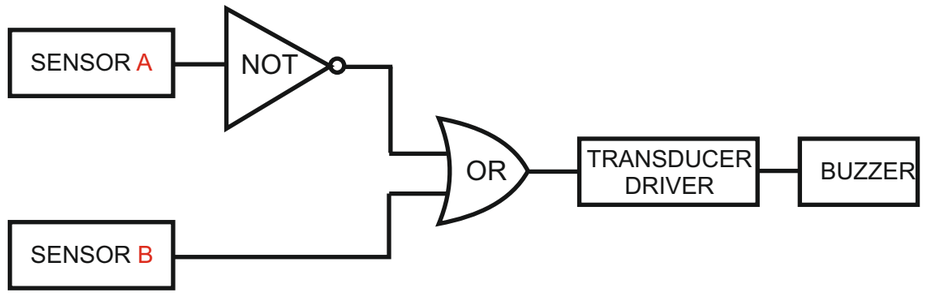
ADVANCED QUESTIONS - LOGIC CIRCUITS

F

An electronics company has developed a baby sitting device which warns parents when their child turns on a lamp next to the bed or when the temperature of the room falls.

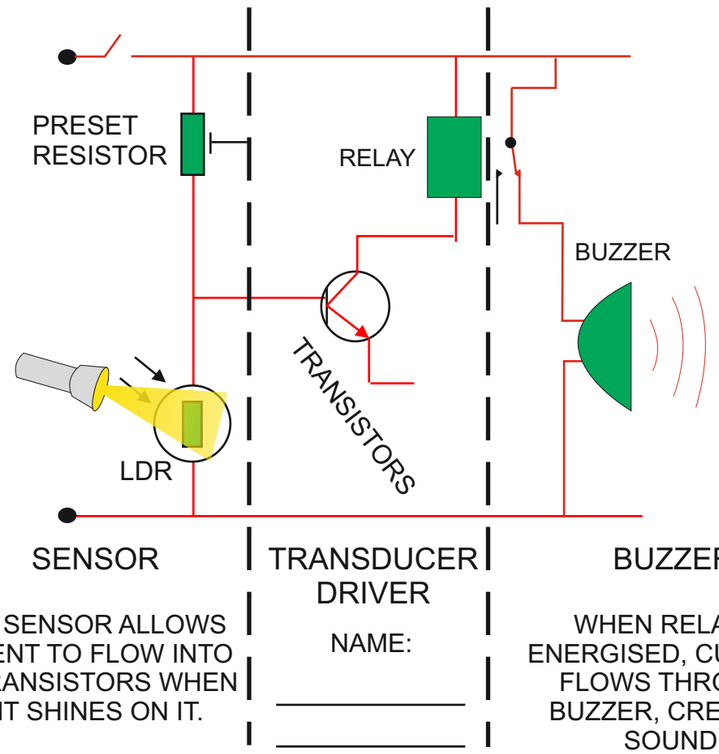
Sensor A is a temperature sensor which outputs false(0, low, off) when the room temperature falls below a set level.

Sensor B is a light sensor and is attached to a lamp. The sensor outputs true (1, high, on) when the lamp is switched on.

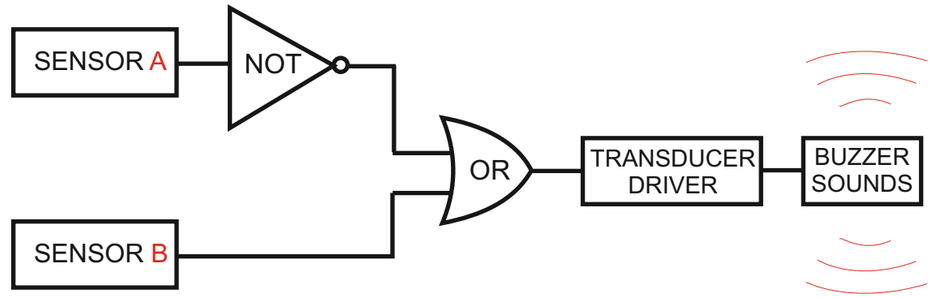


1. What is a transducer driver and what is its function?
A transducer driver is normally a circuit that amplifies a weak signal (current). In this case current from the OR gate is amplified by the transducer driver which in turn energises a relaying - activating the buzzer. A signal (current) from any gate is usually too weak to directly activate a buzzer.

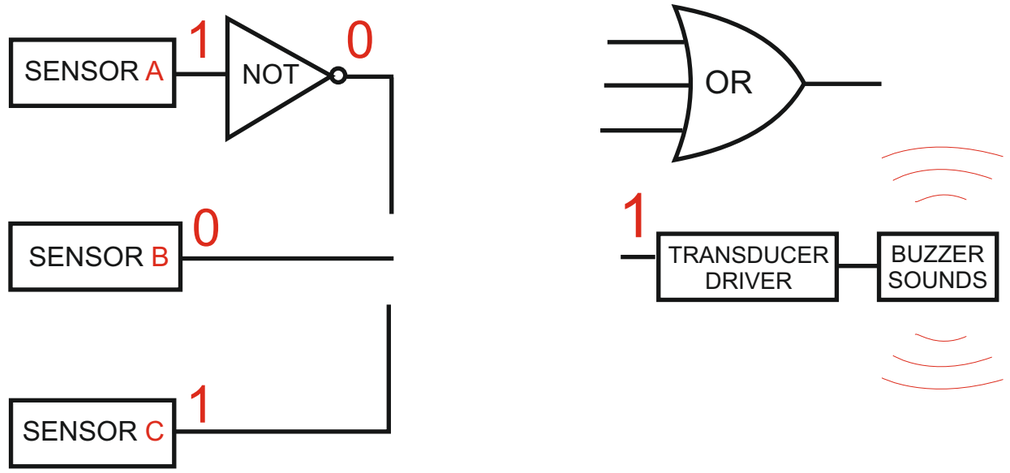
On the circuit diagram complete the transducer driver and name it.



2. The young child awakes and turns on a lamp next to her bed, changing the logic states of the outputs / inputs of the sensors and logic gates. On the logic circuit below, write the logic state of inputs / outputs of the sensors and gates.



3. As the child grows older she regularly gets out of bed and moves around during the night. A new sensor needs to be connected to the system to detect this movement. A micro-switch (SENSOR C) has been added to the system so that when the child opens her bedroom door the buzzer is activated. Complete the circuit below by adding the necessary gate.

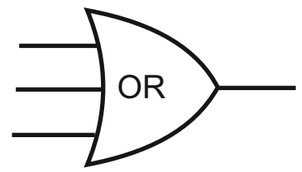


4. In the space opposite write/draw the logic table for your chosen gate.

THREE INPUT OR GATE

A	B	C	Q

INPUT OUTPUT



5. The electronics company has decided to add a circuit that will pulse the buzzer on and off. Name a circuit that could be used.

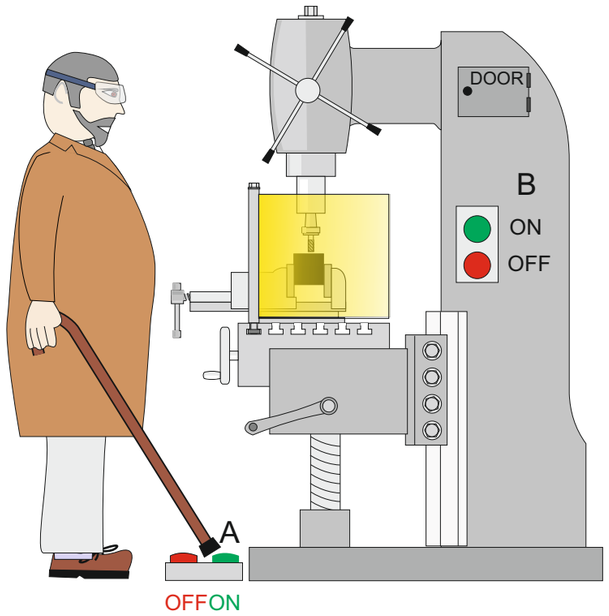
_____

ADVANCED QUESTIONS - LOGIC CIRCUITS

G

1A. **A metal cutting milling machine has two switches, any one will allow the cutter to run. The first switch is on the side of the machine and the second is a foot operated switch.**
However, the machine has two micro-switches (used as safety devices) if any of these is released the cutter will stop. The first micro-switch is on a guard, if this is opened the machine will stop. The second micro-switch is on a door which allows access to the moving mechanism of the milling machine. If this is opened the machine will stop.
The micro-switches are normally logic '1' (true, high, on) when pressed.

Draw the logic diagram for this machine.



1B. **What moving parts would you expect to see behind the door leading to the internal mechanism of the milling machine? Why would access to this area be dangerous if the machine is working at the same time?**

1C. **Is having an ON and OFF switch on the floor a good idea? How would you improve the design of the switch to make the machine safer to use?**

1D. **The room has two emergency stop buttons at either end of the workshop. If either of these are pressed all machinery in the room will stop. Draw the new logic circuit for this arrangement of buttons and switches.**

ON / OFF SWITCES

MICRO-SWITCHES

MACHINE OFF

EMERGENCY STOPS

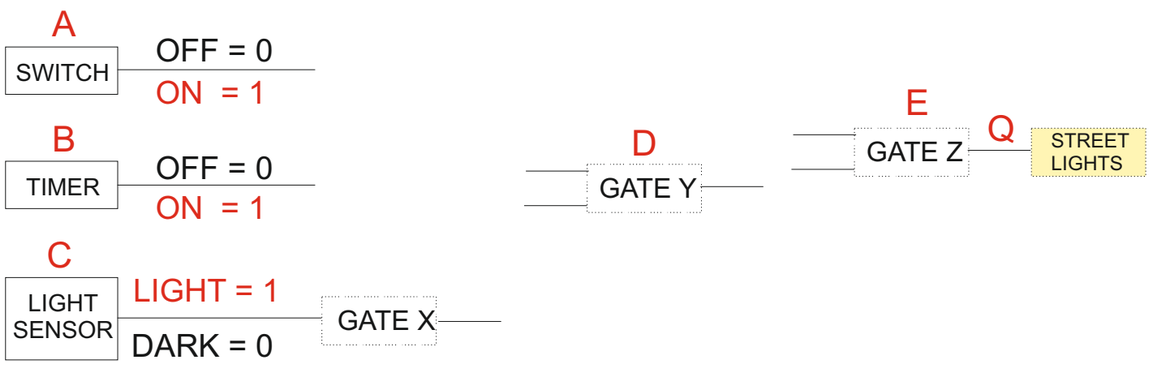
WORLD ASSOCIATION OF TECHNOLOGY TEACHERS https://www.facebook.com/groups/254963448192823/ www.technologystudent.com © 2020 V.Ryan © 2020

ADVANCED QUESTIONS - LOGIC CIRCUITS

H

1. **A local systems designer has developed a system to control street lights. The street lights can be turned on manually, or by the use of a timer so long as a light sensing unit indicates that it is dark.**
Below is an incomplete logic circuit for the control system.

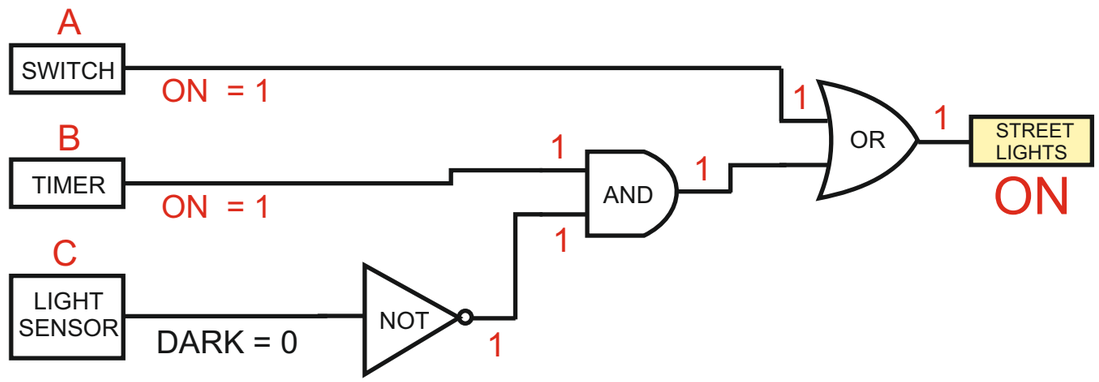
1A. **Complete the diagram below using the correct logic gates. Note the output of the dark/light sensor is '1' (true, high, on) when it is light. The lights must be turned during the dark of night.**



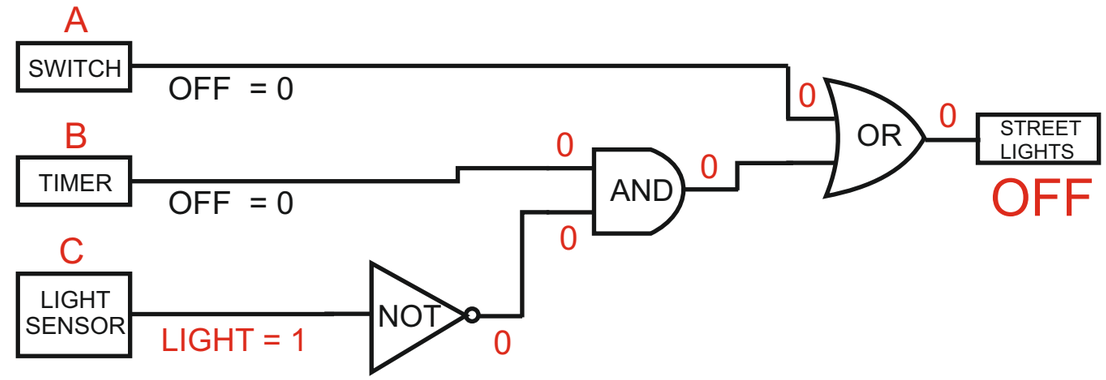
1B. **Name the logic gates you have used:**

GATE X ..... GATE Y ..... GATE Z .....

Below is the logic circuit showing the logic states of inputs and outputs of all the gates when the street lights are ON.



Below is the logic circuit showing the logic states of inputs and outputs of all the gates when the street lights are OFF.



1C. **On the logic circuit below, write the logic states of all inputs and outputs for the following: It is night time, the manual switch is off and the timer is 'on'. Will the street lights be on or off ?**