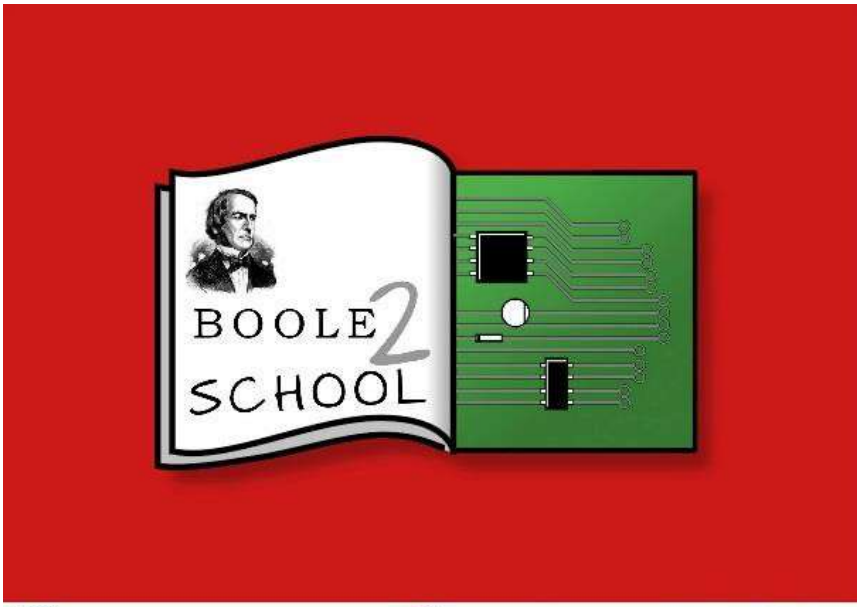

Welcome to the Boole2School Worksheet- 5th and 6th Years

Section 1 - George Boole

1. Who is George Boole?

   _____

   _____

2. Where did he teach in Ireland?

   _____

3. Why are we celebrating him this year?

   _____

   _____

Section 2 - Logic

4. Give an example of a logic argument using assumptions and conclusions:

   _____

   _____

   _____

   _____

5. Decide which of the following is a proposition and which is not:

   (1) What time is it?
   (2) It's time to have some fun.
   (3) This statement you're reading just now is false.

Section 3 - How do we use Boolean Logic?

6. Give an example of the way Boolean logic is used in your everyday life:

   _____

   _____

   _____

Section 4 - Truth Tables

7. For every statement *P* , one can find an opposite NOT(*P)* by the following rules: whenever *P* is TRUE, then NOT(*P)* is FALSE. Whenever *P* is FALSE, then NOT(*P)* is TRUE.

   P : " Anna AND Brian are happy." Then NOT(P) is: _____

Fill out the table with true or false depending on what you see you classmates do

Stages	Statements	
	Anna AND Brian are happy.	Anna is NOT happy OR Brian is NOT happy.
1) Anna  , Brian  .		
2) Anna  , Brian  .		
3) Anna  , Brian  .		
3) Anna  , Brian  .		

8. We have proven the Boolean equation NOT (A AND B) = (NOT A) OR (NOT B).

   Complete the following Boolean equations by writing each statement in an equivalent way:

   a) NOT (A OR B) = ?
   b) NOT (NOT A) = ?
   c) A AND A= ?
   d) A AND (NOT A)= ?

   e) The statement A XOR B is the shortcut for "Either A, or B, but not both". It is known as "exclusive or". Can you form the statement A XOR B using the symbols A, B, OR, AND, NOT?

9. One day the famous scientist Dr. Doom makes a public announcement:
   "IF there will be an earthquake tomorrow, THEN this entire building will fall down."

The next day, everybody talks about how Dr. Doom was so wrong. What happened in the meanwhile?

_____

_____

10. The president of the school Bridge club is very good at cheating. Just before the last game, Justine told the president "IF you cheat, THEN you'll have to quit!"
The president does his best – and succeeds – to prove Justine's statement wrong.
Try using Boolean operators like AND, OR or NOT in answering the questions below:

a) In your opinion, what did the president do during the game to prove Justine wrong?

b) The club members decided to send a last warning to their president. They staged a protest with the message "IF you cheat, THEN you'll have to quit!" Find a way to chant this message which is shorter, catchier, and doesn't use IF…THEN but rather some of the Boolean operators like AND, OR or NOT.
Hint: It is the opposite statement to what the president did.

	Justine:	What the president did to prove Justine wrong:	Club members chant:
English:	"IF you Cheat, THEN you'll Quit!"		
Boolean Logic:	IF C THEN Q		

11. IF P, THEN Q is often written as $P \rightarrow Q$. From above, we know this is the same as NOT(P) OR Q. The conditional statement $P \rightarrow Q$ is only FALSE when P is TRUE and Q is FALSE. Once P is FALSE, the conditional statement of $P \rightarrow Q$ can never be FALSE. This fact can be quite tricky to get your head around, but we can prove it logically using the truth table below:

P	Q	NOT P	(NOT P) OR Q	$P \rightarrow Q$
T	T			
T	F			
F	F			
F	T			

11. Q → P is not the same as P → Q , but you can prove that
(NOT Q) → (NOT P) is the same as P → Q.

You may use this table if you like:

P	Q	$P \rightarrow Q$	NOT P	NOT Q	(NOT Q) → (NOT P)

13. "You can fool all the people some of the time, and some of the people all the time, but you cannot fool all the people all the time." *Abraham Lincoln*
Try to find another equivalent way of saying "you cannot fool all the people all the time":

Section 5 – Puzzles

14. **King Rumbo**

King Rumbo likes to make crazy rules for his people. For example, in Rumbo's country, everybody must wear a letter on their front and a number on their back. A new rule states:

"IF you wear 7 on one side, THEN you must wear an A on the other side".

King Rumbo sees seven people walking in various directions on the street wearing

A 7 B 6 C 5 A

He'd like to call some of them and check if they cheated on his new rule. However, for security reasons, the king's council has forbidden the king from checking on more than three people at once. Which three people should the king call?

15. **The stolen chocolate**

In the famous royal family of the isle of Kids a chocolate has been stolen. The suspects are no less than the five princesses! Inspector S. Mart is immediately called upon when the queen discovers that a chocolate is missing from the chocolate box: princesses are supposed to be absolutely honest!

Anna: Cindy is guilty;
Belinda: I am innocent;
Cindy: Diana is guilty;
Diana: Cindy lies if she says I am guilty;
Elizabeth: Anna tells the truth and Cindy lies;

Assuming that **only one of them lies** and all the others speak the truth, who stole the chocolate? And assuming that **only one spoke the truth**, who would be guilty?

Hint: You may fill the table out with true or false based on the statements above.

	Anna is Guilty	Belinda is Guilty	Cindy is Guilty	Diana is Guilty	Elizabeth is guilty
Anna: Cindy is guilty					
Belinda: I am innocent					
Cindy: Diana is guilty					
Diana: Cindy lies if she says I am guilty					
Elizabeth: Anna tells the truth and Cindy lies					

1. **The Quad**

When George Boole became the first professor of mathematics in University College Cork in 1849 the college was a much smaller place than it is today. What is now the centre of the university, a U-shaped building called the Main Quadrangle, or the Quad for short, was the whole university then. If you walk towards the inside of the U-shape, the building that faces you is called the North Wing, on your left is the West Wing and on your right, the East Wing. In a recent challenge 9 students were assigned a study room in this historic building. There are two floors and a basement in each wing and one room on each floor of each wing has been allocated for each of the 9 students. Mark, one of the lucky students to get a study space, was told to allocate the study rooms. He made detailed notes as to where each student should go but spilled a cup of coffee over his notebook. The following notes are all that he is left with. Help him to check to see that the rooms are all allocated properly.

1. Joe does not study on the bottom floor.
2. Harry studies in a room directly above John and directly next to Owen (who lives in the West wing).
3. Tom studies in the East wing and one floor higher than Harry.
4. Kevin studies in a room directly above Harry.
5. Michael is based directly above Denis.

Who studies where?

You may use the table below:

	The Main Quadrangle		
	West	North	East
Top			
Middle			
Bottom			

Section 6 – Follow-up

If you found this lesson particularly enjoyable, you might wish to try out one of the mathematics enrichment programmes which are run in 5 centres across Ireland. More info at http://www.irmo.ie/