Logic Gates

Welcome to the Microsoft Workshop on Logic Gates

On a farm, gates may be used to control the 'flow' of sheep or goats between pens. In this case, the gate consists of a physical barrier whose position is controlled by a farmer. The farmer decides about the flow of animals and then moves the physical barrier to permit the desired flow.

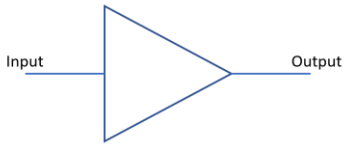
In a computer, a gate controls the flow of electric current through a circuit. The current that flows through a gate establishes a voltage at a point in the circuit. This voltage represents a single 'bit' of information. The voltage may either be high or on (representing the value '1' or true) or low or off (representing the value '0' or false).

The overwhelming computing power of logic gates stems from the fact that the output of any gate is a voltage, which can in turn be used to control another gate. A computer chip therefore can be designed to make complex decisions about the information flow within itself. This ability enables sophisticated systems to be created by interconnecting as many as a million gates within a single chip. All of this with no farm hands and no moving parts.

Logic gates are part of the circuits inside your computer. They take one or more **INPUTS**. Depending on the type of logic gate used these inputs are then compared against each other, and a single **OUTPUT** provided. A logic gate looks to see which inputs are on and then based on what type of logic gate it is, produces and either on or off output.

Logic Gates

The simplest logic gate is input/output. An input/output logic gate works like a light switch in your home. When you turn the light switch on, the light goes on and when you turn the light switch off, the light turns off. An input/output logic gate has a single input and a single output.



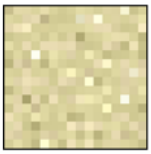
We can represent this using the following truth table. A truth table is like an answer key, it shows the inputs and outputs for a logic gate. Engineers use them to check that their circuits are doing what is intended.

Input	**Output**
Off	Off
On	On

In this case we only have 1 input that can either be ON or OFF. If our input is ON our output is ON and if our input is OFF our output is OFF. When creating a truth table, you can use O and 1 to represent OFF and ON respectively. However, some folks use T, TRUE, or ON instead of 1 or F, FALSE or OFF instead of O.

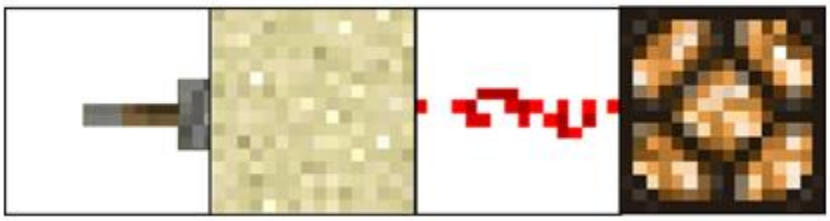
Logic Gates

We can use the built-in blocks in Minecraft to build our logic gates.

 Switch	The switch is the input to our logic gate. We can turn it ON or OFF.
 Redstone Lamp (Output)	The Redstone Lamp is used as the output of our logic gate. It will show us if the gate is ON or OFF
 Redstone (Ground)	Redstone is used to connect our inputs to our outputs. It is a conductor or wire, so it will only replicate the input it is given.
 Redstone Torch (Ground)  Redstone Torch (Side of block)	The torch will invert or flip the value coming into it.
 Block (Generic)	Objects like switches and torches need something to attach to. For this we use a sandstone block.

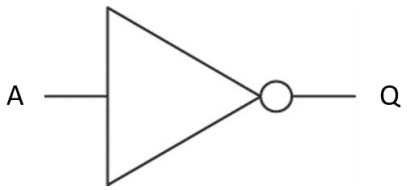
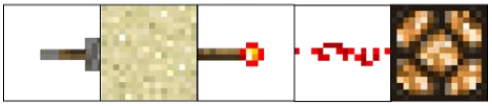
Now we can build an input/output logic gate in Minecraft, it will look something like this.

Input / Output Gate

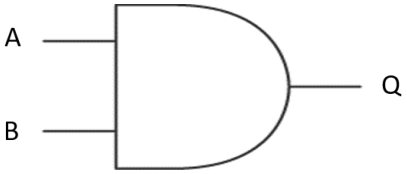
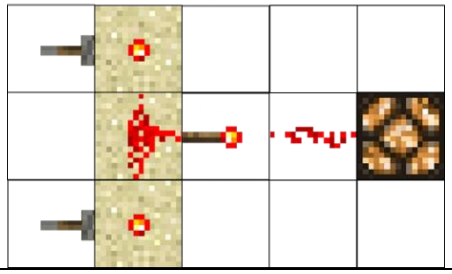


Logic Gates

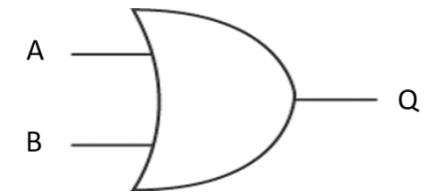
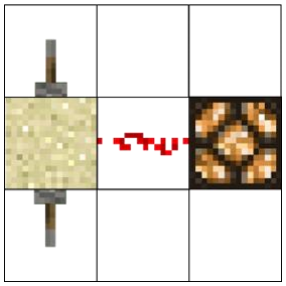
NOT logic gates take one input. If the input is ON the output will be OFF, and if the input is OFF then the output will be ON. Fill out the truth table for the NOT logic gate:

NOT Gate	Minecraft	Truth Table	
		**A**	**Out**
		On	
		Off	

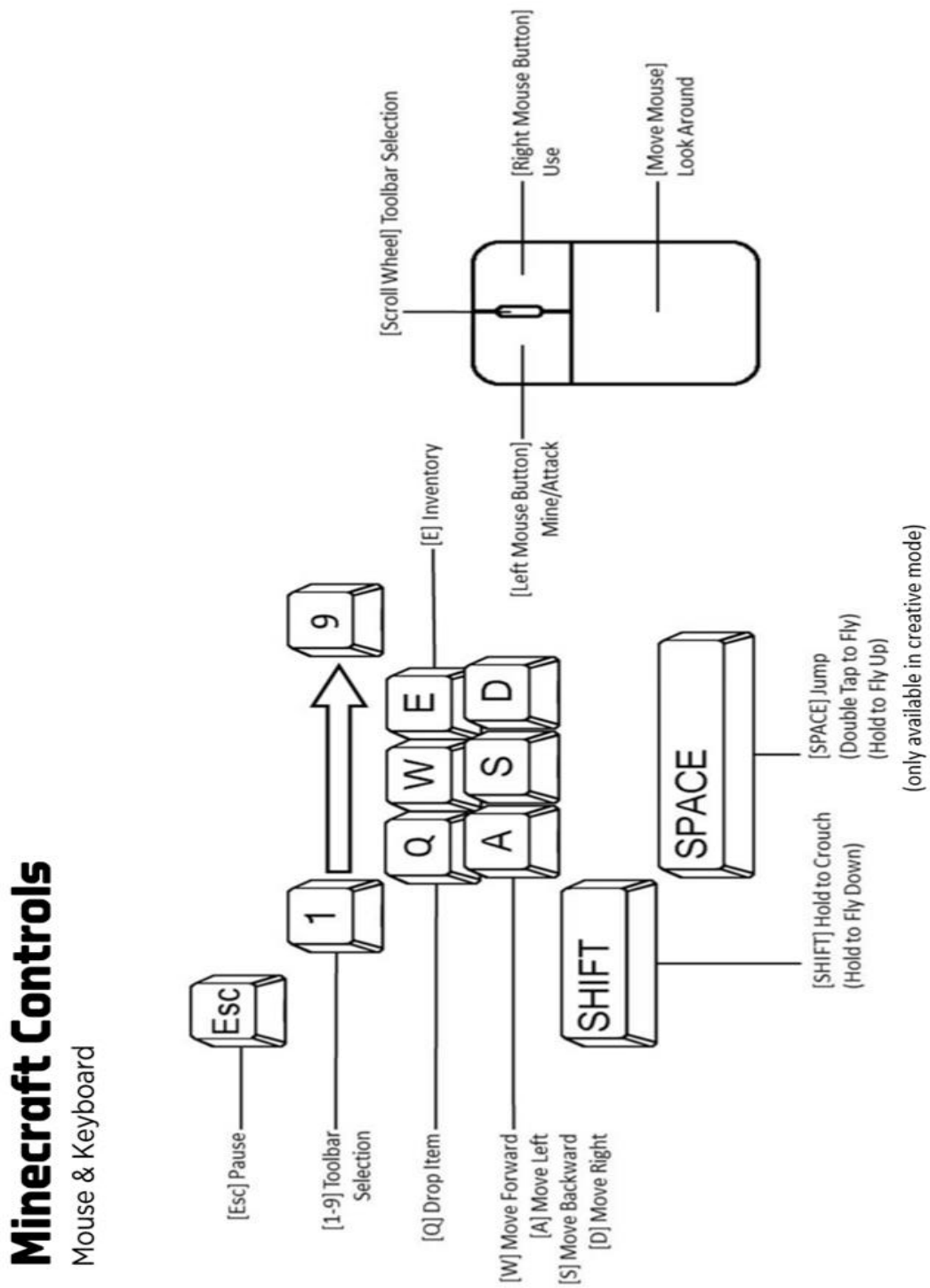
AND logic gates take 2 inputs. BOTH inputs must be ON to output ON, if either of the inputs are OFF then the output will be OFF. Fill out the truth table for the AND logic gate:

AND Gate	Minecraft	Truth Table		
		**A**	**B**	**Out**
		On	On	
		On	Off	
		Off	On	
		Off	Off	

OR logic gates take 2 inputs. If either input is ON the output will be ON, and only if BOTH inputs are OFF then the output will be OFF. Fill out the truth table for the OR logic gate:

OR Gate	Minecraft	Truth Table		
		**A**	**B**	**Out**
		On	On	
		On	Off	
		Off	On	
		Off	Off	

Logic Gates


Minecraft Controls
Mouse & Keyboard
Esc
1
9
Q
W
E
A
S
D
SHIFT
SPACE
[Esc] Pause
[1-9] Toolbar Selection
[Q] Drop Item
[W] Move Forward
[A] Move Left
[S] Move Backward
[D] Move Right
[E] Inventory
[SHIFT] Hold to Crouch (Hold to Fly Down)
[SPACE] Jump (Double Tap to Fly) (Hold to Fly Up) (only available in creative mode)
[Left Mouse Button] Mine/Attack
[Scroll Wheel] Toolbar Selection
[Right Mouse Button] Use
[Move Mouse] Look Around

Logic Gates

Primary Inventory slots: To use these items, scroll the wheel on the mouse or use the numbers on the keyboard to select the item you want to use. Then press the right mouse button.

Secondary Inventory slots: If you don't need something right away you can move it to your secondary inventory. Press the "e" key to bring up the secondary inventory screen then you can drag and drop items. For most blocks you can have up to 64 of a block in a given inventory slot.

HINT: You can get rid of unneeded blocks by placing them in a chest.