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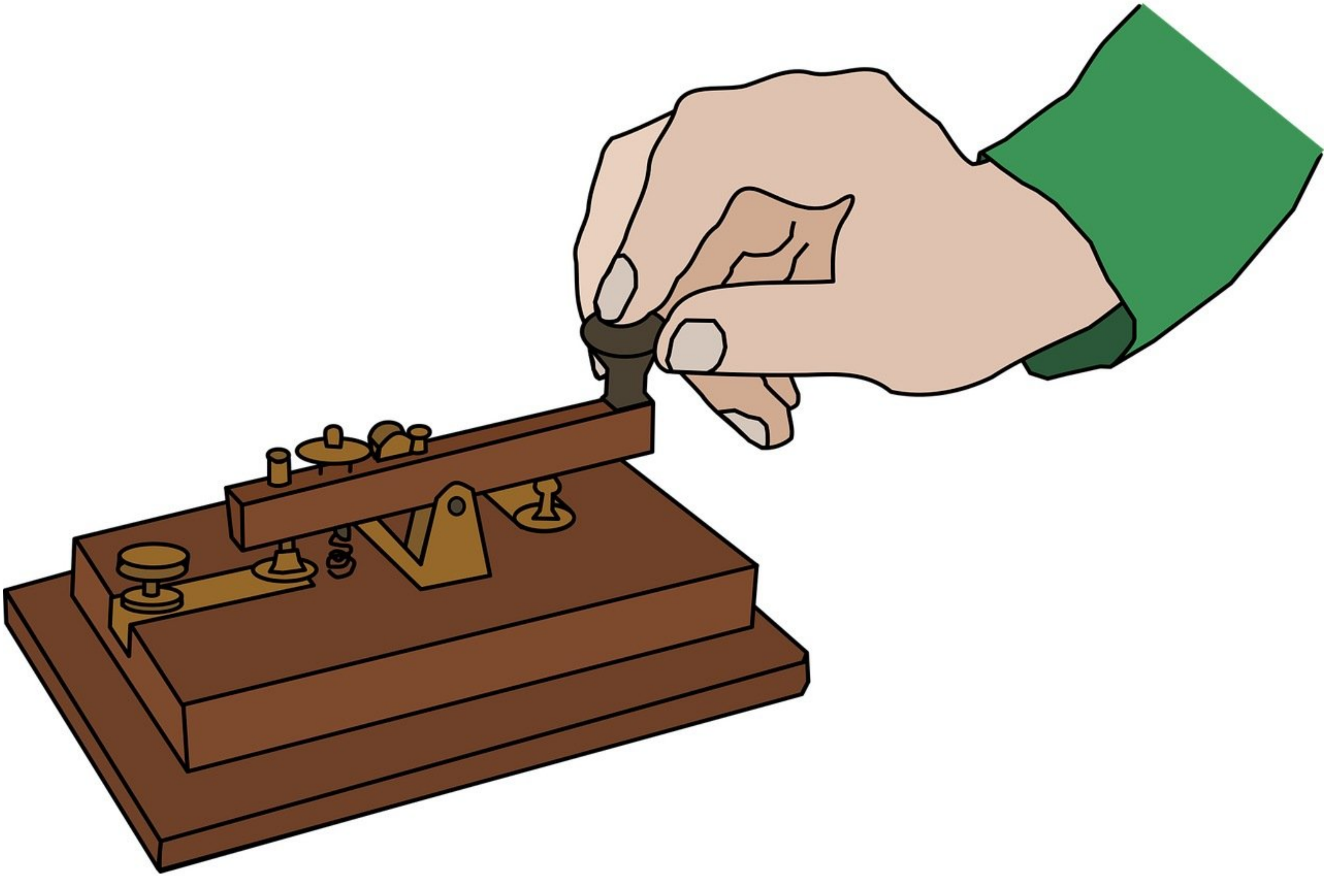
C - Morse Code Machine

Using a switch input and an IF block, make your own Morse Code machine to transmit any letter you like.



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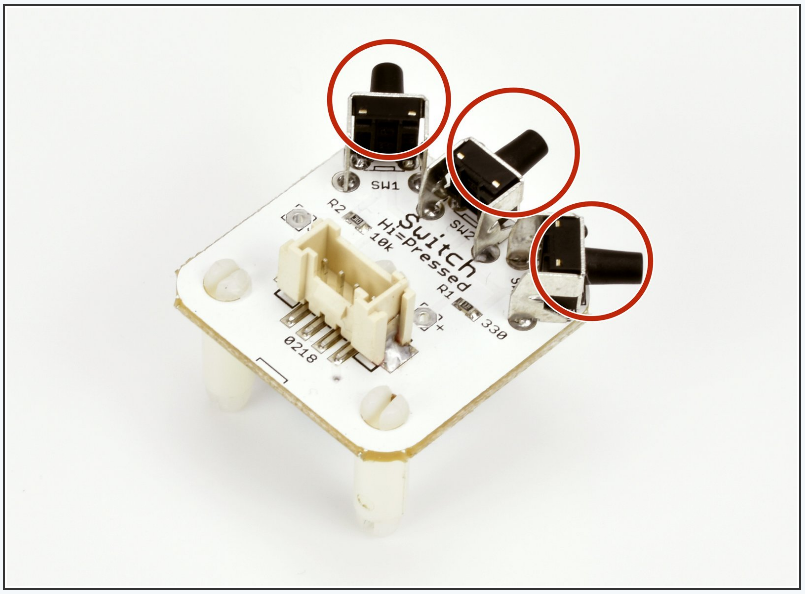
INTRODUCTION

Using a switch input and an IF block, make your own Morse Code machine to transmit any letter you like.

Step 1

Switches and Inputs

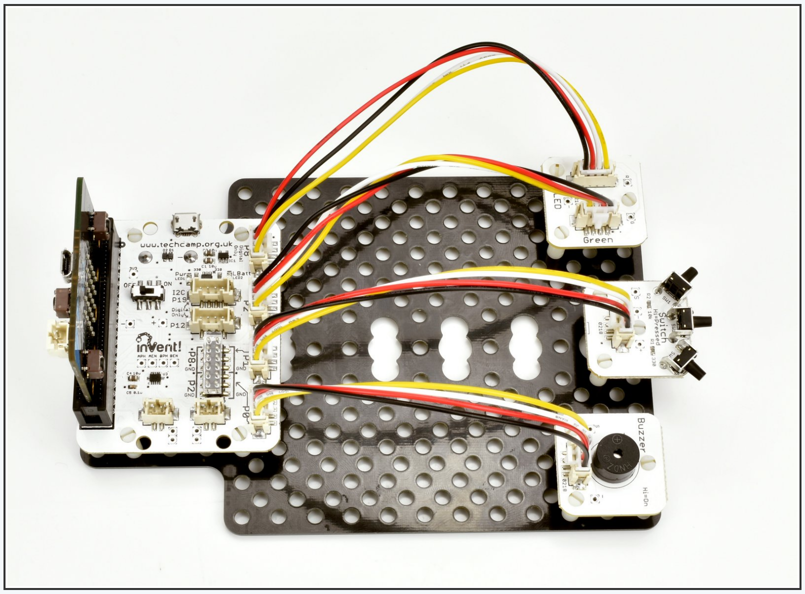
- So far, we have only used **outputs** - things that the micro:bit can change to **0** or **1**.
- **Inputs** work in a similar, but opposite way - they can send a 1 or 0 signal **back to the micro:bit!**
- Our program then needs to **decide** what to do, depending on whether the signal is 0 or 1.
- The **switch module** is a great example of an input - when one of the switches is pressed, the pin it is connected to will change to **1**.



Step 2

Setup the Switch

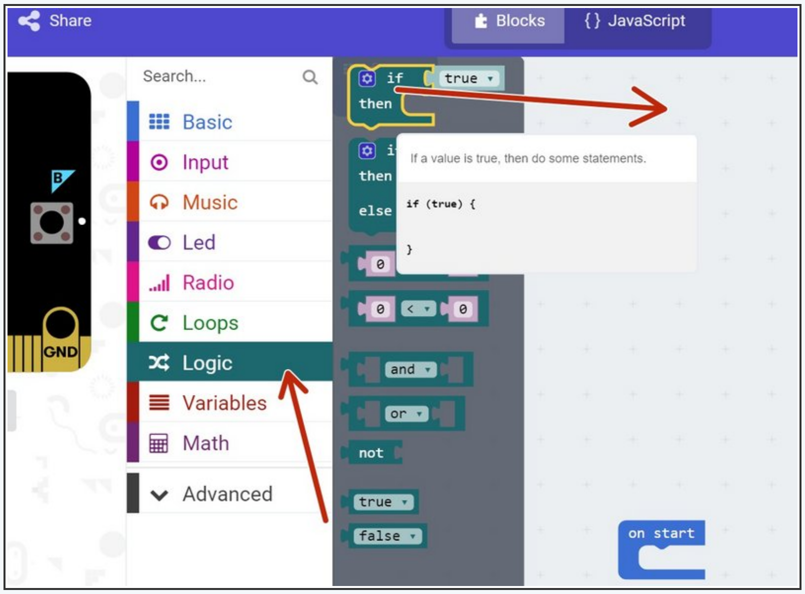
- Assemble your robot like the picture. The connections should be:
  - Buzzer - **P0**
  - Switch - **P1**
  - Green LED - **P2**
  - Red LED - **P8**



Step 3

Using Inputs

- Using inputs is slightly more complicated - the micro:bit needs to **make a decision** on what to do, based on the input.
- We can make decisions easily using a **IF block.**
- Drag in an **If block** to a new program - you will find it in the **Logic menu**.



If a value is true, then do some statements.

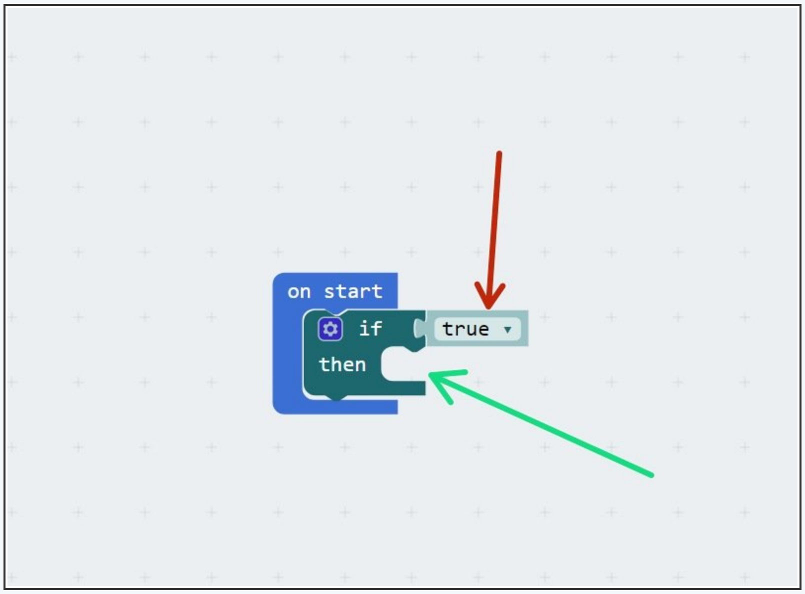
```
if (true) {

}
```

Step 4

If Blocks

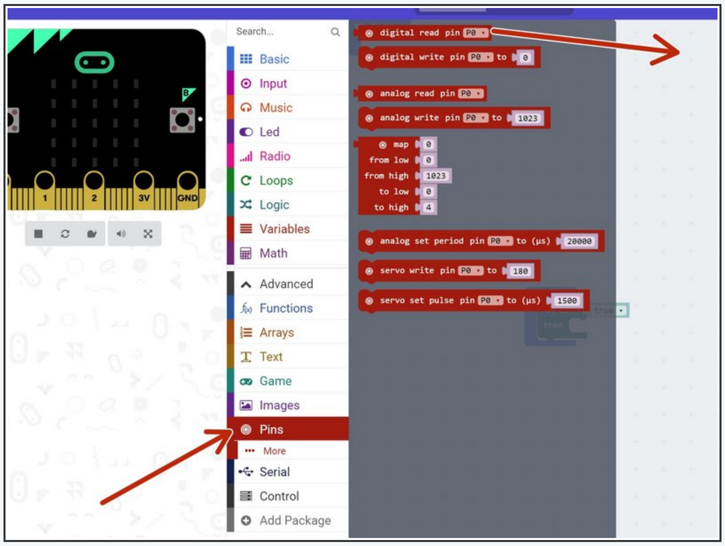
- If blocks have **two** parts:
  - **Condition** - this is the block you put at the start of the IF block. The condition can be either **true** or **false**
  - **Conclusion** - this is just some blocks of code that are **only run if the condition is true** - if the condition is false, they are **skipped!**
- You're a bit like a computer that can use your own 'IF' blocks every day! For example, **IF** the bell rings, **THEN** the lesson is over.

ⓘ Can you think of any more examples of IF blocks you use in real life?



Step 5

Turning on an LED


Search...
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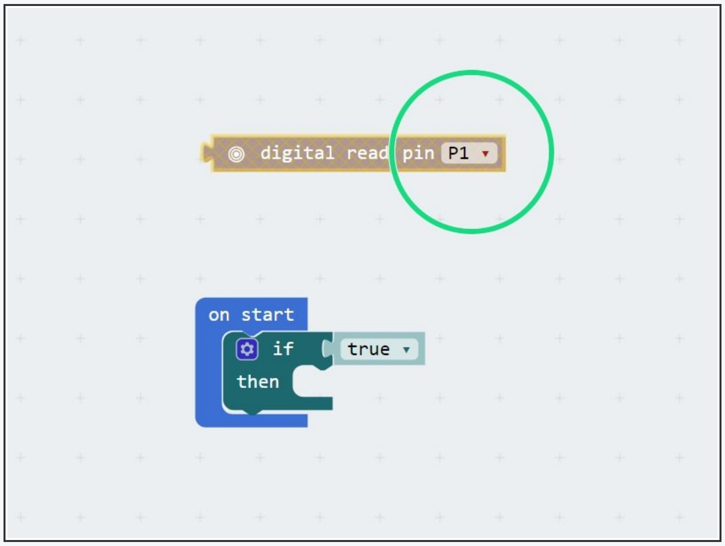
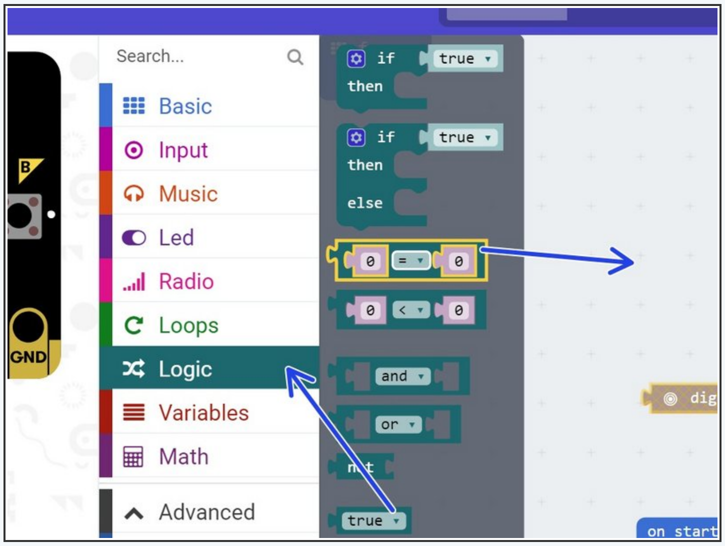
Functions
Arrays
Text
Game
Images
Pins
More
Serial
Control
Add Package
digital read pin P0
digital write pin P0 to 0
analog read pin P0
analog write pin P0 to 1023
map 0 from low 0 from high 1023 to low 0 to high 4
analog set period pin P0 to (µs) 20000
servo write pin P0 to 180
servo set pulse pin P0 to (µs) 1500





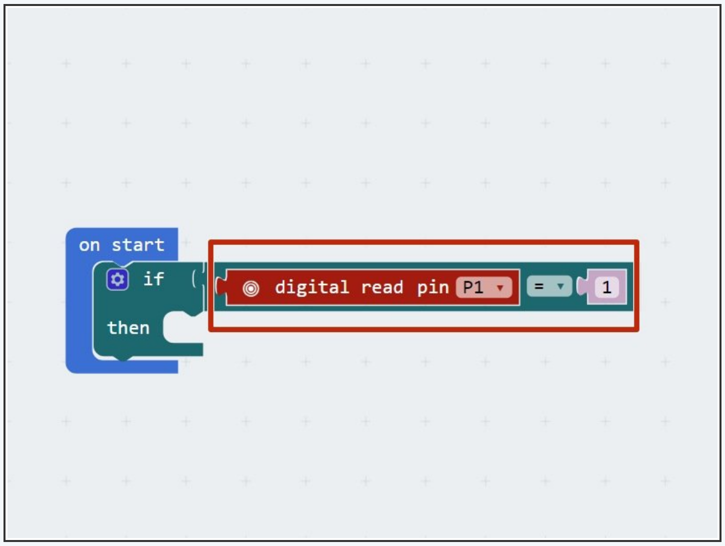
- To use the switch input in the If block, we use a **digital read block**, that will tell us if a pin is **0 or 1**. Drag one into the program from the **pins** menu.

- Change it so that it checks **P1**, which is attached to the switch.

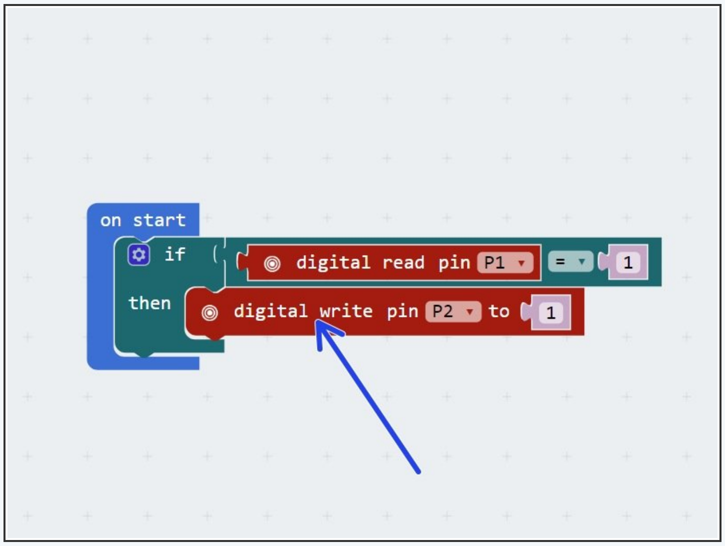
- We need to check if the **digital read** of P1 is **equal to 1**. From the logic menu, drag an **=** block into the program.

Step 6

Turning on an LED



```
on start
  if ( digital read pin P1 = 1 )
  then
```



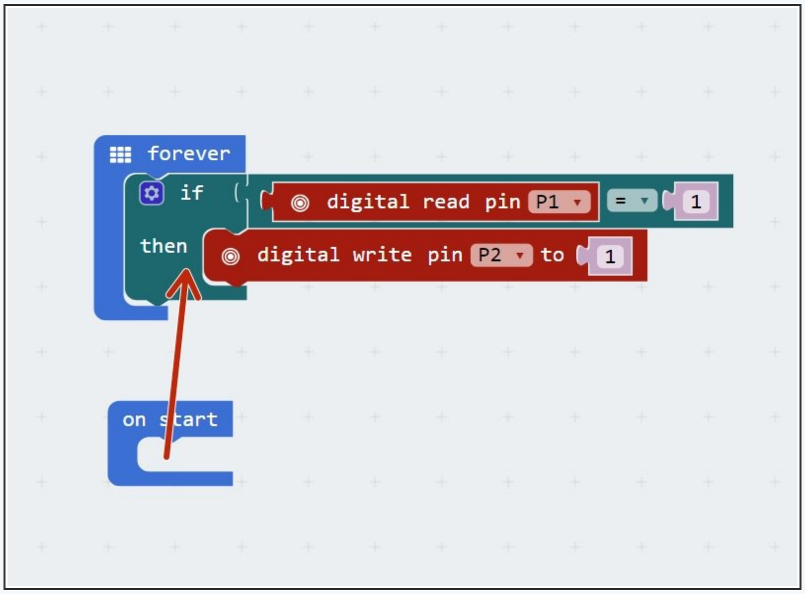
```
on start
  if ( digital read pin P1 = 1 )
  then
    digital write pin P2 to 1
```

- Put the equals block into the **condition** of the if block, and drag in the **digital read** block as well, so the condition checks **if digital read P1 = 1**
- Our if block now checks **if the switch is pressed!**
- N.B. You always need to drag in a comparison block (like the 'equals' one we've used here) as well as then dragging in another block (like the 'digital read') into this comparison block
- Add a **digital write** block to the **conclusion** of the if block, to **turn on an LED** if the switch is pressed.
- Download your program, and send it to the micro:bit.
- **Hold down the switch** whilst you power on the micro:bit. Your LED should light up! What happens if you don't hold down the switch? **Will it light up if you press the switch after turning on the power?**

Step 7

Checking Forever

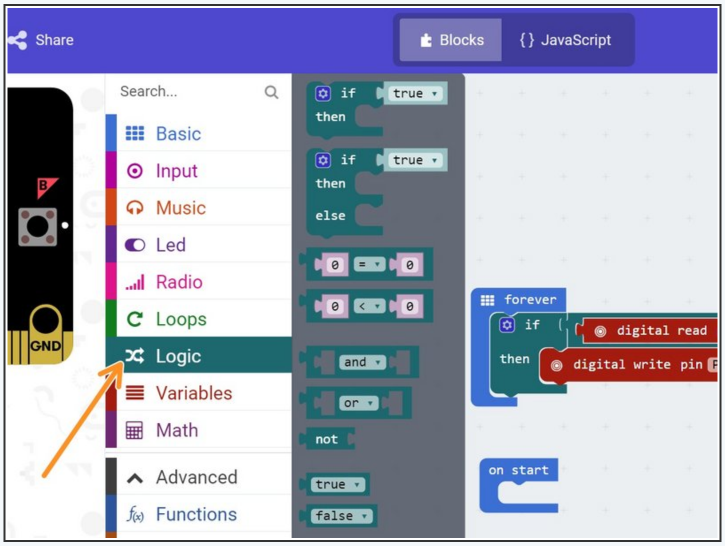
- You would expect the previous program to turn on the LED **when you press the switch.**
- You should have found that it only works if you **hold the switch down** when you upload the code, or hold it down and turn the robot off and on again.
- What's wrong? Let's think through the program:
    - **Start** program
    - If digital read P1 = 1, digital write P2 1
    - **End** program
- Our robot only checks the switch **once, then stops!** We need to make sure it keeps checking, forever.
- Move the if block **into the forever block** instead of **on start**, and check everything now works properly.

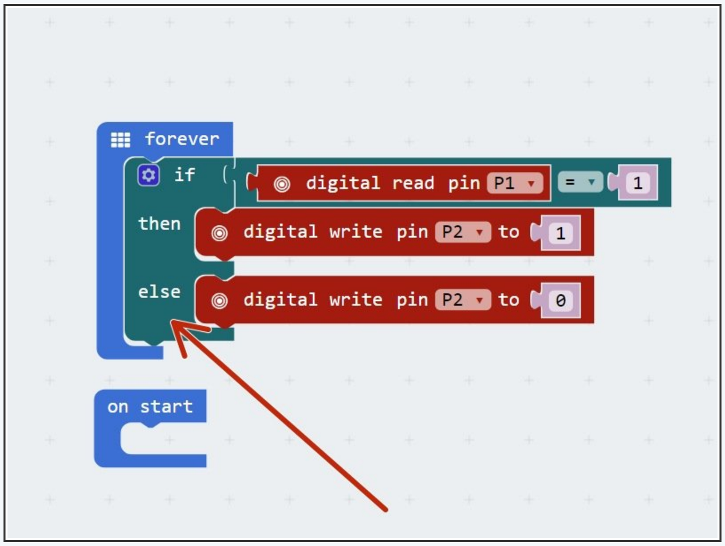


```
forever
  if digital read pin P1 = 1
  then
    digital write pin P2 to 1
on start
```

Step 8

More conditionals





```
forever
  if  digital read pin P1 = 1
  then  digital write pin P2 to 1
  else  digital write pin P2 to 0
on start
```

- IF blocks are part of a family of blocks called **conditionals** - you can find them all in the **logic menu**. Have a look through and see if you can guess what some of them do!
- We're going to have a look at one more conditional, the **IF/ELSE** block.
- **IF/ELSE** blocks start the same way as an IF block, but have another bit on the end - the **ELSE** part!
- If the **condition** is true, the IF conclusion is run and the **ELSE conclusion is ignored.**
- If the **condition** is false, the IF conclusion is ignored and the **ELSE conclusion is run!**
- Have a go at building the example in the picture - **before** you program the robot, can you **guess what it will do?** Don't forget to put it in the **forever loop!**

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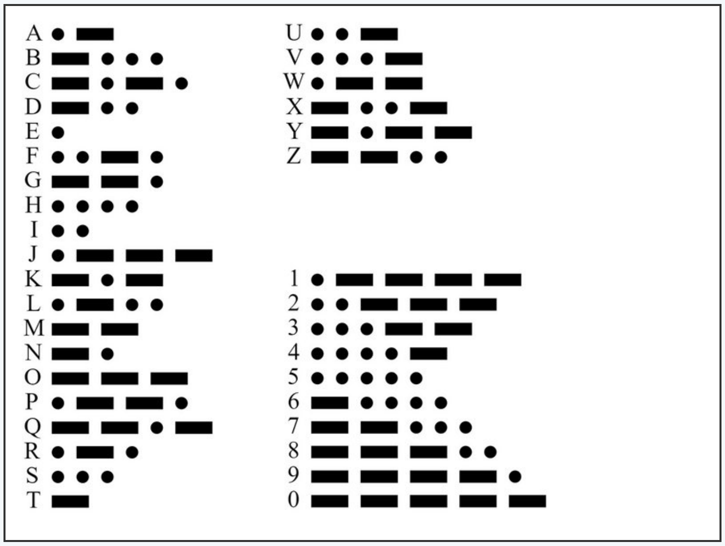
Step 9

Your Own Morse Code Machine

- You may have noticed we have actually made our own **Morse Code machine** already!
- By holding down the switch for a long time you can send a **dash**, and a short press would send a **dot.**
- For this challenge, add some more blocks so that:
  - When the switch **is** pressed, the green LED **and** buzzer are on
  - When the switch **isn't** pressed, only the **red LED** is on.

Step 10

Decode Morse Code from a friend



A	● ▬	U	● ● ▬
B	▬ ● ● ●	V	● ● ● ▬
C	▬ ● ▬ ●	W	● ▬ ▬
D	▬ ● ●	X	▬ ● ● ▬
E	●	Y	▬ ● ▬ ▬
F	● ● ▬ ●	Z	▬ ▬ ● ●
G	▬ ▬ ●		
H	● ● ● ●		
I	● ●		
J	● ▬ ▬ ▬		
K	▬ ● ▬	1	● ▬ ▬ ▬ ▬
L	● ▬ ● ●	2	● ● ▬ ▬ ▬
M	▬ ▬	3	● ● ● ▬ ▬
N	▬ ●	4	● ● ● ● ▬
O	▬ ▬ ▬	5	● ● ● ● ●
P	● ▬ ▬ ●	6	▬ ● ● ● ●
Q	▬ ▬ ● ▬	7	▬ ▬ ● ● ●
R	● ▬ ●	8	▬ ▬ ▬ ● ●
S	● ● ●	9	▬ ▬ ▬ ▬ ●
T	▬	0	▬ ▬ ▬ ▬ ▬

- Time for a harder challenge!
- Using the Morse Code card in the second picture, can you send a **secret message** to your neighbour?

ⓘ You can click on the picture for a **larger version.**

- Get them to decode it and see what they come up with - **no speaking allowed!**

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Step 11

Your Name in Morse Code

- A super hard challenge now - can you write a program that sends Morse Code for your initials (or even your whole name) **automatically, but only when you press the button?**
- If you're feeling really clever, try and **use some loops** to reduce the length of your program if you need to send lots of dots or dashes **in a row.**