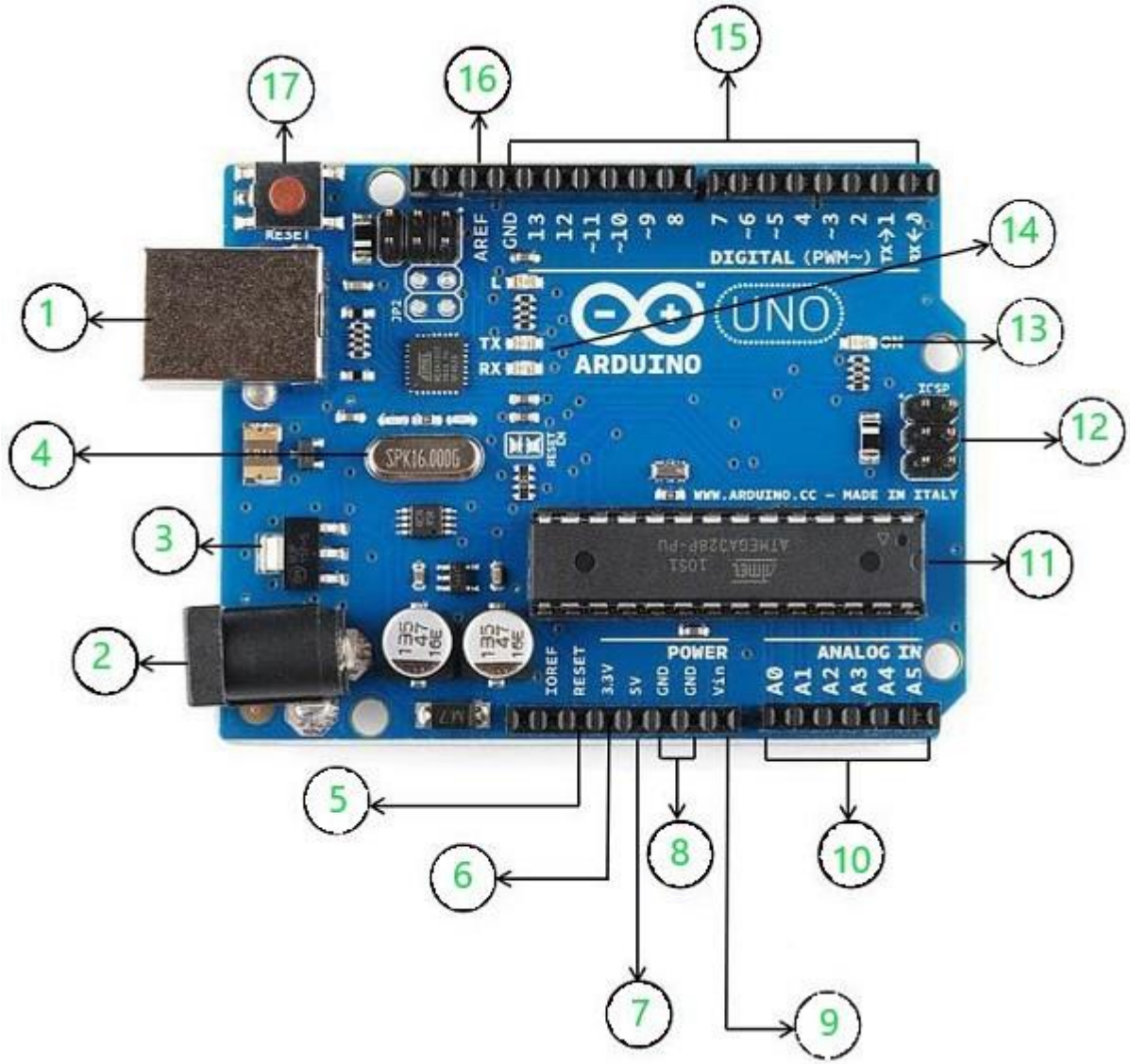
Experiment no:2

AIM: Familiarization with Arduino and Raspberry Pi boards.

. Arduino is an open source hardware and software company. Project,and user community that designs and manufactures single board micro controllers and micro controller kits for building digital devices.
. Arduino board designs a variety of micro-processors and controllers .The board are equipped with set of digital and analog input/output pins that may be interfaced to various expansion boards .



1.

USB: can be used for both power and communication with the IDE

2.Barrel Jack: used for power supply

3.Voltage Regulator: regulates and stabilizes the input and output voltages

4.Crystal Oscillator: keeps track of time and regulates processor frequency

5.Reset Pin: can be used to reset the Arduino Uno

6. 3.3V pin: can be used as a 3.3V output

7.5V pin: can be used as a 5V output

8. **GND pin:** can be used to ground the circuit.

9. Vin pin: can be used to supply power to the board

10. Analog pins(A0-A5): can be used to read analog signals to the board

11. Microcontroller(ATMega328): the processing and logical unit of the board

12. ICSP pin: a programming header on the board also called SPI

13. Power indicator LED: indicates the power status of the board

14. RX and TX LEDs: receive(RX) and transmit(TX) LEDs, blink when sending or

receiving serial data respectively

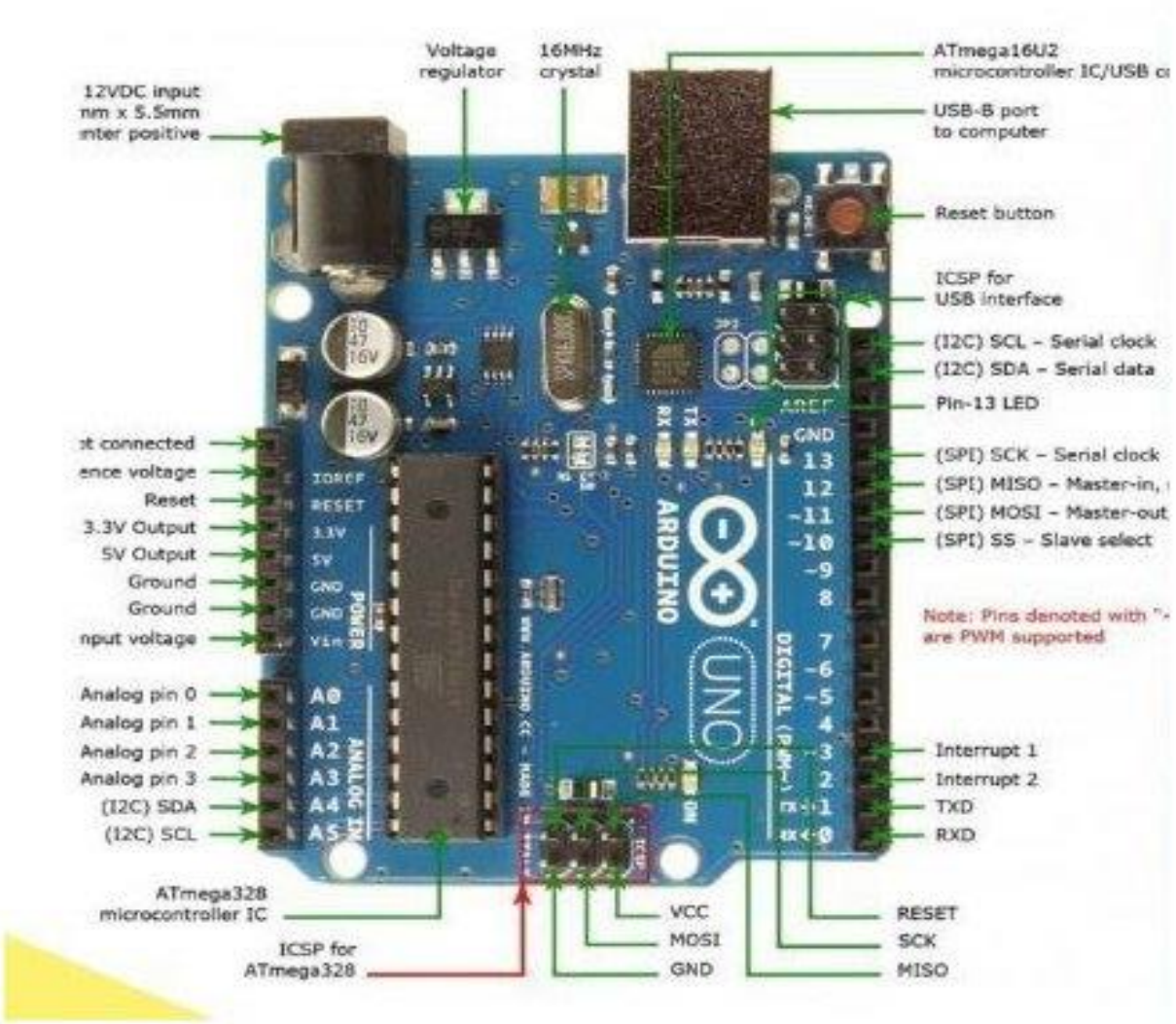
15. Digital I/O pins: 14 pins capable of reading and outputting digital signals 6 of these pins are

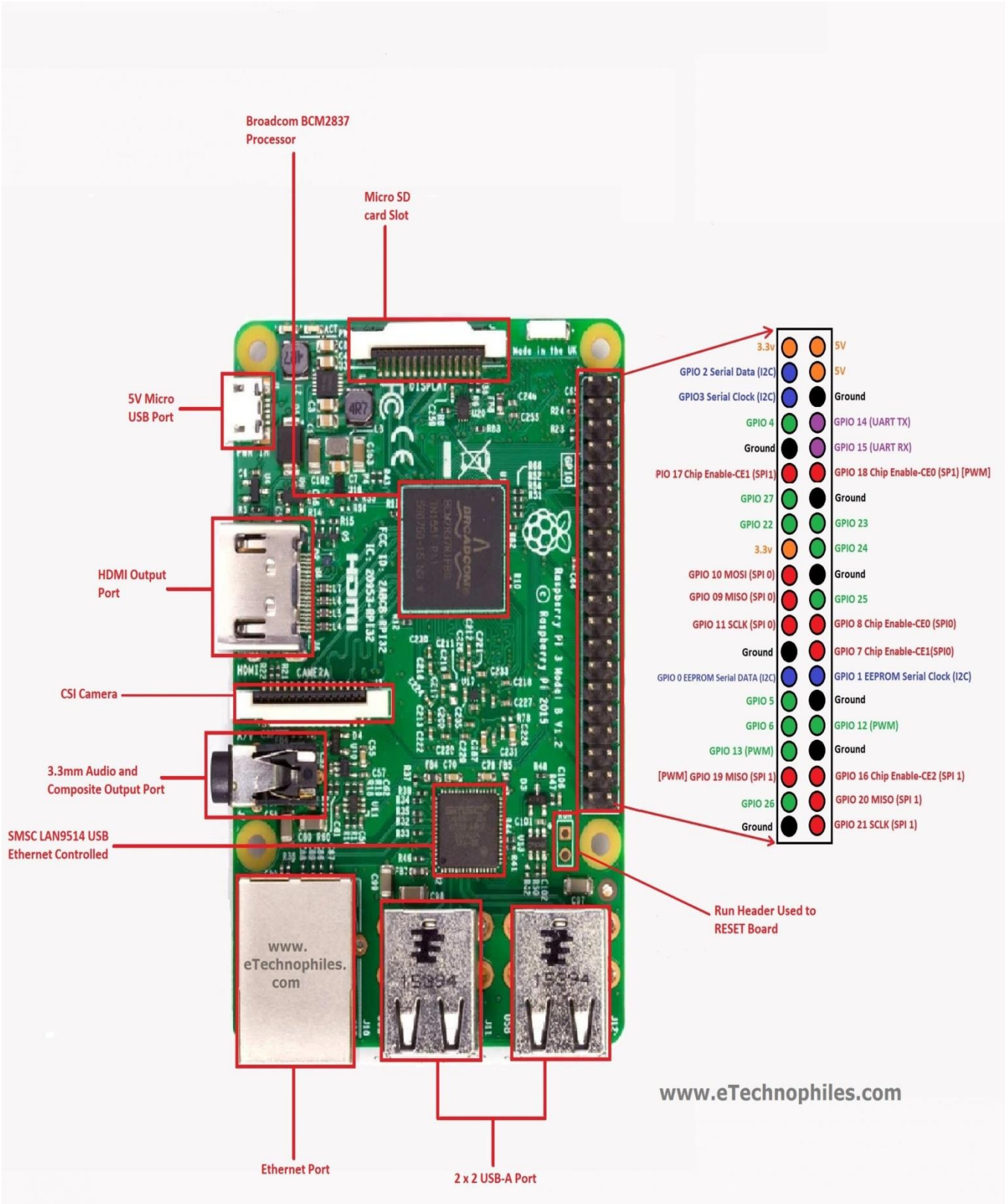
also capable of PWM

16. AREF pins: can be used to set an external reference voltage as the upper limit for the

analog pins

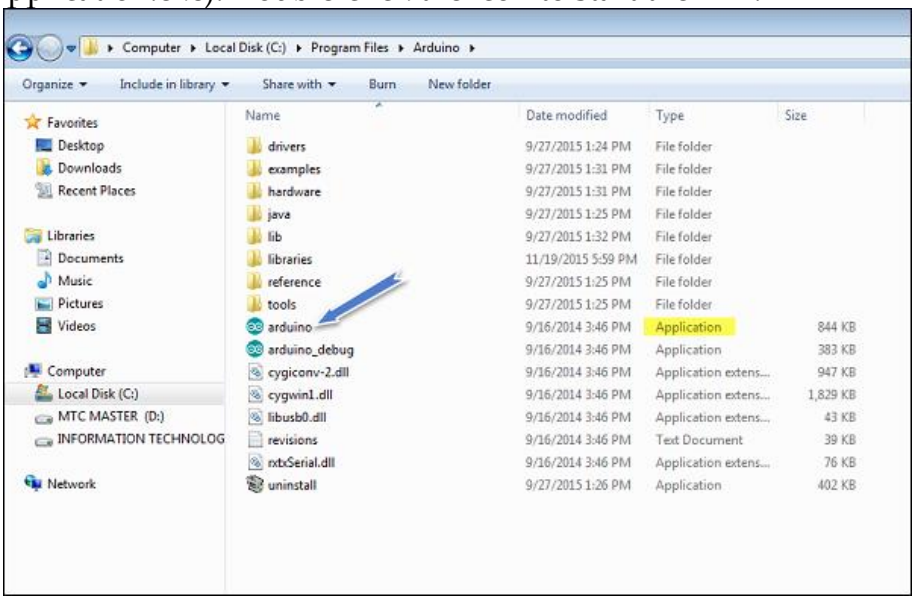
17. Reset button: can be used to reset the board


Voltage regulator
16MHz crystal
ATmega16U2 microcontroller IC/USB c
12VDC input
nm x 5.5mm
nter positive
USB-B port to computer
Reset button
ICSP for USB interface
(I2C) SCL – Serial clock
(I2C) SDA – Serial data
Pin-13 LED
(SPI) SCK – Serial clock
(SPI) MISO – Master-in,
(SPI) MOSI – Master-out
(SPI) SS – Slave select
Note: Pins denoted with "~
are PWM supported
Interrupt 1
Interrupt 2
TXD
RXD
RESET
SCK
MISO
VCC
MOSI
GND
ATmega328 microcontroller IC
ICSP for ATmega328
Analog pin 0
Analog pin 1
Analog pin 2
Analog pin 3
(I2C) SDA
(I2C) SCL
Ground
Ground
3.3V Output
5V Output
Reset
ARDUINO
DIGITAL (PWM~)
POWER
ANALOG IN



Launch Arduino IDE.

After your Arduino IDE software is downloaded, you need to unzip the folder. Inside the folder, you can find the application icon with an infinity label (application.exe). Double-click the icon to start the IDE.



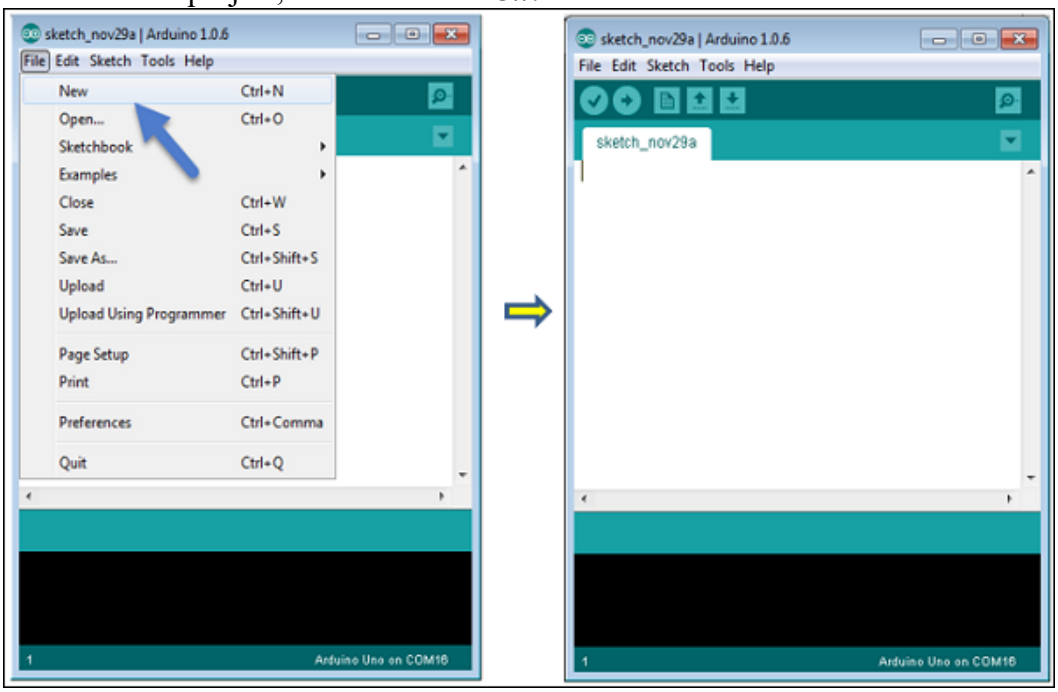
Step 5 − Open your first project.

Once the software starts, you have two options −

Create a new project.

Open an existing project example.

To create a new project, select File → **New**.



To open an existing project example,

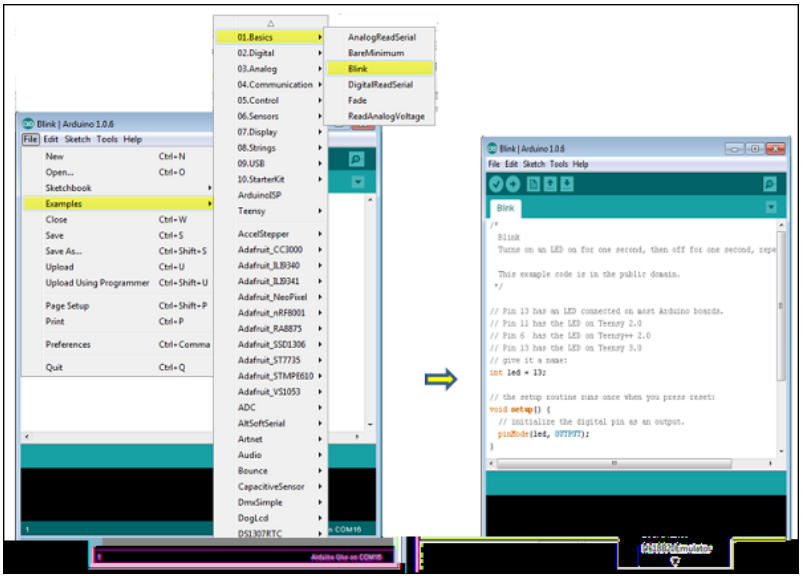
select File

→ Example

→ Basics

→ Blink.

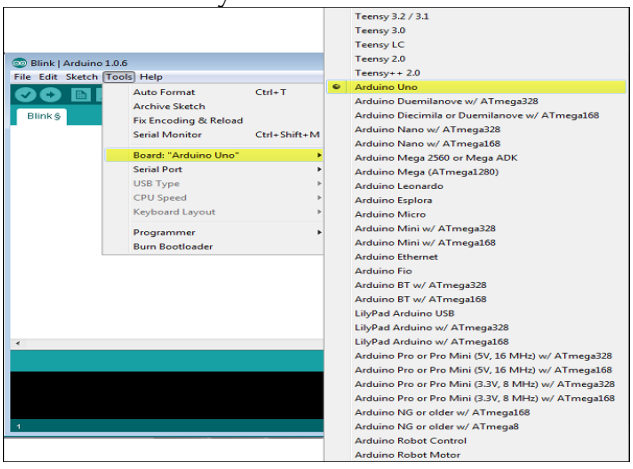
Here, we are selecting just one of the examples with the name **Blink**. It turns the LED on and off with some time delay. You can select any other example from the list.



Step 6 − Select your Arduino board.

To avoid any error while uploading your program to the board, you must select the correct Arduino board name, which matches with the board connected to your computer.

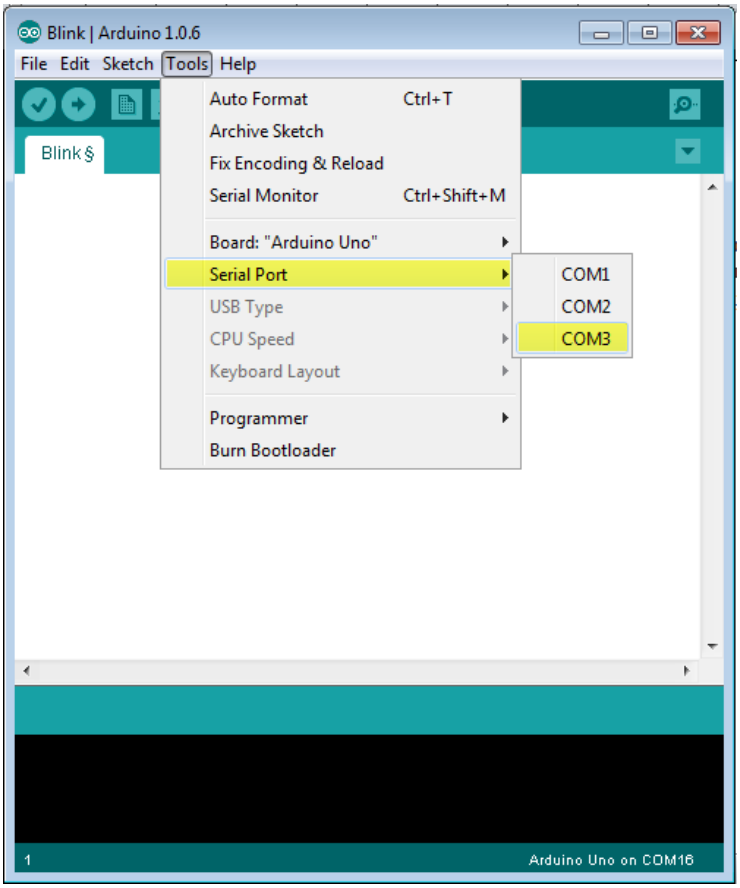
Go to Tools → Board and select your board.



Here, we have selected Arduino Uno board according to our tutorial, but you must select the name matching the board that you are using.

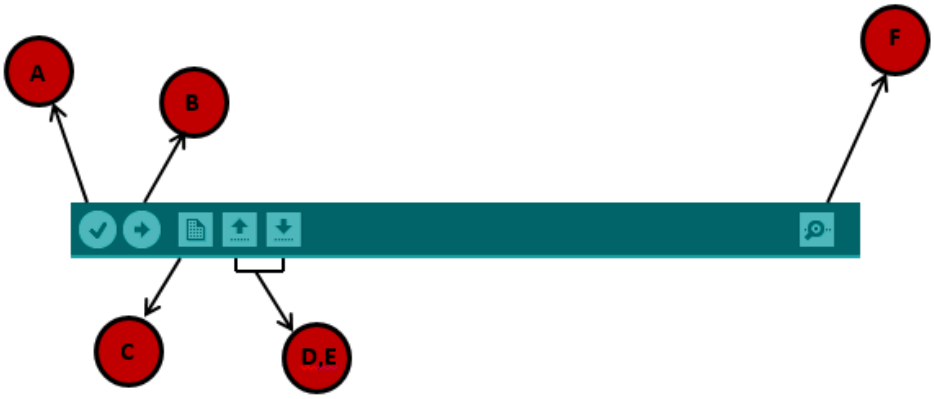
Step 7 − Select your serial port.

Select the serial device of the Arduino board. Go to **Tools → Serial Port** menu. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, you can disconnect your Arduino board and re-open the menu, the entry that disappears should be of the Arduino board. Reconnect the board and select that serial port.



Step 8 − Upload the program to your board.

Before explaining how we can upload our program to the board, we must demonstrate the function of each symbol appearing in the Arduino IDE toolbar.



A − Used to check if there is any compilation error.
B − Used to upload a program to the Arduino board.
C − Shortcut used to create a new sketch.
D − Used to directly open one of the example sketch.
E − Used to save your sketch.
F − Serial monitor used to receive serial data from the board and send the serial data to the board.

Now, simply click the "Upload" button in the environment. Wait a few seconds; you will see the RX and TX LEDs on the board, flashing. If the

upload is successful, the message "Done uploading" will appear in the status bar.

Note − If you have an Arduino Mini, NG, or other board, you need to press the reset button physically on the board, immediately before clicking the upload button on the Arduino Software.

Arduino - Program Structure

In this chapter, we will study in depth, the Arduino program structure and we will learn more new terminologies used in the Arduino world. The Arduino software is open-source. The source code for the Java environment is released under the GPL and the C/C++ microcontroller libraries are under the LGPL.

Sketch − The first new terminology is the Arduino program called "**sketch**".

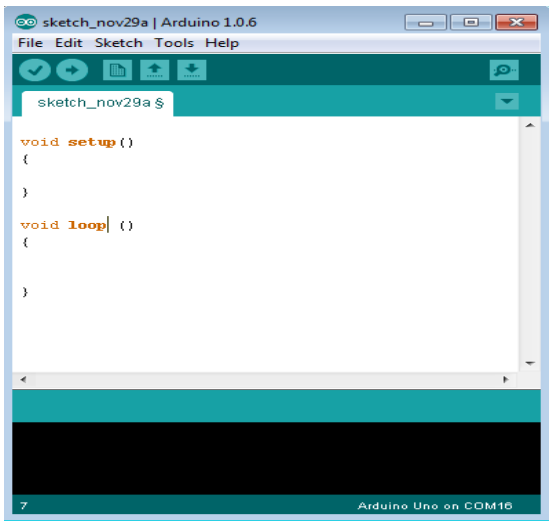
Structure

Arduino programs can be divided in three main parts: **Structure, Values** (variables and constants), and **Functions**. In this tutorial, we will learn about the Arduino software program, step by step, and how we can write the program without any syntax or compilation error.

Let us start with the **Structure**. Software structure consist of two main functions −

Setup( ) function

Loop( ) function



Void setup ( ) {

}

PURPOSE − The **setup()** function is called when a sketch starts. Use it to initialize the variables, pin modes, start using libraries, etc. The setup function will only run once, after each power up or reset of the Arduino board.

INPUT − -

OUTPUT − -

RETURN − -

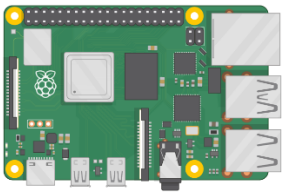
Void Loop ( ) {

}

PURPOSE − After creating a **setup()** function, which initializes and sets the initial values, the **loop()** function does precisely what its name suggests, and loops consecutively, allowing your program to change and respond. Use it to actively control the Arduino board.
INPUT − -
OUTPUT − -
RETURN − -

RASPBERRY PI

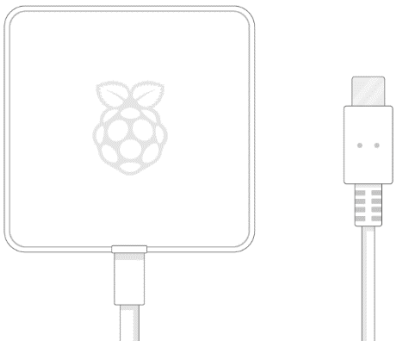
There are several models of Raspberry pi and for most people Raspberry Pi 3 Model B is the one to choose. Raspberry Pi 3 Model B is the newest, fastest, and easiest to use.
Raspberry Pi 3 comes with either 2GB or 4GB of RAM. For most educational purposes and hobbyist projects, and for use as a desktop computer, 2GB is enough.



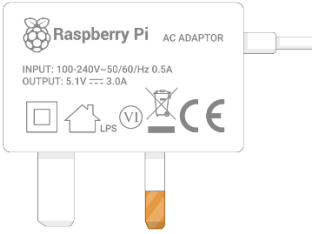
Raspberry Pi Zero and Zero W are smaller and require less power, so they're useful for portable projects such as robots. It's generally easier to start a project with Raspberry Pi 3 , and to move to Pi Zero when you have a working prototype that a smaller Pi would be useful for.

A power supply

To connect to a power socket, all Raspberry Pi models have a USB port (the same found on many mobile phones): either USB-C for Raspberry Pi 3 , or micro USB for Raspberry Pi 3, 2 and 1.

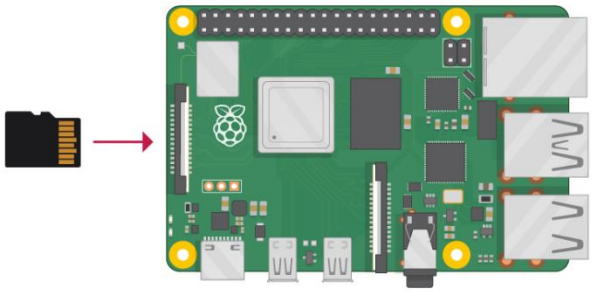


You need a power supply that provides:
At least 3.0 amps for Raspberry Pi 3



At least 2.5 amps for Raspberry Pi 3

- We recommend using our official Universal Power Supply.
- A microSD card
- Your Raspberry Pi needs an SD card to store all its files and the Raspbian operating system.



- You need a microSD card with a capacity of at least 8 GB.
- Many sellers supply SD cards for Raspberry Pi that are already set up with Raspbian and ready to go.

A keyboard and a mouse

To start using your Raspberry Pi, you need a USB keyboard and a USB mouse. Once you've set your Pi up, you can use a Bluetooth keyboard and mouse, but you'll need a USB keyboard and mouse for the first setup.

An Ethernet cable

The large Raspberry Pi models (but not Pi Zero/Zero W) have a standard Ethernet port to connect them to the internet; to connect Pi Zero to the internet, you need a USB-to-Ethernet adaptor.

Raspberry Pi 3 , 3, and Pi Zero W can also be wirelessly connected to the internet.

Set up your SD card

If you have an SD card that doesn't have the Raspbian operating system on it yet, or if you want to reset your Raspberry Pi, you can easily install Raspbian yourself. To do so, you need a computer that has an SD card port — most laptop and desktop computers have one.

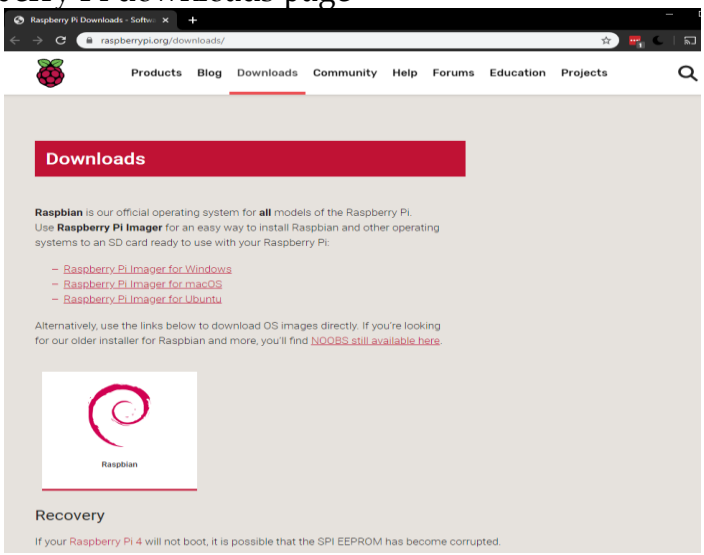
The Raspbian operating system via the Raspberry Pi Imager

Using the Raspberry Pi Imager is the easiest way to install Raspbian on your SD card.

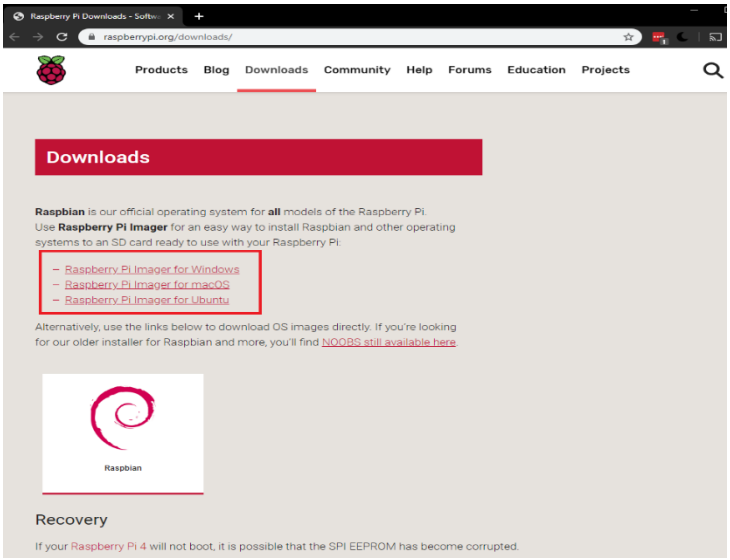
Note: More advanced users looking to install a particular operating system should use this guide to installing operating system images.

Download and launch the Raspberry Pi Imager

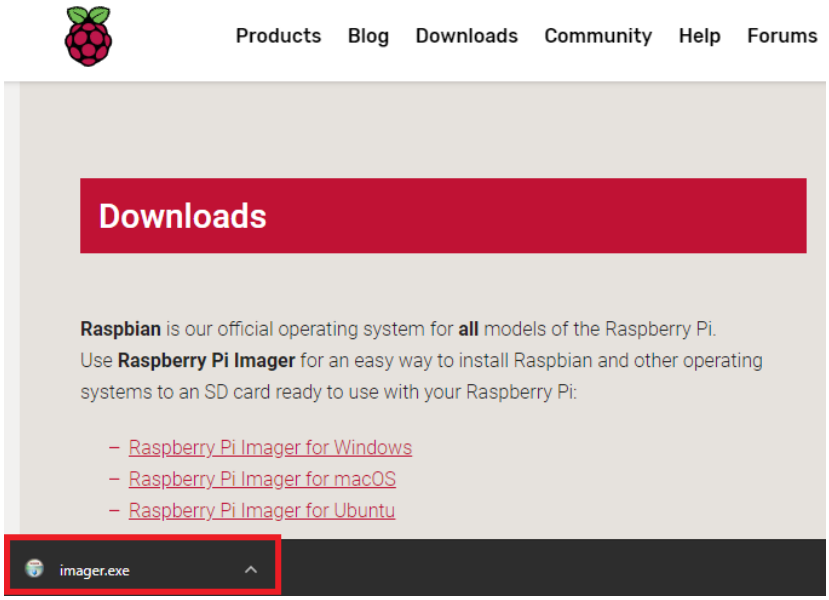
Visit the Raspberry Pi downloads page



Click on the link for the Raspberry Pi Imager that matches your operating system



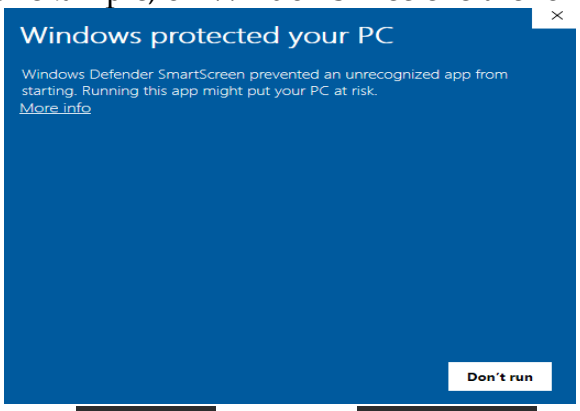
When the download finishes, click it to launch the installer



Using the Raspberry Pi Imager

Anything that's stored on the SD card will be overwritten during formatting. If your SD card currently has any files on it, e.g. from an older version of Raspbian, you may wish to back up these files first to prevent you from permanently losing them.

When you launch the installer, your operating system may try to block you from running it. For example, on Windows I recieve the following message:

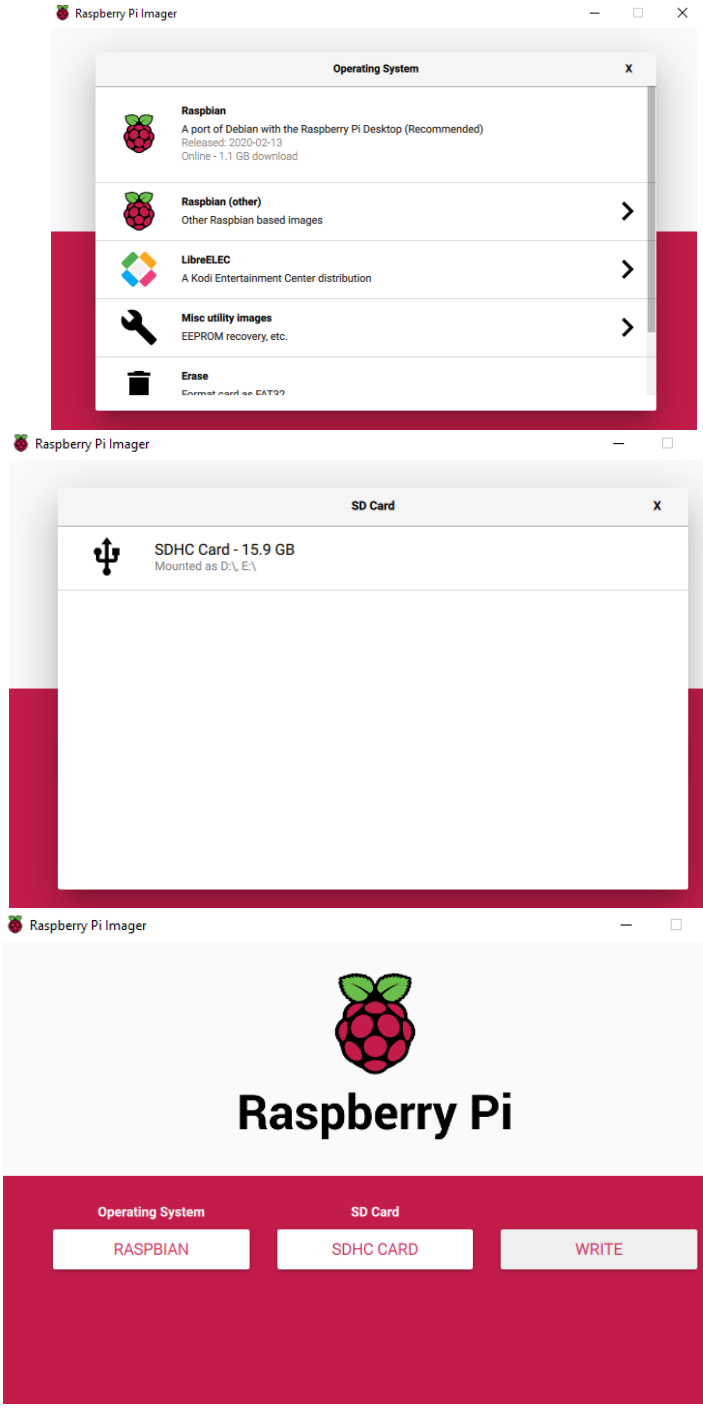


If this pops up, click on More info and then Run anyway

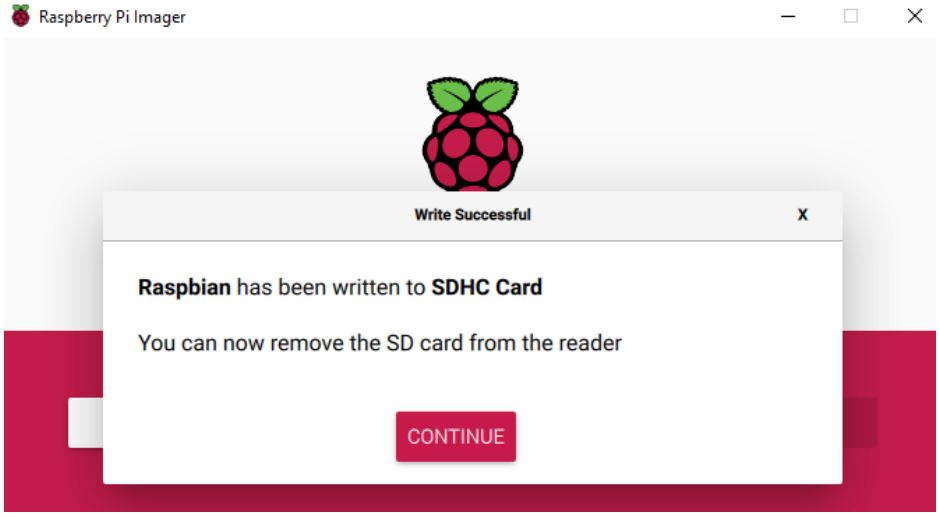
Follow the instructions to install and run the Raspberry Pi Imager

Insert your SD card into the computer or laptop SD card slot

In the Raspberry Pi Imager, select the OS that you want to install and the SD card you would like to install it on

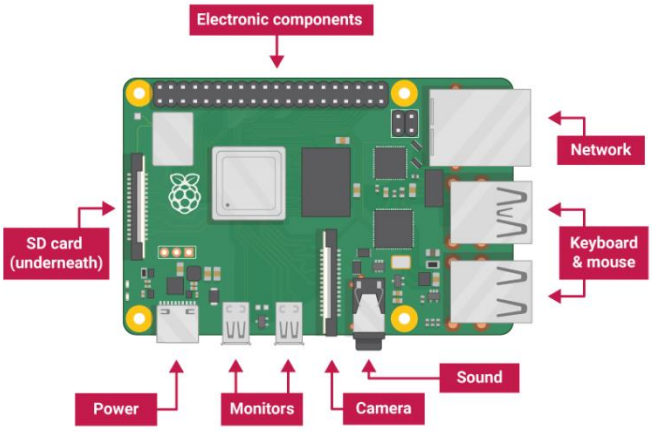


Then simply click the WRITE button
Wait for the Raspberry Pi Imager to finish writing
Once you get the following message, you can eject your SD card

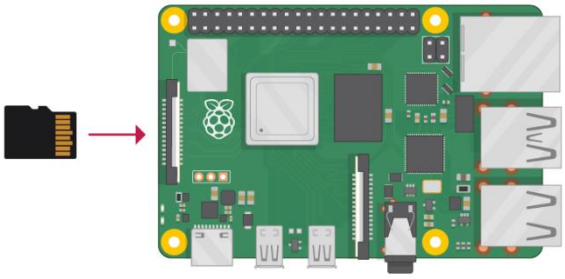


Connect your Raspberry Pi

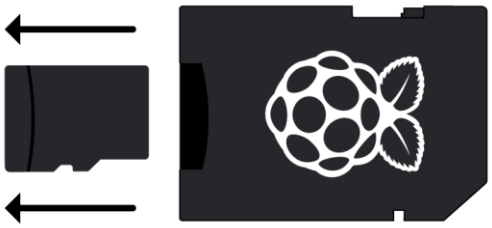
Now get everything connected to your Raspberry Pi. It's important to do this in the right order, so that all your components are safe.



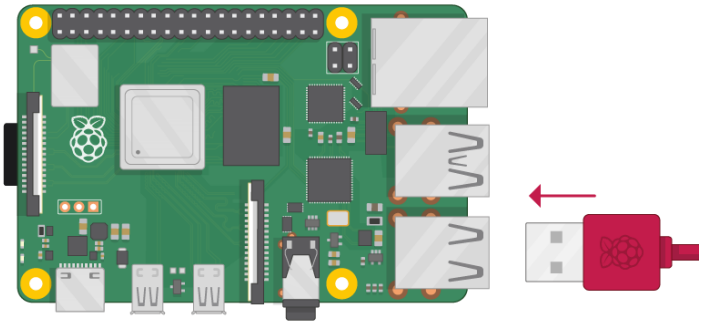
Insert the SD card you've set up with Raspbian (via NOOBS) into the microSD card slot on the underside of your Raspberry Pi.



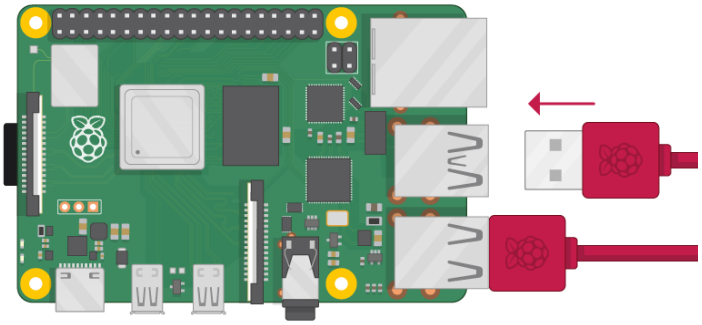
Note: Many microSD cards come inside a larger adapter — you can slide the smaller card out using the lip at the bottom.



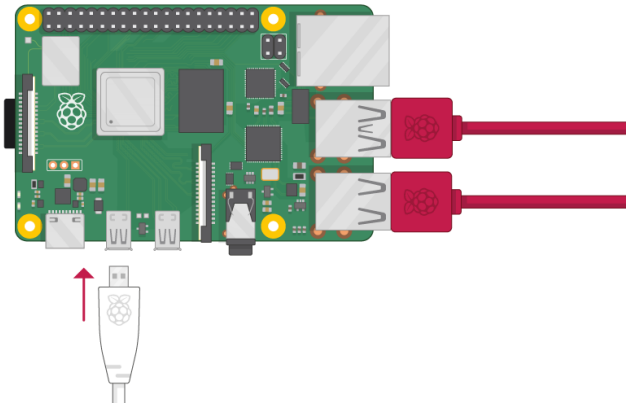
Find the USB connector end of your mouse's cable, and connect the mouse to a USB port on Raspberry Pi (it doesn't matter which port you use).



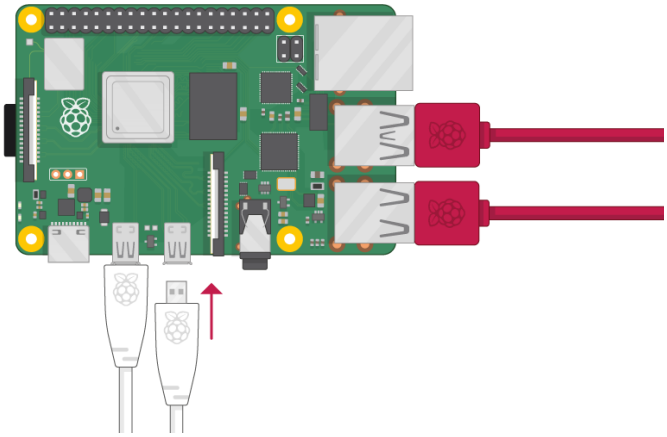
Connect the keyboard in the same way.



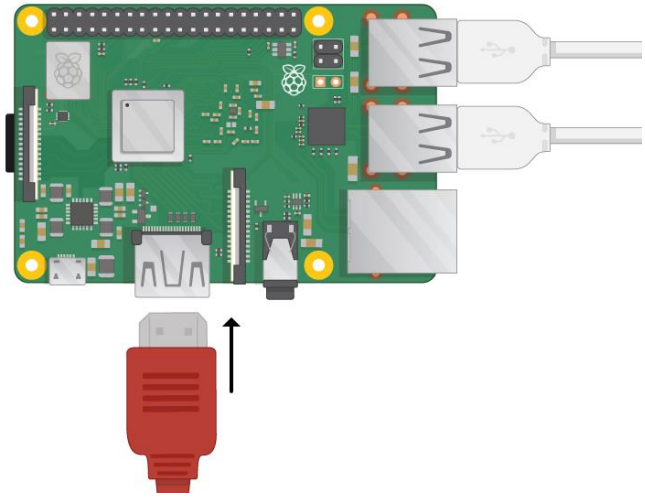
Make sure your screen is plugged into a wall socket and switched on.
Look at the HDMI port(s) on the Raspberry Pi — notice that they have a flat side on top.
Use a cable to connect the screen to Raspberry Pi's HDMI port — use an adapter if necessary.
Raspberry Pi 3
Connect your screen to the first of Raspberry Pi 3 's HDMI ports, labelled HDMI0.



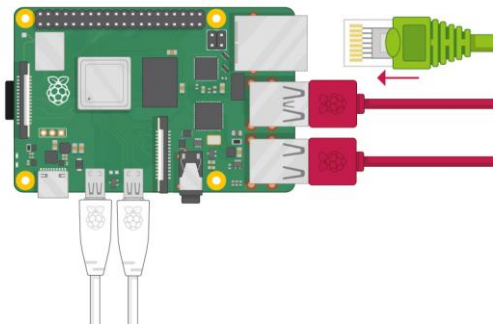
You can connect an optional second screen in the same way.



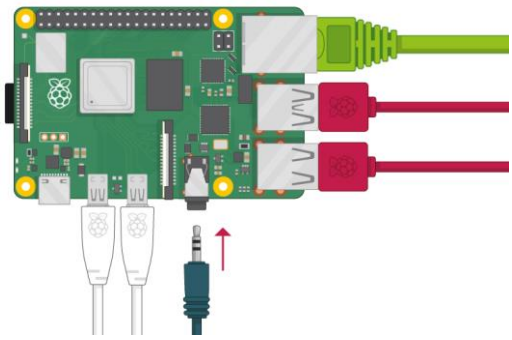
Raspberry Pi 1, 2, 3
Connect your screen to the single HDMI port.



Note: nothing will display on the screen, because your Raspberry Pi is not running yet.
If you want to connect your Raspberry Pi to the internet via Ethernet, use an Ethernet cable to connect the Ethernet port on Raspberry Pi to an Ethernet socket on the wall or on your internet router. You don't need to do this if you want to use wireless connectivity, or if you don't want to connect to the internet.



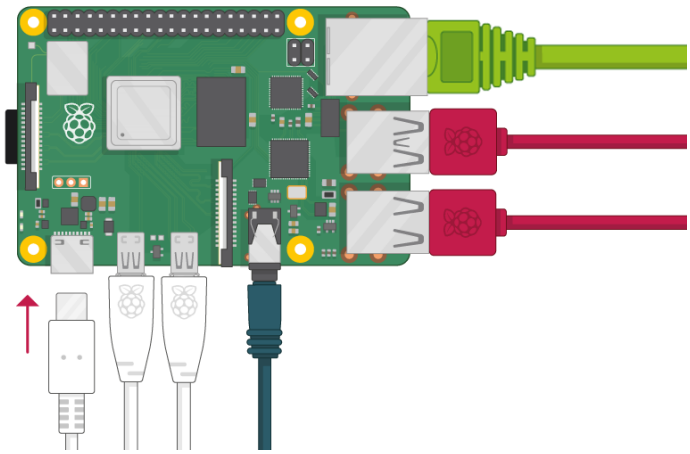
If the screen you are using has speakers, sound will play through those. Alternatively, connect headphones or speakers to the audio port if you prefer.



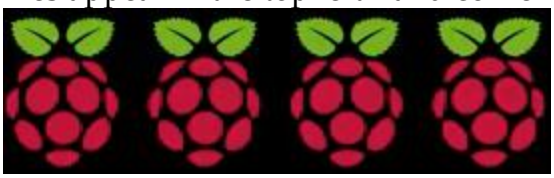
Start up your Raspberry Pi

Your Raspberry Pi doesn't have a power switch: as soon as you connect it to a power outlet, it will turn on.

Plug the USB power supply into a socket and connect it to your Raspberry Pi's power port.



You should see a red LED light up on the Raspberry Pi, which indicates that Raspberry Pi is connected to power. As it starts up (this is also called booting), you will see raspberries appear in the top left-hand corner of your screen.

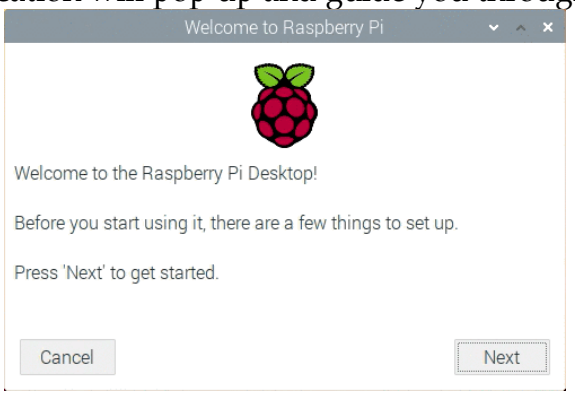


First-time startup with NOOBS

After a few seconds the Raspbian Desktop will appear.

Finish the setup

When you start your Raspberry Pi for the first time, the Welcome to Raspberry Pi application will pop up and guide you through the initial setup.

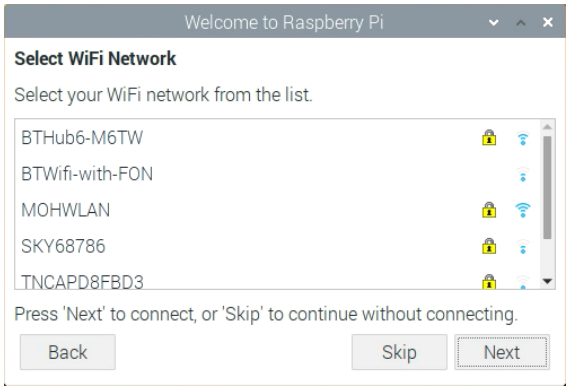


Click Next to start the setup.

Set your Country, Language, and Timezone, then click Next again.

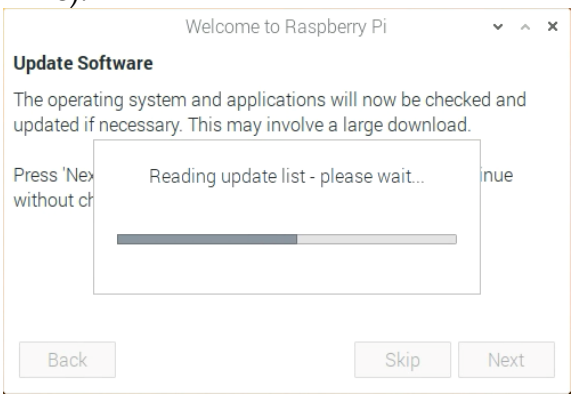
Enter a new password for your Raspberry Pi and click Next.

Connect to your WiFi network by selecting its name, entering the password, and clicking Next.



Note: if your Raspberry Pi model doesn't have wireless connectivity, you won't see this screen.

Click Next let the wizard check for updates to Raspbian and install them (this might take a little while).



Click Done or Reboot to finish the setup.

Note: you will only need to reboot if that's necessary to complete an update.