Raspberry Pi notes

Download the Raspbian Operating System
https://www.raspberrypi.com/software/

The download will be a binary file, called a boot image. The downloaded file will have either an .img extension or a .img.xz extension. The latter is a compressed file that you will have to uncompress using whatever archive tool you have, and get the .img file.

The .img file is the bootable operating system file. It needs to be copies to the "boot sector" of your medium (SD card, USB, whatever).

You need special software to copy it to a bootable SD card.

You can use one of the following to do the copying:
- Raspbian Disk Imager (https://www.youtube.com/watch?v=ntaXWS8Lk34)
- Balena Etcher https://www.balena.io/etcher/
- Or the **dd** command in linux if you know about it.

You can't just use the normal file copy command, which will not copy the boot image to the boot sector of the disk.

Main Raspberry Pi sites
https://www.raspberrypi.com/ (commercial)
https://www.raspberrypi.org (RPi Foundation)

Initial boot

When the Pi boots the first time, you will be thrown into a setup screen. Go through the screens, make sure you set a user id and password, change the locale and keyboard (default is UK, UK keyboard is different from US Keyboard, so change it to US). There is a screen asking if you want to enable SSH, SPI, 1-Wire, etc, enable them all. (This will make sure that respective kernel modules are loaded and available). The Pi will then reboot, and you will get the GUI interface. On the top right-hand side of the screen, you will see an icon to setup wifi connection. Do that next.

Connecting to the internet

If you plug in your Pi with Ethernet, you probably don't need to do anything else for Internet connectivity.

Wi-Fi at home

This is normal stuff, just give your home router password, and you should connect.

Wi-Fi at school

You have to connect your Pi just like you connect a game console, through "NP Hawks Devices"
For this, you have to first register your device at https://access.newpaltz.edu.

Registration requires you to find the "Hardware Address" or MAC Address of your wireless network interface. Open a terminal on the Pi and execute "ifconfig" command:

```
easwaran@raspberrypi:~ $ ifconfig
eth0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        ether dc:a6:32:b0:17:e1  txqueuelen 1000  (Ethernet)
        RX packets 0  bytes 0 (0.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 34  bytes 3334 (3.2 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 34  bytes 3334 (3.2 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

wlan0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.2.118  netmask 255.255.255.0  broadcast 192.168.2.255
        inet6 fe80::1621:ff7e:88e3:5831  prefixlen 64  scopeid 0x20<link>
        ether dc:a6:32:b0:17:e3  txqueuelen 1000  (Ethernet)
        RX packets 79765  bytes 112927549 (107.6 MiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 38961  bytes 4023727 (3.8 MiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

The MAC address of your wireless card is dc:a6:32:b0:17:e3
(The output also shows your IP address, 192.168.2.118)

Running Pi configuration again

You can run the Pi configuration script any time. You can pull it down from the main menu, or just use the command *sudo raspi-config* in a terminal. The *sudo* command allows you to perform the command that comes after it as thoug you have admin privileges.

First thing to do after post-configuration reboot and after establishing connectivity:

Get updates to your system. Raspbian OS is a Debian-based OS, (much like Ubuntu, Debian is a linux distribution), so you will use *apt* commands to get system updates and install new software. You will need to do this occasionally, or before installing new software.
In the terminal, issue two commands in this sequence:
>sudo apt-get update
>sudo apt-get upgrade

Each of these commands will take some time (total of may be about 20 minutes, I think). In the end you will have a brand new updated system.

When you boot Pi first (or second) time, you will get a prompt to upgrade everything, which you can choose to do (or not). After that first time, you can run the **sudo apt-get update** and **sudo apt-get upgrade** commands in a terminal to manually update/upgrade your pi.

Installing and removing software on the Pi is also done with *apt* commands. A list of apt commands is given below.

Common Package Management functions using Debian apt

Debian Linux (of which Raspbian is a derivative) uses a package management system called apt (Advanced Package Tool)
https://wiki.debian.org/Apt
https://debian-handbook.info/browse/stable/sect.apt-get.html

updating your system
  sudo apt-get update
  sudo apt-get upgrade
  (and go get some coffee)
Check what packages are installed
  sudo dpkg -l
or
  sudo dpkg --get-selections
Check what packages are available
  sudo apt-cache pkgnames
Install a package
  Checkout these packages:
    gpm (mouse in Command Line mode)
      sudo apt-get install gpm
    lighttpd (lightweight http server)
      sudo apt-get install lighttpd
    links (command line http client)
      sudo apt-get install links
    ipython (nice python environment in CL mode)
      sudo apt-get install ipython
    sqlite (simple database engine that supports some SQL)
      sudo apt-get install sqlite
Check the files installed as part of a package
    What files were installed as part of gpm installation?
      sudo dpkg -L gpm
Check if a specific package is installed
      sudo dpkg -l | grep -i gpm

Other Resources

Some useful introductions

https://projects.raspberrypi.org/en/projects/raspberry-pi-getting-started

https://www.amazon.com/Getting-Started-Raspberry-Introduction-Fastest-Selling-dp-1680456997/dp/1680456997

Cool Projects to inspire you

https://www.instructables.com/howto/raspberry+pi/

Remote access to your Pi (Headless Pi)

1. CL access (command-line access)

If have a way of finding your Pi's IP address, and if you have enabled SSH (secure shell) in your Pi configuration, then from a terminal on your laptop/pc you can execute:

    ssh Your_IP_Address

For example,

    ssh 192.168.2.118

Here's screenshot of making an ssh connection:

```
linux6:~/s2022$ ssh 192.168.2.118
The authenticity of host '192.168.2.118 (192.168.2.118)' can't be established.
ECDSA key fingerprint is SHA256:9HyHXh/l9hAL+cFmricMM5bKTqQjpwgvoc3apqjeZZ0.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.2.118' (ECDSA) to the list of known hosts.
easwaran@192.168.2.118's password:
Linux raspberrypi 5.15.32-v8+ #1538 SMP PREEMPT Thu Mar 31 19:40:39 BST 2022 aarch64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Sat Jul 16 06:53:57 2022
easwaran@raspberrypi:~ $ uname
Linux
easwaran@raspberrypi:~ $ uname -l
uname: invalid option -- 'l'
Try 'uname --help' for more information.
```

2. GUI access

On the Pi configuration menu, enable VNC server. Reboot if necessary. VNC stands for "Virtual Network Computing" which is a light-weight remote access protocol. There are multiple implementations of VNC. Pi uses, by default, a VNC server called RealVNC.

If VNC server is enabled on your Pi, you will see the VNC logo on your top right menu bar along with sound and network indicators.

On your PC/laptop, you need to install a VNC viewer application, VNC Viewer applications can be downloaded for all platforms, including Windows and MACs.

Bring up the VNC Viewer on your laptop, and type in the IP of your Pi in the appropriate place. It will prompt for your username and password. Then you will see your Pi desktop appear on your laptop.

Here is a Pi desktop inside a Mac window: