Raspberry Pi Python Programming
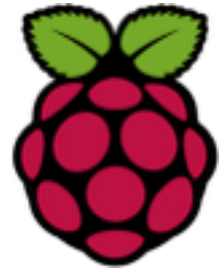
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Quick Setup

Follow the instructions at `https://www.raspberrypi.org/help/noobs-setup/`.

Once you reach the "Setup" screen, you should only need to change a few things:

- Go under "Enable Boot to Desktop/Scratch", and choose "Desktop Log in as user 'pi'…"
- Under "Internationalization Options"
  - change the Locale, and include all three "en_US.*" locales
  - change the Timezone to US/Mountain
  - change the Keyboard Layout to "Generic 105-Key (Intl) PC"—>"Other"—>"English (US)"

Reboot the Pi and you should see the Raspbian Desktop. If you only see the command line, then log in using username "pi" and password "raspberry". Then type "startx" to start the Desktop.

To re-run the setup program, open up a Terminal program and type "sudo raspi-config".

Setup Wireless Network

From the Raspbian Desktop, choose the computer network icon in the upper right of the Desktop. From the dropdown list, you should be able to select your wireless network and then enter in the key. Open up the Epiphany Web Browser and verify that you have an internet connection.

How do I find out more?

Setup: `https://www.raspberrypi.org/help/noobs-setup/`
Adventures in Raspberry Pi (Carrie Anne Philbin): `http://www.amazon.com/dp/1119046025`
Raspberry Pi 2 Model B: `https://www.sparkfun.com/products/13297`
Raspberry Pi Edimax Wifi Adapter: `https://www.sparkfun.com/products/13677`
Raspberry Pi Power Supply: `https://www.sparkfun.com/products/12890`
Turtle Graphics: `https://docs.python.org/3.0/library/turtle.html`
Sierpinski: `https://qfunction.wordpress.com/2009/11/11/turtle-graphics-in-python-cool/`
Minecraft Pi: `https://www.raspberrypi.org/learning/getting-started-with-minecraft-pi/`

Turtle Graphics in Python

Start up Python 3 under `Menu -> Programming -> Python 3`. Once the Python Shell starts, try out some Python commands at the Python prompt:

```
>>> 2+2
>>> import random
>>> help(random.randint)
>>> random.randint(0,10000000)
```

Now create a Python program. In the Python Shell, choose `File -> New Window` to create a new text editor window. Let's make a program that uses Turtle graphics and calls itself recursively:

```
import turtle                        <— Load the turtle module

def fib(n,m):                        <— Define a new function called "fib" with two parameters n, m
|    turtle.forward(2*m)             <— Move the turtle forward a certain number of pixels
|    if n >= 2:                      <— Here is a "block" of code - watch out for indentation!
|    |    turtle.left(m)             <— Turn the turtle a certain number of degrees
|    |    fib(n-1,m)                 <— Call myself recursively, but decrease the "branch" number
|    |    turtle.right(2*m)
|    |    fib(n-2,m)
|    |    turtle.left(m)
|    turtle.forward(-2*m)            <— Careful… this is not part of the "if" block

turtle.reset()                       <— This is not part of the "fib" function.
turtle.left(90)
fib(10,15)
```
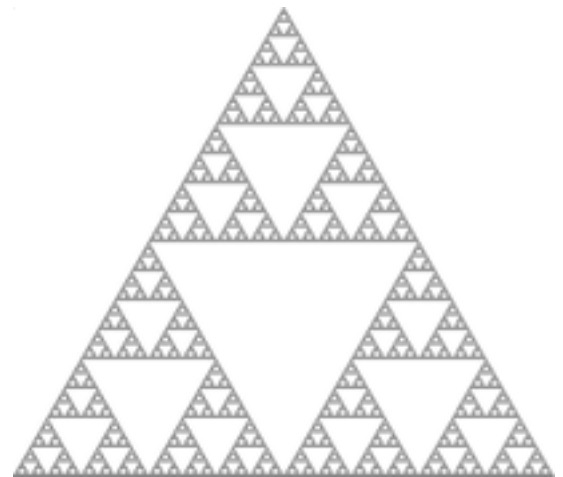
Save the program as `turtlefib.py`, then choose `Run -> Run Module`.

Now let's try a more complicated example:

```
import turtle

def striangle(depth,base):
    turtle.down()
    if depth == 0:
        turtle.begin_fill()
        for i in 0,1,2:
            turtle.forward(base)
            turtle.left(120)
        turtle.end_fill()
    else:
        for i in 0,1,2:
            striangle(depth-1,base)
            turtle.up()
            turtle.forward(base*2**depth)
            turtle.left(120)
            turtle.down()

turtle.reset();
turtle.speed(0);turtle.hideturtle()
turtle.fillcolor(1,0,0)
striangle(4,15)
```

Save this program as `sierpinski.py`, then choose `Run->Run Module`.

What happens if you change the parameters in the call to striangle at the bottom of the program?

Can you figure out how to change the pen color?

Minecraft Pi

In this section, we'll control Minecraft using Python.

First, start up Minecraft P   i under `Menu->Games`.

Click Start Game and create a new world. Try walking around and destroying blocks.

Next, start up Python 3 under `Menu->Programming`. Once the Python Shell starts, try the following commands:

```
>>> from mcpi import minecraft
>>> mc = minecraft.Minecraft.create()
>>> mc.postToChat("Hello world")
```

To find your location:

```
>>> x, y, z = mc.player.getPos()
```

Note that "x" is your east-west position, "z" is your north-south position, and "y" is your up-down position.

Let's teleport ourselves 100 squares in the air:

```
>>> mc.player.setPos(x, y+100, z)
```

Now let's create a stone block, then change it to diamond:

```
>>> mc.setBlock(x, y, z+1, 1)
>>> mc.setBlock(x, y, z+1, 57)
```

See the next page for the list of possible blocks.

We can create a whole cube of blocks with a single call:

```
>>> x, y, z = mc.player.getPos()
>>> mc.setBlocks(x+1, y+1, z+1, x+11, y+11, z+11, 1)
```

Let's completely surround ourselves with TNT. Note that we need to use an 8th argument (set to 1) to "arm" the TNT:

```
>>> TNT = 46
>>> x, y, z = mc.player.getPos()
>>> mc.setBlocks(x-5, y-1, z-5, x+5, y-1, z+5, TNT, 1)
```

Go ahead and destroy the TNT…

Enough destruction, let's drop some flowers while we walk. This is easier to type in a text editor. In the Python Shell, choose `File -> New Window` to create a new text editor window.

```
from mcpi import minecraft
from time import sleep
mc = minecraft.Minecraft.create()
flower = 38
while True:
    x, y, z = mc.player.getPos()
    mc.setBlock(x, y, z, flower)
    sleep(0.1)
```

Save the program as `myflower.py`, then choose `Run -> Run Module`.

Key	Action
W	Forward
A	Left
S	Backward
D	Right
E	Inventory
Space	Jump
Double space	Fly / Fall
Esc	Pause / Game menu
Tab	Release mouse cursor
1–8	Choose from quick bar
Left mouse	Destroy blocks
Right mouse	Place blocks

Block Numbers

AIR	0
STONE	1
GRASS	2
DIRT	3
COBBLESTONE	4
WOOD_PLANKS	5
SAPLING	6
BEDROCK	7
WATER_FLOWING	8
WATER	8
WATER_STATIONARY	9
LAVA_FLOWING	10
LAVA	10
LAVA_STATIONARY	11
SAND	12
GRAVEL	13
GOLD_ORE	14
IRON_ORE	15
COAL_ORE	16
WOOD	17
LEAVES	18
GLASS	20
LAPIS_LAZULI_ORE	21
LAPIS_LAZULI_BLOCK	22
SANDSTONE	24
BED	26
COBWEB	30
GRASS_TALL	31
WOOL	35
FLOWER_YELLOW	37
FLOWER_CYAN	38
MUSHROOM_BROWN	39
MUSHROOM_RED	40
GOLD_BLOCK	41
IRON_BLOCK	42
STONE_SLAB_DOUBLE	43
STONE_SLAB	44
BRICK_BLOCK	45
TNT	46
BOOKSHELF	47
MOSS_STONE	48
OBSIDIAN	49
TORCH	50
FIRE	51
STAIRS_WOOD	53
CHEST	54
DIAMOND_ORE	56
DIAMOND_BLOCK	57
CRAFTING_TABLE	58
FARMLAND	60
FURNACE_INACTIVE	61
FURNACE_ACTIVE	62
DOOR_WOOD	64
LADDER	65
STAIRS_COBBLESTONE	67
DOOR_IRON	71
REDSTONE_ORE	73
SNOW	78
ICE	79
SNOW_BLOCK	80
CACTUS	81
CLAY	82
SUGAR_CANE	83
FENCE	85
GLOWSTONE_BLOCK	89
BEDROCK_INVISIBLE	95
STONE_BRICK	98
GLASS_PANE	102
MELON	103
FENCE_GATE	107
GLOWING_OBSIDIAN	246
NETHER_REACTOR_CORE	247
PAINTING	321
STONE_STAIRS	67
OAK_STAIRS	53
OAK_STAIRS	59
NETHERRACK	87
TRAPDOOR	96
MELON_SEEDS	105
BRICK_STAIRS	108
SANDSTONE_STAIRS	128
STONE_BRICK_STAIRS	109
NETHER_BRICK	112
NETHER_BRICK_STAIRS	114
QUARTZ_BLOCK	155
QUARTZ_STAIRS	156
STONE_CUTTER	245
BONE_MEAL	351

Special Block Values

WOOL:
0: White
1: Orange
2: Magenta
3: Light Blue
4: Yellow
5: Lime
6: Pink
7: Grey
8: Light grey
9: Cyan
10: Purple
11: Blue
12: Brown
13: Green
14: Red
15: Black

WOOD:
0: Oak (up/down)
1: Spruce (up/down)
2: Birch (up/down)
(below not on Pi)
3: Jungle (up/down)
4: Oak (east/west)
5: Spruce (east/west)
6: Birch (east/west)
7: Jungle (east/west)
8: Oak (north/south)
9: Spruce (north/south)
10: Birch (north/south)
11: Jungle (north/south)
12: Oak (only bark)
13: Spruce (only bark)
14: Birch (only bark)
15: Jungle (only bark)

SAPLING:
0: Oak
1: Spruce
2: Birch

GRASS_TALL:
0: Shrub
1: Grass
2: Fern

TORCH:
1: Pointing east
2: Pointing west
3: Pointing south
4: Pointing north
5: Facing up

STONE_BRICK:
0: Stone brick
1: Mossy stone brick
2: Cracked stone brick
3: Chiseled stone brick

STONE_SLAB /
STONE_SLAB_DOUBLE:
0: Stone
1: Sandstone
2: Wooden
3: Cobblestone
4: Brick
5: Stone Brick

TNT:
0: Inactive
1: Ready to explode

LEAVES:
1: Oak leaves
2: Spruce leaves
3: Birch leaves

SANDSTONE:
0: Sandstone
1: Chiseled sandstone
2: Smooth sandstone

STAIRS_[COBBLESTONE, WOOD]:
0: Ascending east
1: Ascending west
2: Ascending south
3: Ascending north
4: Ascending east (upside down)
5: Ascending west (upside down)
6: Ascending south (upside down)
7: Ascending north (upside down)

LADDERS, CHESTS, FURNACES,
FENCE_GATE:
2: Facing north
3: Facing south
4: Facing west
5: Facing east

[WATER, LAVA]_STATIONARY:
0-7: Level of the water, 0 being the
highest, 7 the lowest

NETHER_REACTOR_CORE:
0: Unused
1: Active
2: Stopped / used up