**HOMEWORK 6**

**1. Give specific details for using the RPi’s GPIO as digital outputs and digital inputs.**

**Ans:**

The Raspberry Pi has 40 GPIO pins on the board in which several are power pins i.e. 5V, 3.3V and Ground pins. While rest of the pins have different characteristics that can perform multiple operations using different protocols. Basically, the Raspberry Pi GPIO pins are used as input, output or for communicating with other devices through TX and RX pins.

We first explain how the Raspberry Pi input GPIO pins are used. The input pins on the PI board can read input signals like the state of push button, read data from the connected sensor and in some cases where pull-up or pull-down resistors are needed so some GPIO pins of the raspberry pi board are already these resistors connected built-in. pull-up resistors are already make the pin in HIGH state by continuously sending 1 so in order to toggle or take operation on this pin you must send LOW 0 in this port. Similarly, the pull-down resistor is the reciprocal of pull-up resistor and also their operations. So, the configuration of GPIO pins must be keep in mind to use as input or output.

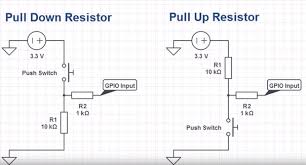
Now talking about the digital output pin of the raspberry pi. These pins are the same GPIO pins which depend on us whether we configure these pin as input or output. The behavior of these pins as input is discussed in above paragraph. When these pins are configured as output, the potential (voltages) on these pins are from 0v to 5V which depend on the user and its usage. The output voltages of the can be set from 0v to 5v Dc. And the period of turn ON or OFF the port voltage can be set by using programming languages. The duty cycle of port can also be varied with the help of programming. The pins can be used to run different devices like sending information to sensors, connected with other devices, control motors and smart appliances, control LEDs and display devices etc.

**2. Describe the importance of pull-up and pull-down resistors as they relate to using the RPi’s GPIO pins.**

**Ans:**

The basic purpose of these resistors is to control the flow of electric current from the source to Digital pins and vice versa. A pull-up resistor allows the controlled current from voltage source to digital input pins. Similarly, pull -down resistor control the current flowing from pins to ground. Another purpose of using the pull-up and pull-down resistor is to avoid the pin from floating inputs. So pull-down resistors are used when you want to ensure that the input connected with the operating device are LOW when the switch are open and pull-up resistors are used when you want to ensure that inputs are high when the switch are open.

In Raspberry pi you can check whether pull-up and pull-down resistors are enabled or not by connecting a 100Kohm resistor between the pin and ground and then between the pin 3.3V and specific digital pin. Pull-up resistors are used when we want our default state is high and wants that this HIGH state changed by some external interruption so we use the pull-up resistor. The pull-down resistor is the exact opposite of the pull-up resistor.in some cases when we didn’t use pull-up resistor, the circuit output is directly connected with the ground pin of the raspberry pi when the button is pressed. While when the button is in open state, he logic level pin in floating and make some undesirable circuit in the result.



**3. Complete the An Enhanced GPIO Class section in chapter 6, pages 242 – 244. Copy the results of the test for your answer and give a picture/video of your program as it executes.**

**Ans:**

**Result of the test:**

pi@raspberrypi:~ $ cd exploringrpi

pi@raspberrypi:~/exploringrpi $ cd chp06

pi@raspberrypi:~/exploringrpi/chp06 $ cd GPIO

pi@raspberrypi:~/exploringrpi/chp06/GPIO $ cd tests

pi@raspberrypi:~/exploringrpi/chp06/GPIO/tests $ ./test\_callback

You have 10 seconds to press the button:

Listening, but also doing something else...

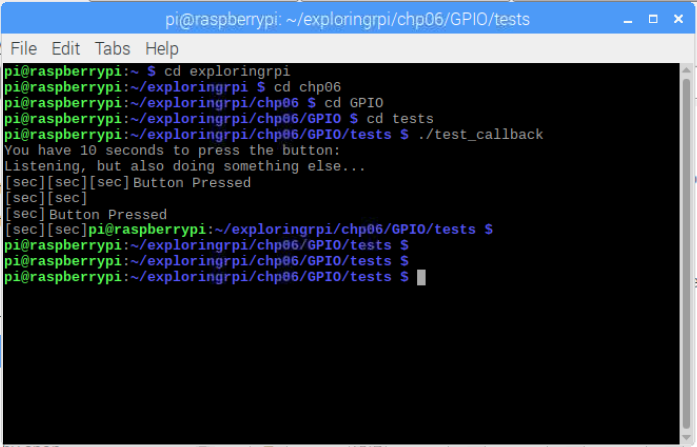
[sec][sec][sec]Button Pressed

[sec][sec]

[sec]Button Pressed

[sec][sec]

**Picture of program execution:**

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**4. Complete the WiringPi section in chapter 6, pages 252 – 259. Copy the results of the test for your answer and give a picture/video of your program as it executes.**

**Ans:**

Result of the test:

This is an RPi: Pi 3

with revision number: 02

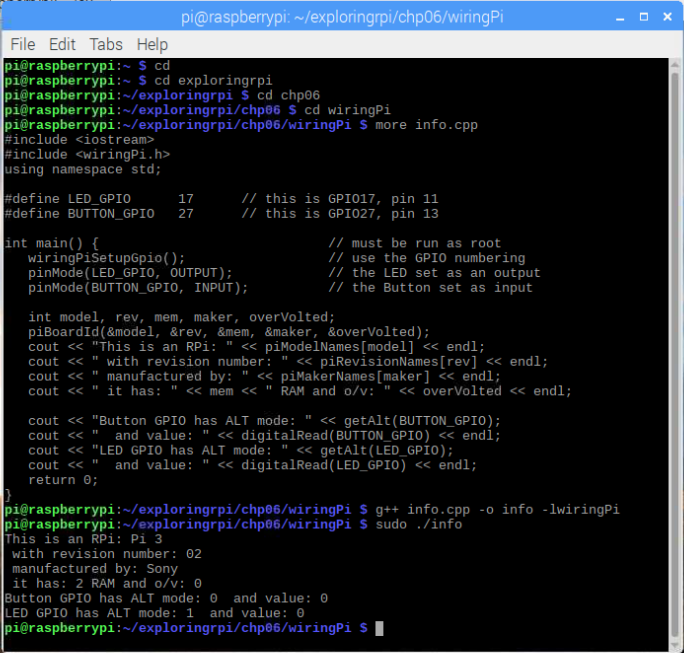
manufactured by: Sony

it has: 2 RAM and o/v: 0

Button GPIO has ALT mode: 0 and value: 0

LED GPIO has ALT mode: 1 and value: 0

**Picture of program execution:**



**5. Complete the PWM Application – Controlling a Servo Motor section in chapter 6, pages 266 – 268. Copy the results of the test for your answer and give a picture/video of your program as it executes.**

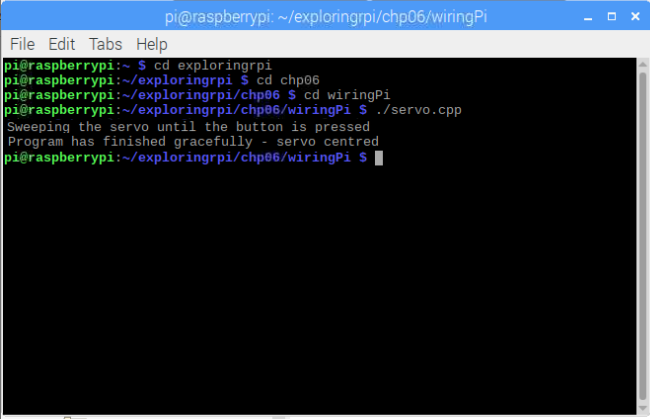
**Ans:**

**Result of the test:**

Sweeping the servo until the button is pressed

Program has finished gracefully – servo centered

**Picture of program execution:**

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