

# ***Unit 1: Introduction to Mathematical Teaching tools using Raspberry Pi***

***Milind Diwan***

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***African School of Fundamental Physics and Applications.***

***High School Teacher's Workshop***

***University of Namibia and Namibia University of Science and  
Technology***

# Purpose

- ***Introduce the Raspberry-Pi as an educational tool.***
- ***Introduce some of the educational resources that come with the Raspberry-Pi.***
- ***Some basic training on using Linux and the functionality on the pi.***
- ***Introduce mathematica on the pi***
- ***Demonstrate simple problem solving using mathematica.***
- ***Discuss how tools like this could be introduced in African schools including difficulties and opportunities.***

# *What is it ?*

- *[www.raspberrypi.org](http://www.raspberrypi.org) for more information.*
- *The raspberry-pi is a compact ARM based computer with a lot of functionality.*
- *It needs USB power through a micro-USB connector.*
- *Has 4 USB ports, 1 HDMI output, 1 ethernet, 1 audio out, WIFI, GPIO capability. Can be used with many other low cost components.*
- *System is built on a micro-SD card. Comes with debian-linux (rasbian) with many educational tools including games. Comes with Mathematica.*
- *Supported by a large global community that is interested in making computing easy and fun.*



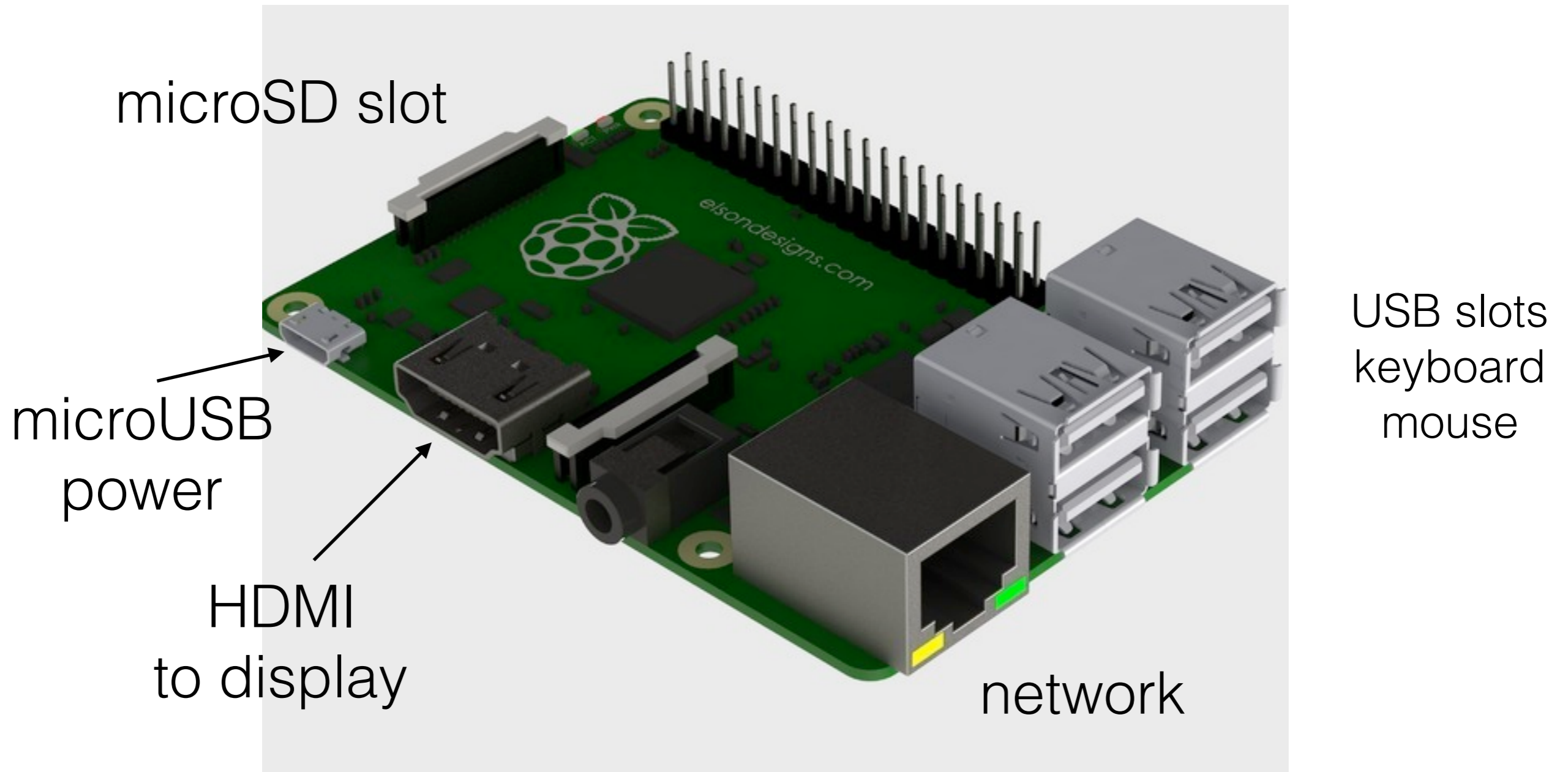
***Cost is US\$35/each  
with cables and microSD cost  
goes to ~US\$50-60***

This computer can be used to make many instruments, but we will only use some part of its functionality.

# ***Where to buy it ?***

- ***This is available on Amazon, but may have to wait for an African branch of Amazon. Can also be purchased from UAE.***
- ***This (pishop) appears to be the official South African retailer. You can buy up to 5 units, cables and accessories. Costs are the same as anywhere else in the world.***
- ***<https://www.pishop.co.za/store/>***
- ***[www.raspberrypi.org](http://www.raspberrypi.org) has information on where to buy throughout the world.***
- ***You can also download the software for the Pi from the same site. The software gets loaded onto the small micro-SD chip (it needs to be >8 GB to have enough space, the software is about 4.5 GB). We will learn more about this later.***

# *turning on the Pi*



- ***Plug in the micro-sd card. connect keyboard/mouse and display. The micro-Sd card has operating system called Rasbian. This also has a lot of files that we will be using.***
- ***Finally connect power. Power needs to provide >2.1 AMP. Close to 2.5 Amp is better.***
- ***Connect ethernet cable.***

# Basic operations with the pi

- *default username is pi with password: raspberry*
- *click on wireless to start the WIFI.*
- *click on file-folder to get folder list*
- *click on raspberry to see various options. Click on games to start a game.*
- *click on command line terminal. This is a version of the Linux operating system. Very powerful and free. useful commands*
  - *pwd (present working directory)*
  - *ls -lt (directory listing)*
  - *sudo ... (this allows to do anything as a superuser)*
  - *sudo raspi-config (get configuration tool)*
  - *hostname -I (get the network ID)*
  - *sudo adduser <name of user>*
  - *man leafpad (get information on text editor)*
  - *leafpad & ( start text editor)*

# Plan

- **UNIT1**

- *This introduction*
- *How to connect and turn on the Raspberry Pi*
- *Simple LINUX commands, and commands to do some more sophisticated things.*
- *Play a game and look at some of the software on Rasbian*
- *Start Mathematica and do simple operations.*

- **UNIT 2**

- *Provide simple introduction to mathematica.*
- *Work through a tutorial on basics*
- *Show list operations*
- *Show plotting functions*
- *Make a plot of interesting environmental data for Windhoek*

- *UNITs 3, 4, 5, 6 will cover various Mathematica functionality for teaching physics.*

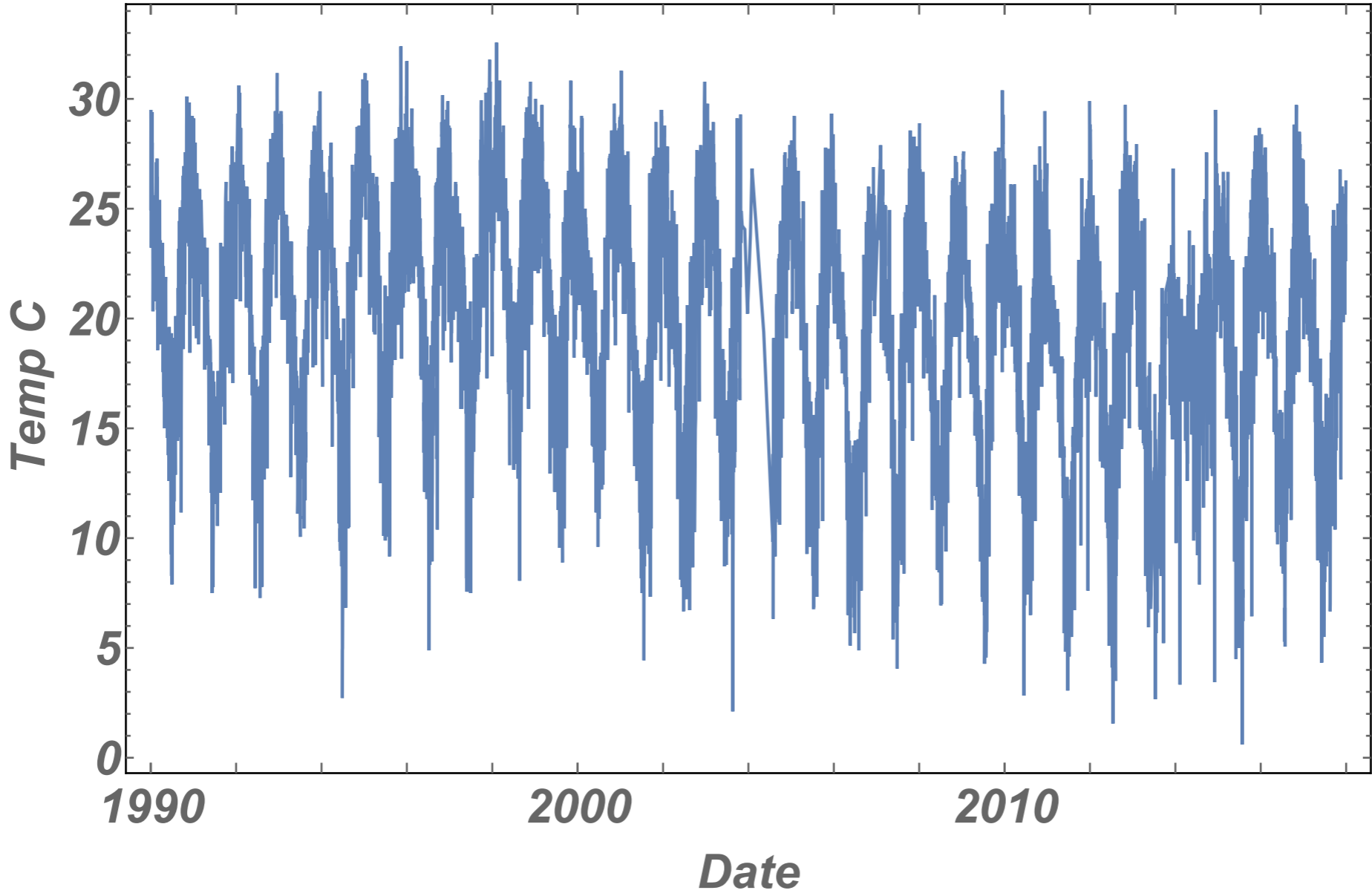
- *Of course, you can explore the Raspberry pi for many other applications which we will not cover.*

# First quick exercise on Mathematica

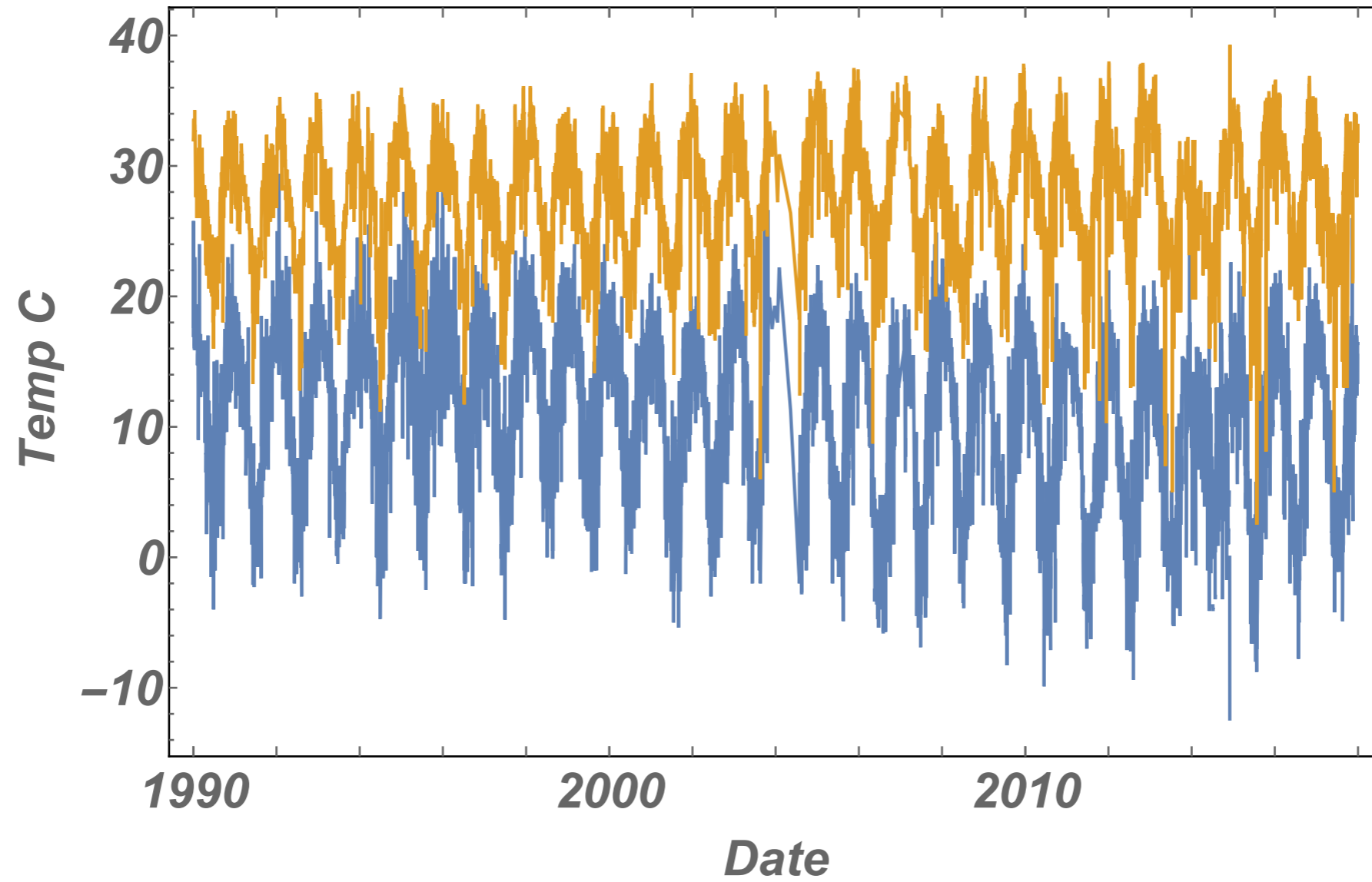
- ***Mathematica is a computer program that allows you to do mathematics on the computer.***
- ***You have to learn to type in equations and set up problems using the special language. The program will solve the problems for you.***
- ***Most important: the solutions can be visualized in a variety of ways. This makes the tool very important for education.***
- ***This program is distributed free on raspberry pi. With network access you have access to a huge library of information and data from the providers of this program (Wolfram).***
- ***We are going to learn elementary techniques for using this program.***
- ***But first I must convince you of its power ! And so we are going to***
  - ***Make a plot of the weather in Windhoek over last many decades !***
  - ***On your raspberry pi go to the folder labeled UNIT1 on the desktop and click on WINDHOEK-TEMP.***



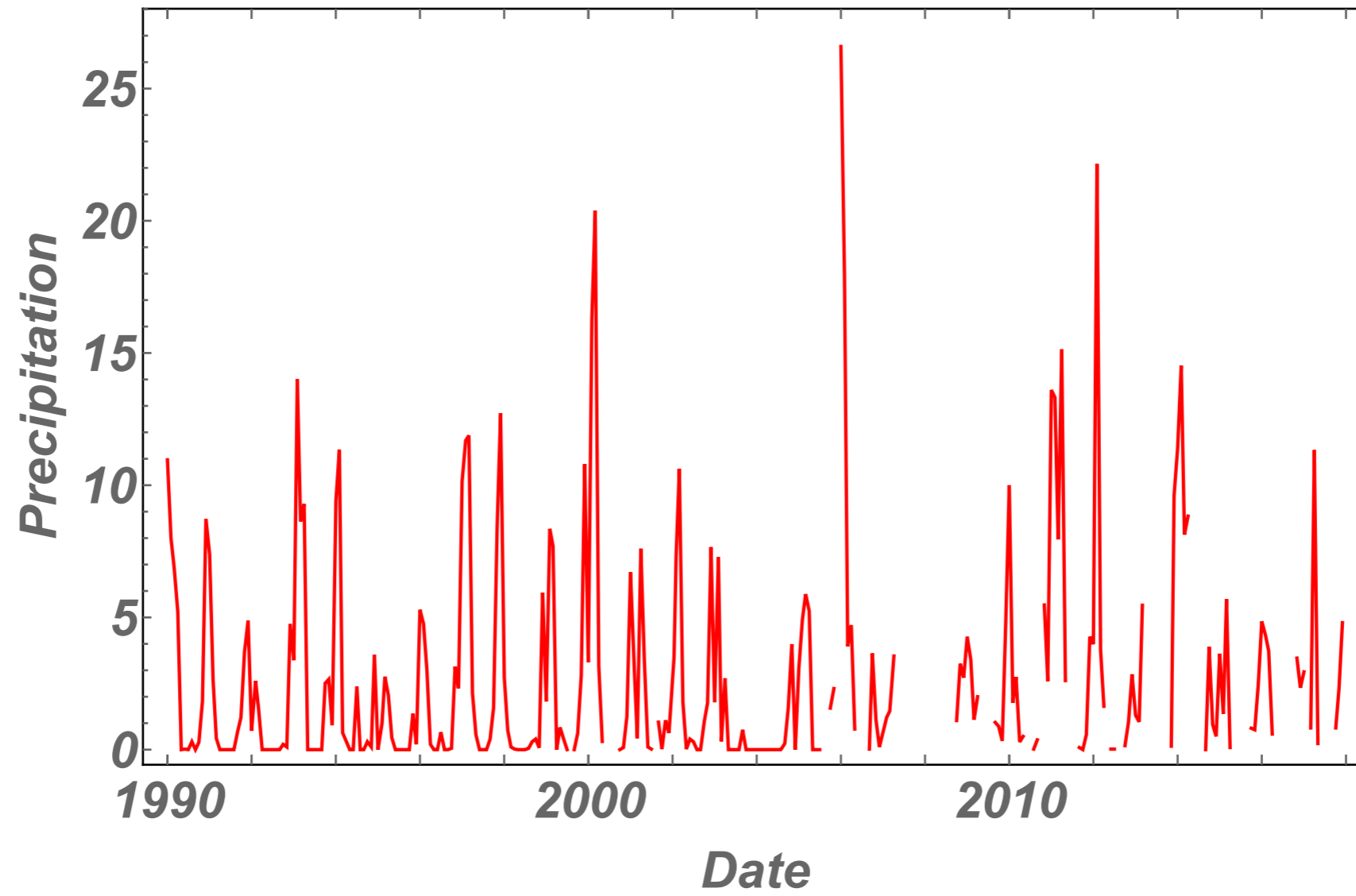
daily average temperature over 3 decades



minimum and maximum temp daily



# weekly rainfall in cm



# ***Other programming tools on pi***

- Blue J Java
- Python
- Scratch (programming for children)
- sonic coding to write music.
- You can use the pins to turn on/off lights and motors using python program. type the command <pinout> in the console. (simplest way to play is with scratch)
- Don;t try too many things at once. I do not know how to use them all.