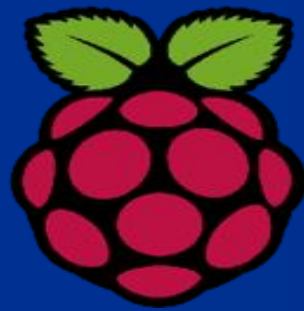


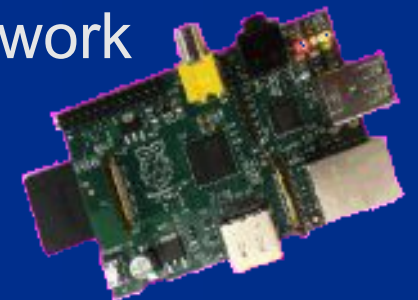
Raspberry Pi and other Animals

The world of teeny-weeny computers



Teeny Weeny Computers

- ❑ We are surrounded by a hidden world of tiny computers which control most of the devices we encounter in our lives.
- ❑ These things are all around us buried in familiar objects, and we largely take them for granted.
- ❑ They are true computers running programs comprising a set of instructions directing them to carry out their appointed task.
- ❑ They interact with our world through sensors which allow them to monitor the environment and act accordingly.
- ❑ These devices are cheap, available and accessible to people who have an interest in exploring how they work and what they can do.



Where do we find these devices today?

Almost everywhere.....

- ❑ TVs, DVD players, remote controls
- ❑ phones,
- ❑ washing machines,
- ❑ domestic appliances, cookers, hobs, food processors
- ❑ cars
- ❑ thermostats & heating controls
- ❑ multimeters
- ❑ clocks
- ❑ radios
- ❑ security systems
- ❑ electric tooth brushes
- ❑ electronic toys and games
- ❑the list is endless



So*What exactly is a computer?*

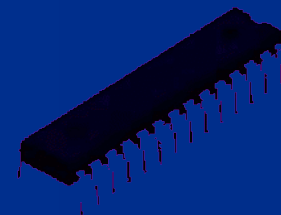
- ❑ Originally.....
- ❑ 50+ years ago computers were people
- ❑ Today
- ❑ They are devices that processes data according to a set of instructions. Processing can be mathematical or logical operations or the assembly, storage, or manipulation of information.



Are Computers the same as logic chips?

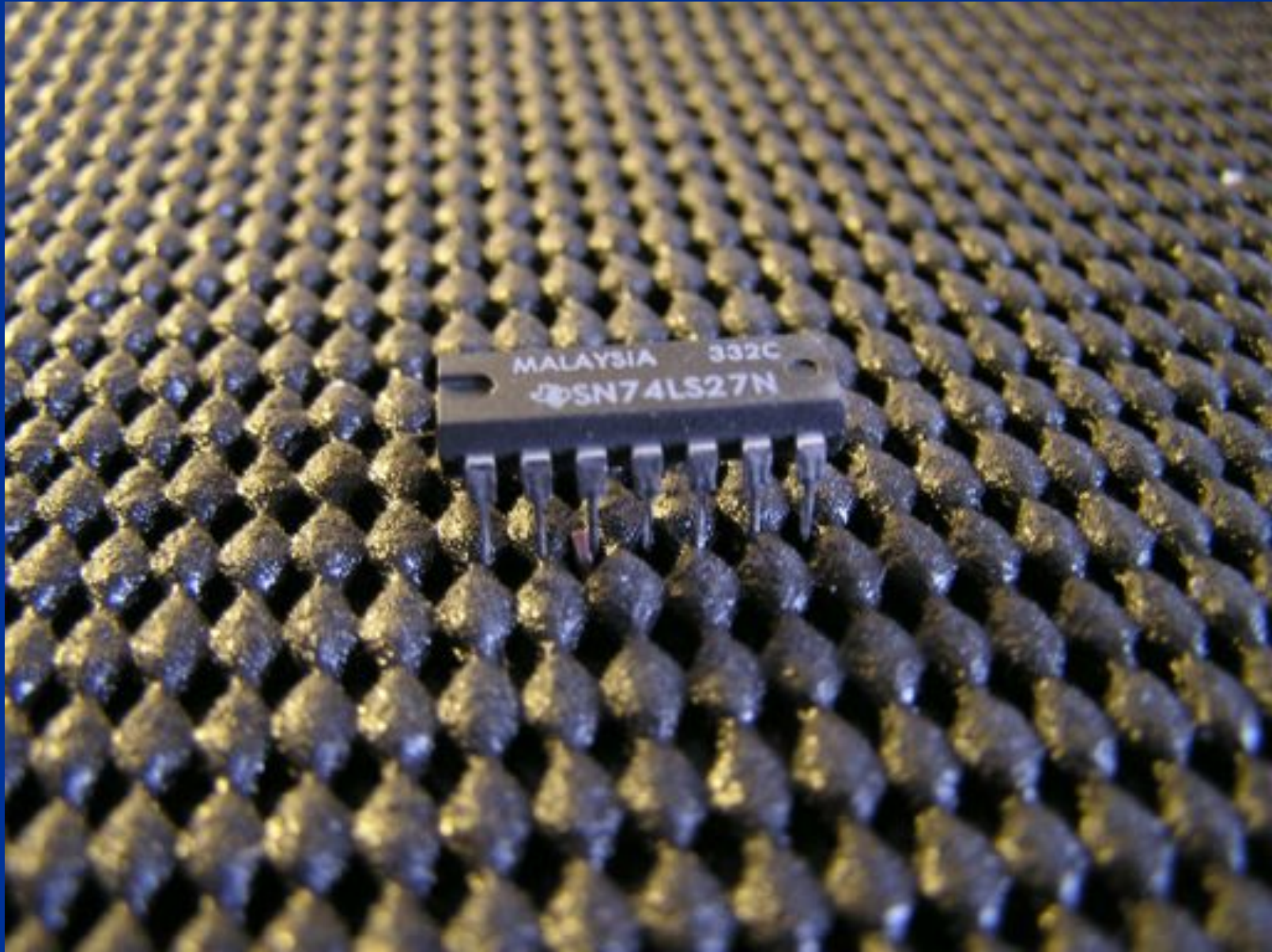
Well not really.....

- ❑ Logic circuits carry out a single function based on their internal wiring and components.
- ❑ To change their function requires either a physical change to their internal connections or a change to their components parts.
- ❑ However – sometimes they may look similar



SN74LS27N

Triple 3 input NOR Gate



NOR Gates



A	B	Out
0	0	1
0	1	0
1	0	0
1	1	0



Computers

- ❑ Generic devices which can carry out many tasks dependent on the nature of the software program that is stored in their internal memory.



ATMEL AT TINY 26L



AT tiny26L Features

- ❑ **AVR® 8-bit Microcontroller**
- ❑ – 2K Bytes of Programmable Flash Memory
- ❑ – 2 x 8-bit Timer/Counter
- ❑ – 2 High Frequency Pulse Width Modulation Outputs
- ❑ – Universal Serial Interface
- ❑ – 8 x Differential 10 bit Analogue to Digital channels
- ❑ – On-chip Analog Comparator
- ❑ – External Interrupt
- ❑ – Programmable Watchdog Timer with Separate On-chip Oscillator
- ❑ – In-System Programmable
- ❑ – Internal Calibrated RC Oscillator
- ❑ – 16 Programmable I/O Lines
- ❑ – Operating Voltages 2.7V – 5.5V
- ❑ – Cost about £2



OK – ignore all the technical stuff – this is a really serious computer on a tiny chip with lots of functions and lots of input output pins to let it interact with the outside world



ATMEL AT90S8515



ATMEL AT90S8515



And they make bigger ones



Arduino Uno



Arduino Uno

- ❑ The Arduino Uno is a microcontroller board based on the ATmega328. It has
- 14 digital input/output pins (6 can be used as PWM outputs)
- 6 analog inputs (ADC)
- a 16 MHz crystal oscillator
- a USB connection
- a power jack (7-12v DC)
- an ICSP header (for programming)
- a reset button.
- ❑ A complete self-contained computer based on an ATMEL chip
- ❑ Operational focus is on device control - utilising the excellent input/output functions of the ATMEL chip



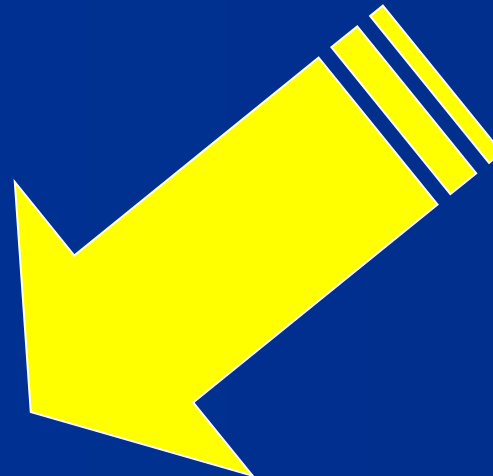
What can you do with Arduino?

- ❑ Light seeker
- ❑ Hand Shadow
- ❑ Multicopter control
- ❑ Walker



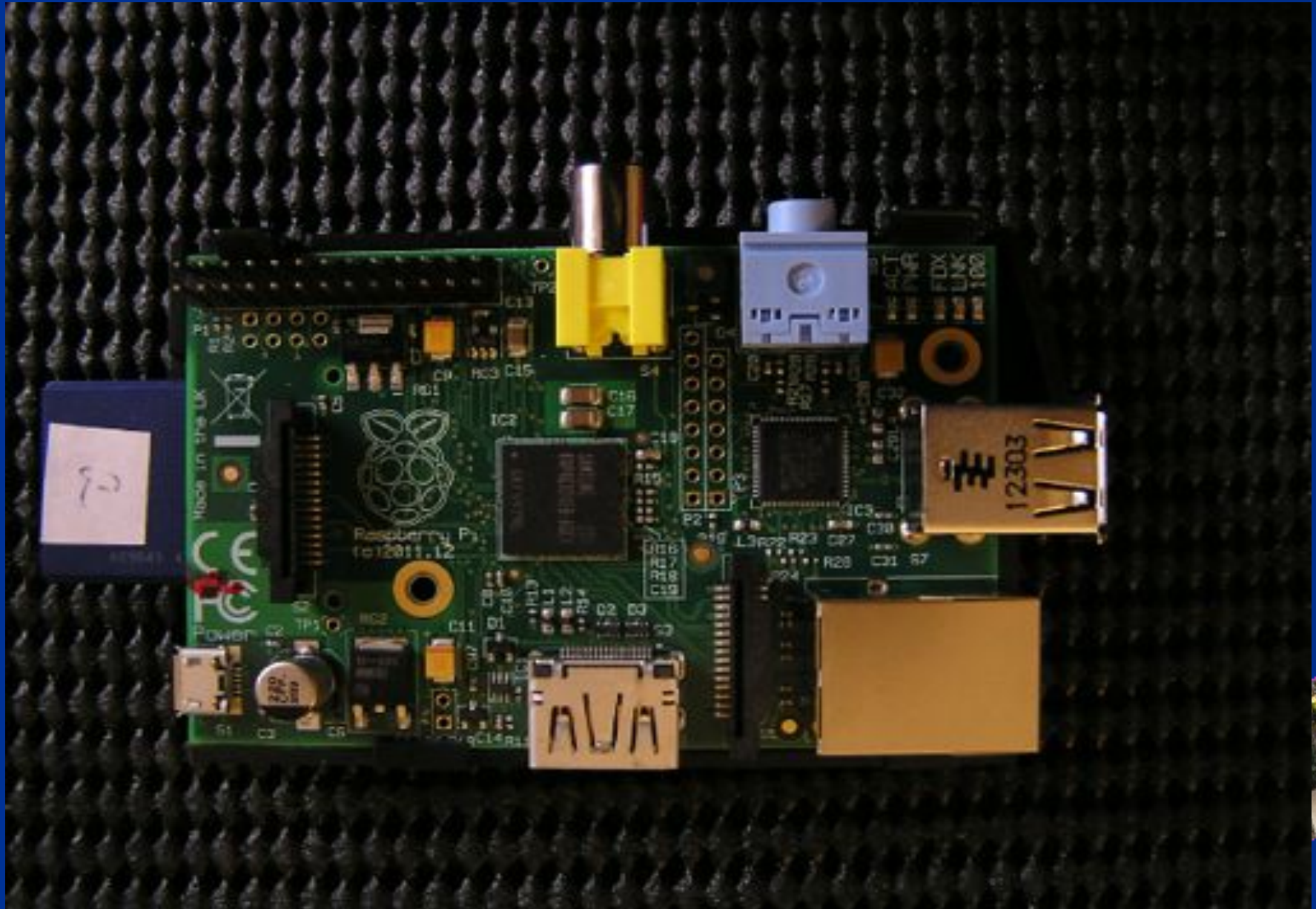
How do you program Arduino?

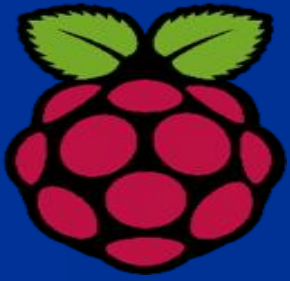
- ❑ Simple compiler and downloader on a PC
- ❑ USB connection to the board
- ❑ Lets do it





And now ...RASPBERRY PI

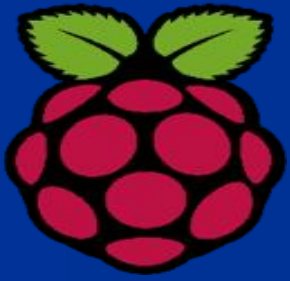




Why Pi?

- ❑ Conceived by Eben Upton and his colleagues at the University of Cambridge Computer Laboratory around 2006.
- ❑ They became concerned about the year-on-year decline in the numbers and skills levels of the A Level students applying to read Computer Science in each academic year.





Why Pi?

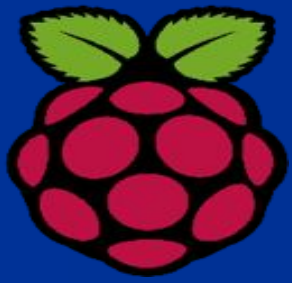
- ❑ From a situation in the 1990s where most applicants were coming to interview as experienced hobbyist programmers, the landscape in the 2000s was very different; a typical applicant might only have done a little web design.
- ❑ Something had changed the way kids were interacting with computers.



A number of problems were identified

- ❑ the colonisation of the ICT curriculum with lessons on using Word and Excel, or writing web pages
- ❑ the end of the dot-com boom
- ❑ the rise of the home PC with complex and impenetrable operating systems
- ❑ games consoles replacing the Amigas, BBC Micros, Spectrum and Commodore 64 machines that people of an earlier generation learned to program on.





The Raspberry Pi Solution

- ❑ Eben and his colleagues decided to develop an affordable computer with which children could learn “real” IT skills by having full access to the hardware and operating system.
- ❑ It would be based on an open operating system that would encourage people to develop their own applications and share them with others.



So what is it?

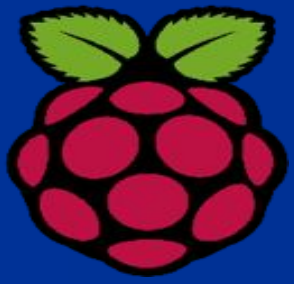
- ❑ ARM CPU (700Mhz)
- ❑ A graphics processor
- ❑ 512Mb memory
- ❑ SD memory card for storage
- ❑ HDMI video interface
- ❑ Composite video interface
- ❑ Ethernet port
- ❑ 2 USB ports
- ❑ Audio socket
- ❑ 26-pin header providing 8 GPIO pins
- ❑ plus access to I²C, SPI, UART)



So what is it?

- ❑ Runs free operating systems available from the internet – so far based on Linux
- ❑ Runs free applications available from the internet
- ❑ No hard disk - all software accessed from an SD card, USB port or the network
- ❑ Feels and behaves like a desktop computer
- ❑ But .. all aspects are transparent and accessible by those who might be interested.





Lets plug it in.....



So what does it do?

- ❑ Is it as “real” computer? - YES
- ❑ Should I scrap my laptop/desktop and buy one? – NO
- ❑ Does it compete with PC World? - NO
- ❑ Can I do email / internet browsing on it? - YES
- ❑ Can it run other programs? - YES LOTS!
- ❑ Will I need other things in addition to the basic board? – YES
- ❑ Do I have to be a computer geek to use one - NO
- ❑ Will I have to learn some new things to get it going? - YES
- ❑ Will I learn about how a computer works? - not everything but much more than you would with a normal PC or MAC
- ❑ Do I have to assemble it? - YES and NO - you wont need a soldering iron but you will have to plug bits in



