Teaching KS3 Computing

Session 7

Theory: How computers work

Practical: Building on programming skills

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Today's session

5:00 – 6:00

How computers work

6.00 – 7.00

Building on programming skills

From the national curriculum- as last week

At KS3 students should be able to:

- understand the hardware and software components that make up computer systems, and how they communicate with one another and with other systems
- understand how instructions are stored and executed within a computer system;

Computing programme of study

KS3 Curriculum

- Computers are devices for executing programs
- Not every computer is obviously a computer (most electronic devices contain computational devices)
- Basic architecture: CPU, storage (e.g. hard disk, main memory), input/output (e.g. mouse, keyboard)
- Computers are very fast, and getting faster all the time (Moore's law)
- Computers can 'pretend' to do more than one thing at a time, by switching between different things very quickly

Not every computer is obviously a computer

- Not every computer is obviously a computer (most electronic devices contain computational devices)
- Students can research how many devices they can find that contain a microprocessor.

Devices that contain a microprocessor

Personal

phones
watches
calculators
computers and laptops
cameras
iPods (iPads, other mp3 players, etc.)
WII and X-boxes

Computers:
infrared keyboards and mice
disk drives
switches
hubs

Commercial devices:
cash tills
supermarket bar code scanners
vending machines
lottery ticket dispensing machines
printers
faxes
copiers
automatic door openers
credit card processors
ATM machines

Industry
vehicles (cars, airplanes, boats, trains, trucks, etc)
navigational systems (tomtom, loran, etc)

Home:
clock/radios
ovens
microwave ovens
washing machines
driers
stereo systems
TVs
DVD players
satellite/cable boxes
thermostats
air conditioners
motion detectors
smoke detectors
burglar alarm systems

Medical:
pace makers
insulin auto-injectors
heart monitors
hearing aids

Military:
smart bombs
missiles
guns
turrets
tanks
sonic guns

Police:
radar guns (for speeding tickets)
infrared motion and camera systems (for traffic lights)
uv locators (finding suspects and bodies)
lie detectors

Municipal devices:
traffic lights
walkie-talkies
train ticket purchasing machines

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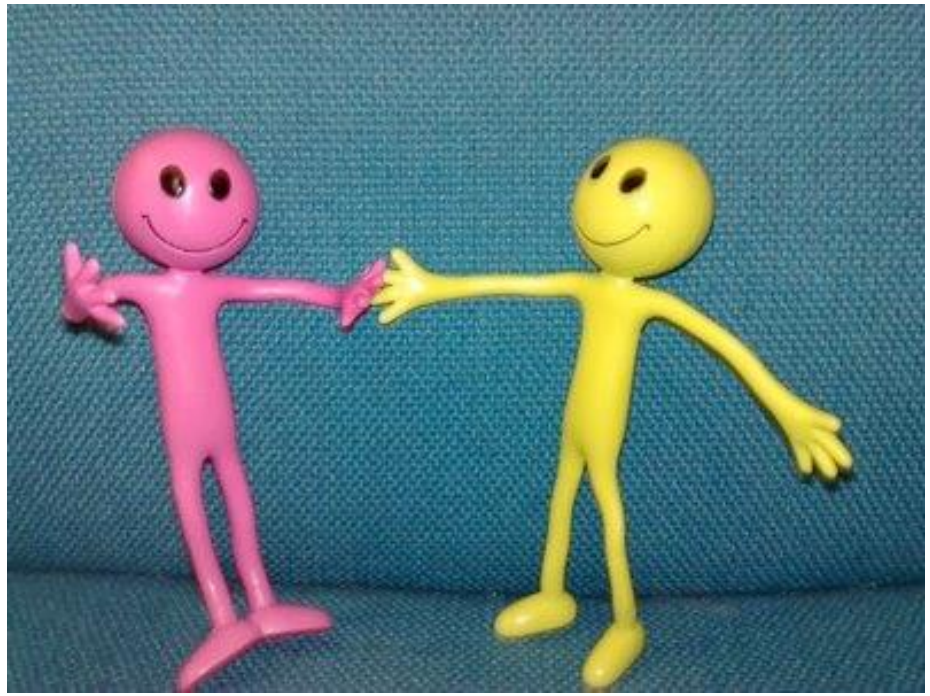
How a computer works – role play

- Work in threes
- One person to be:
  - The Display
  - The Memory
  - The Computer
- Carry out the instructions given

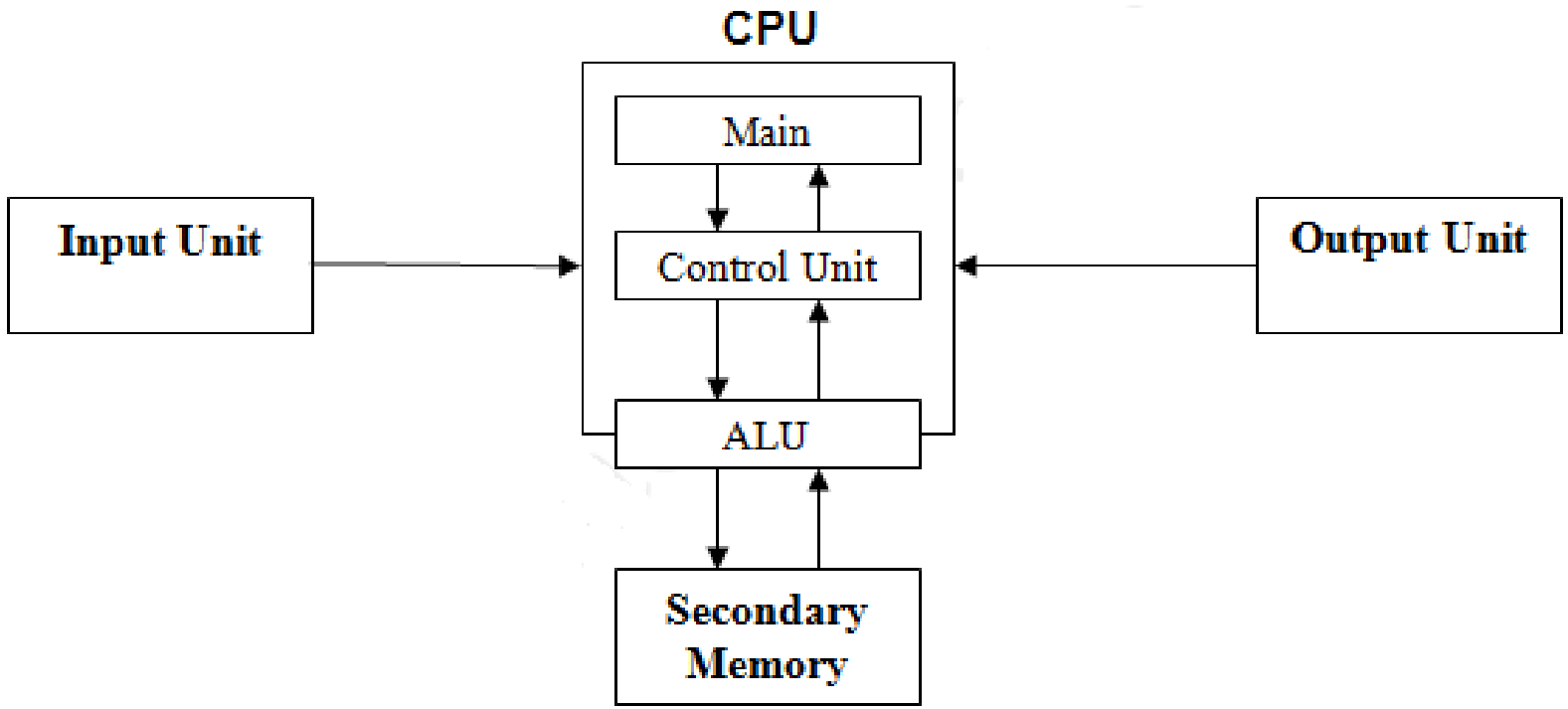


Exercise taken from: http://cse4k12.org/how_computers_work/

Summary of this activity

- This activity gives an abstracted (details removed) view of the computer
- The key points are:
  - The processor executes instructions exactly as provided
  - The processor doesn't "understand" the task – just carries it out in sequence
  - Values are stored in memory
  - The ALU is an area for working out (adding values etc).

Structure of the computer



KS3 students do not need too much detail but they will need more information about the structure of the computer and the fetch-execute cycle at GCSE.

Activity 2: Torches activity

You will need one torch between two people

In pairs …

Here is a simplified 5-bit coding for letters that we have used before.

Use this to code a short word or phrase

Use torches to send the message to another pair

Find out if the message was successfully received

Space	00000	N	01110
A	00001	O	01111
B	00010	P	10000
C	00011	Q	10001
D	00100	R	10010
E	00101	S	10011
F	00110	T	10100
G	00111	U	10101
H	01000	V	10110
I	01001	W	10111
J	01010	X	11000
K	01011	Y	11001
L	01100	Z	11010
M	01101	?	11011

Teaching points from this activity

- Computers need to communicate with each other
- For two computers to communicate they need to use a common set of rules
- This is called a **protocol**
- In working out how to send a message that the other pair understood you established a protocol for communication
- This is an important concept in networking which is essentially the study of how computers communicate

Next week – programming only!

Break