Teaching London Computing

Programming for GCSE

Topic 5.1: Computer Components
Aims

- Overview of computer components
- Example: Raspberry Pi
- The Universal Machine
- Performance: Clocks and Cores
### From the specification

<table>
<thead>
<tr>
<th>OCR GCSE Computing</th>
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<tr>
<td>Explain how common characteristics of CPUs such as clock speed, cache size and number of cores affect their performance.</td>
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<th>AQA GCSE Computer Science</th>
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<td>Understand how different components link to a processor (ROM, RAM, I/O, Storage, etc)</td>
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<td>Be able to explain the effect of common CPU characteristics on the performance of the processor. These should include clock speed, number of cores …</td>
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<td>Be able to categorise devices as input or output depending on their function</td>
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COMPUTER COMPONENTS
Computers

- Principal components of a computer
  - Processor
  - Memory
  - Input and Output
Processor

- The part that does the calculation
CPU

- Instructions and data read from memory
- Results written to memory
Graphics Processing Unit (GPU)

- Another computer
  - Separate card → same chip

- Best for graphics calculations
  - Games
  - Frame rate
Memory

- Lots of different types
- Volatile versus permanent
- Size and performance
Motherboard

• Joins everything together
• Standards

• Wires inside
Interface Devices and Cards

- ISA bus Ethernet card
- PCI sound card
- Sound blaster live!
Raspberry Pi

- Complete small computer
- Similar to a mobile phone
USB sockets
Ethernet controller
GPIO
Power: 5V, 1 A
Ethernet socket
USB sockets
Audio

DSI Display I/F

Composite video

Camera connector

HDMI socket
UNIVERSAL MACHINE

The Idea of a Stored Program Computer
What’s a Computer?

• ‘Do anything’
  • With a program
• ‘Do nothing’
  • Without a program

• Embedded computers
  • Control, toys
CLOCKS AND CORES
Clock Speed and Moore’s Law

• CPU repeats the same cycle:
  • Fetch: gets the next instructions
  • Execute: move data according to the instruction

• Clock ‘conducts’ this cycle
  • First IBM PC ~ 8MHz
  • Today ~ 2 GHz

• Greater speed → more instructions per second

• Moore’s law → smaller
  • ... in the past this has meant faster
Pipelines and Cores

• Moore’s law → more transistors

• Idea 1: pipeline
  • Like a factory
  • More instructions / sec

• Idea 2: superscalar – parallel pipelines

• Idea 3: many CPU (cores)
  • Share memory

• Multiple cores do not make 1 program faster
Summary – Computer

• Stored program computer
• Processor(s) – CPU and GPU
• Memory
  • Data and program
• Storage
• Idea of a universal machine
  • Computer + program
• Clock speed
  • 2 GHz → $2 \times 10^9$ instructions per second