**GCSE Computer Science System Architecture**

**Working from home workbook**



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| **Your Name:**  |  | **Class:**  |  |

Due to school closures, self-isolations etc. it is necessary for you to stay away from school and complete work at home. We have tried to make this as easy as possible for you and have provided you with this workbook.

This workbook is designed to be used to help you continue to revise and prepare for your GCSE Computer Science exams.

 

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**Instructions:**

Work through as many sections as you can. We understand that some of you may be ill during this time or helping to look after others who may be ill, so we ask that you do as much as you can. Obviously the more you can complete, the better you will be prepared for your exams so it is in your own interest to work through as much as you can.

Watch the videos where prompted and complete the tasks that are asked. We have tried to cut down on the printing and wasted paper by only including the links to the videos and the tasks and not taken up valuable space with information you can find elsewhere. If you do not have access to YouTube please feel free to use whatever other source of information you have such as textbooks, your own notes etc. to enable you to complete the tasks.

If you have any problems with completing any of the tasks or need any extra help then please contact your teacher however please understand that if they are ill or are looking after somebody else who is ill, they will not be able to give you immediate feedback and you may have to wait for a response.

When you return to school, please bring this workbook with you so your teacher can provide feedback.

We understand this is a difficult time for many but please remain patient and contact your school or teacher if you have any questions or need any additional help.

# What is the CPU?

[**https://youtu.be/3hoizyuPt54**](https://youtu.be/3hoizyuPt54)

If you don’t have access to YouTube, feel free to look up the information in a textbook or other source.

**Now answer these questions:**

1. What do busses do on the motherboard?

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1. What is Moore's Law?

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1. What is cache memory used for?

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1. What happens at each stage of the Fetch – Decode – Execute cycle?

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| Fetch   |
| Decode  |
| Execute  |

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# The Von Neumann Architecture

[**https://youtu.be/PYdHib45nu8**](https://youtu.be/PYdHib45nu8)

If you don’t have access to YouTube, feel free to look up the information in a textbook or other source.

1. What made Von Neumann’s architecture different from previous computers?

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1. Which type of memory is fastest and closest to the CPU, but is also the most expensive? (Tick one)

 ❑ Secondary ❑ Cache ❑ RAM

1. Draw a diagram that shows how the CPU works and is connected to input, output and cache memory. Include and clearly identify the individual registers, the part of the CPU that performs calculations and the part of the CPU that controls how data is transferred around the processor. Make sure your diagram is clearly labelled.

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# The performance of the CPU

[**https://youtu.be/5uTxaKqg2h4**](https://youtu.be/5uTxaKqg2h4)

If you don’t have access to YouTube, feel free to look up the information in a textbook or other source.

1. How many instructions can a 4GHz computer process in 3 seconds? (show your workings out and please note: 1 million is written as 1,000,000 and 1 billion is written as 1,000,000,000)

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1. Why would the size of the cache memory affect the speed of a computer?

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1. Why can the number of cores a CPU has, affect the speed of the computer?

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**Please note:** It takes 1 man, 8 hours to build a brick wall that measures 2 meters x 2 meters. If 2 men were building the same wall, they can build it in half the time, meaning the same size wall can be built in only 4 hours. However, not all jobs can be sped up just be having more people working on it. For instance, it takes 1 woman, approximately 40 weeks (just over 9 months) to have a baby (from conception to birth), but 2 women would not speed up the time to 20 weeks it will still take 40 weeks.

Using the same logic having 2 cores in a processor will not always double the processing speed as some jobs can not be split up and run simultaneously, however having more cores will certainly make the computer much faster because there will be some instructions that can be shared between the cores and run simultaneously.

# Recap Systems Architecture

Use the space below to draw a mind map of important points you have learnt about the CPU, the Von Neumann architecture and the performance of the CPU. Include as much colour, relevant doodles and important information as you can.

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# Practise Exam Questions

1. Describe the purpose of the Control Unit. [2 marks]

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1. Describe the function of the following registers. [2 marks]

MAR ...................................................................................................................................

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MDR ................................................................................................................................... ...........................................................................................................................................

1. What happens at each stage of the fetch-execute cycle? [3 marks]

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1. Elinor says, “*a quad-core processor is twice as fast as a dual-core processor*”. Explain why she is mistaken in believing this. [4 marks]

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# Mark Your Exam Questions

Look back on your answers and mark them using the following criteria.

**1) Describe the purpose of the Control Unit.**

1 mark for any of the following bullet points (max 2 marks)

* The control unit controls the flow of data within the CPU
* The control unit controls the flow of data to other parts of the computer system such as input/out devices and memory
* The control unit carries out the instructions, such as save data to memory, retrieve data to memory etc.

**2) Describe the function of the following registers.**

1 mark for any of the following bullet points, no marks for simply giving the full name of the register (max 2 marks)

* MAR – Holds the memory address that is going to be used by the CPU
* MDR – Holds the data or instruction that is going to be used by the CPU

**3) What happens at each stage of the fetch-execute cycle?**

1 mark for any of the following bullet points (max 3 marks)

* During the fetch part of the cycle the data or instructions to retrieved from memory.
* During the decode part of the cycle the CPU decides of it is data or an instruction and which part of the CPU needs to execute it (ALU or CU).
* During the execute part of the cycle the instruction is carried out or the data is sent to the correct part of the memory.

**4) Elinor says, “a quad-core processor is twice as fast as a dual-core processor”. Explain why she is mistaken in believing this.**

1 mark for any of the following bullet points (max 4 marks)

* A quad-core processor contains 4 cores and a dual-core processor contains 2 cores
* Some programs contain instructions which can be run simultaneous (at the same time) and do not need to wait for other before being processed.
* Many tasks cannot be run simultaneously and so the instructions need to wait until another is completed before it can run.
* This would mean that having more cores makes it faster but not double the speed as not all sets of instructions can be split evenly between two cores.