OCR GCSE COMPUTER SCIENCE



AUTUMN TERM 2

COMPUTER ARCHITECTURE, MEMORY AND STORAGE





Class: ………………………………………………………………………….

Name: ……………………………………………………………………….

Target grade: ……………………………………………………………

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| **Lesson 1: Computer Systems**  |

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| 1. Write down a definition for a computer system:  |

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| 2. Draw a diagram to represent a computer system |

3. List three examples of input devices which can be used to input data

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| 1. |
| 2. |
| 3. |

4. List three examples of input devices which can be used to input data

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| 1. |
| 2. |
| 3. |

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| 5. What is an embedded computer? |

6. Give three examples of devices where embedded computers are used

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| 1. |
| 2. |
| 3. |

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| **Lesson 2: The CPU** |

1. The CPU fetches instructions from ……………………… and executes those instructions. It processes data using the ………………………...

2. The control unit controls the way data moves around the CPU. Write down two other things that it does:

a.

b.

3a. The arithmetic logic unit (ALU) is found inside the CPU. What does the arithmetic part do?

3b. What does the logic part do?

4. A register is a special type of ……………………. inside the CPU which can ……………………………….hold a data value whilst a software program is running.

5. The CPU contains another type of temporary memory. This is faster to access than RAM but slower than the registers. What is this memory called?

……………………………………

6. What happens each time the clock inside the CPU ticks?

7a. The …………….. bus carries data around the system

7b. The …………………. bus carries information on the location of the data

7c. The …………………. bus handles commands to control the hardware devices

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| **Lesson 3: Von Neumann Architecture** |

1. Von Neumann architecture is where both the …………….. and the …………………. that are currently being used are stored in computer ………………… (RAM)

|  |
| --- |
| 2. Write down three features of the Von Neumann architecturea. |
| b. |
| c. |

3. When the CPU needs to fetch an instruction or data from RAM, it is initially stored in the ………………………………. It is then moved from the …………….. to the relevant register in order to be processed

4. Describe the role of the Instruction Register

5. Write down the register that fits this description: The ……………………………… is used to identify the location of the next instruction (or data) to be executed by the CPU

6. Describe the role of the Memory Address Register

7. Describe the role of the Accumulator

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| **Lesson 4: Fetch-Decode-Execute Cycle** |

1. Complete the following diagram to illustrate the Fetch operation.

The program you want to run is loaded into

The starting address location is loaded into the

The program counter value is copied into the

The Control Unit then loads the address on to the

And then sends a signal to

To read the address

The instruction at that address is passed across the data bus and copied into the

The instruction in the MDR is copied into the

So that it is ready to use during the next stage (Decode)

The

Is incremented by one location so that it is ready to begin the next fetch cycle.

***That is the end of the fetch cycle.***

2. Explain what takes place during the ‘decode’ part of the fetch-decode-execute cycle

3. Outline what takes place during the ‘execute’ part of the fetch-decode-execute cycle

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| **Lesson 5: CPU Performance** |

**Glossary**

|  |  |
| --- | --- |
| Central Processing Unit (CPU) |  |
| Clock |  |
| Gigahertz |  |
| Overclocking |  |
| Heatsink |  |
| Core |  |
| Cache |  |

1. The three main factors which affect the performance of a CPU are:

a)

b)

c)

2. During each tick of the clock, how many instructions can be processed?

1 100 1000 1 million

3. How many instructions can a 3 GHz CPU process per second?

4. The higher the clock frequency, the faster the CPU can run

TRUE FALSE

5. There is a limit to the speed that a CPU clock can tick because:

6. To keep the temperature of the CPU down, which of the following are used?

A thermometer A motherboard A heat sink

7. Circle which of the following ARE part of a CPU core:

|  |  |  |
| --- | --- | --- |
| Register | Heat sink | Control Unit |
| Hard disk | ALU | External cache |

8. Fill in the blanks

|  |  |  |  |
| --- | --- | --- | --- |
| dual | split | four | Tasking |
| tasks | simultaneously | parallel | Sequential |

Having additional cores allows more tasks to be carried out …………………….. This is called multi-…………………. and it speeds up the processing time. A CPU with two cores is called a ‘……………… core processor’. A CPU with …………… cores is called a ‘quad core processor’. A quad core processor can deal with four ………….. at the same time. ………………. processing is where a single task is ………… into two or more parts and each part is processed at the same time. However, this doesn’t always double performance as some programs are …………………. and cannot easily be split into two parts.

9. The cache acts as a temporary buffer between the …………….. and ……………….

10. The cache stores instructions and data that are frequently been used, ……………………………………………………………………………………………………………………………………

11. Because instructions and data can be used directly from the cache, it …………… processing

12. The CPU will always have its own internal cache

TRUE FALSE

13. Cache memory is FASTER / SLOWER to access than RAM

14. Cache memory is LESS / MORE expensive than RAM

Tick if you understand the following:

|  |  |
| --- | --- |
| Clock speed |  |
| How the clock speed can affect the performance of the CPU |  |
| How Gigahertz relates to the number of instructions that can be processed |  |
| Why CPUs have a limit to how fast they can run |  |
| Overclocking |  |
| Heatsinks |  |
| CPU cores |  |
| Dual and quad core processors |  |
| How having additional cores can speed up processing time |  |
| Why having two cores won’t always mean double the processing speed |  |
| The cache |  |
| How a cache can help improve CPU performance |  |
| Internal and external cache |  |
| A disadvantage of the cache |  |

If there is anything in this list that you have not ticked, go back and re-read that section

|  |
| --- |
| The score I got in my quiz was …………………. |

|  |
| --- |
| Write down one question that you still want to ask about this topic.  |
| Look up the answer and write it down here  |

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| --- |
| **Lesson 6: Memory** |

**Glossary**

|  |  |
| --- | --- |
| Main memory |  |
| Gigabyte |  |
| Volatile memory |  |
| Non volatile |  |
| Virtual memory |  |
| Disk thrashing |  |
| Read-write |  |
| Read only  |  |
| BIOS |  |

1. For programs to be accessed by the CPU the ………………………………. loads them into ………

2a. A typical personal computer might have around ………. GB of RAM installed

2b. A computer where processing heavy applications are run may have up to ….... GB of RAM installed

3. RAM is: VOLATILE NON VOLATILE

4. James is writing an essay. He has it on his screen but hasn’t saved it to the hard disk. The electricity goes off for a few seconds. When the computer reboots, there is no sign of James’ essay. Explain why.

5a. Virtual memory is found on the ………………..

5b. Virtual memory is VOLATILE NON VOLATILE

6. Briefly explain how virtual memory works

7. Explain why adding additional RAM might help improve the computer’s performance

8. ROM is READ ONLY READ / WRITE

9. What was traditionally stored in ROM? …………………………………..

10. Name one other thing that ROM can be used to store

…………………………………………………………………………………………………..

11. In the table below, compare RAM and ROM

|  |  |
| --- | --- |
| **RAM** | **ROM** |
|  |  |
|  |  |
|  |  |

12. Flash memory is READ ONLY READ / WRITE

13. Flash memory is often used to store the BIOS instructions TRUE FALSE

14. A disadvantage of flash memory is that ……

Tick if you understand the following:

|  |  |
| --- | --- |
| The term ‘memory’ |  |
| The purpose of RAM |  |
| The terms ‘volatile’ and ‘non volatile’ |  |
| Why virtual memory is used |  |
| The purpose of ROM |  |
| Why flash memory is used rather than ROM |  |

If there is anything in this list that you have not ticked, go back and re-read that section

|  |
| --- |
| The score I got in my quiz was …………………. |

|  |
| --- |
| Write down one question that you still have about this topic.  |
| Look up the answer and write it down here  |

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| **Lesson 7: Storage** |

**Glossary**

|  |  |
| --- | --- |
| Non volatile | Data is retained when the power is lost |
| Storage device |  |
| Storage media |  |
| Magnetic storage |  |
| Optical storage |  |
| Solid state media |  |
| Serial access |  |
| Random access  |  |

1a. Memory, or primary storage, cannot store programs and data long term because it is

………………………

1b. Storage (also known as secondary storage) can store data long term because it is

…..………………….

2. There are three main storage technologies. These are:

|  |  |  |
| --- | --- | --- |
| ………….. | …………… | ……………. |

3. Complete the following table:

|  |  |  |
| --- | --- | --- |
| **Storage Media** | **Technology Used** | **Example of use** |
| Magnetic hard disk | Magnetic | Main storage for computer programs and files |
| Magnetic tape |  |  |
| Compact Disk (CD) |  |  |
| DVD & Blu Ray |  |  |
| Solid state hard drive |  |  |
| USB memory stick |  |  |
| Flash memory card |  |  |

4. Complete the following table:

|  |  |  |
| --- | --- | --- |
| **Storage Technology** | **Advantages** | **Disadvantages** |
| Magnetic | Low cost per gigabyte of storage – cheapest of the three technologiesHuge storage capacityMagnetic tape can hold its data for decades | Not as portable as other technologiesData can be lost near strong magnetic fieldsHard disk has mechanical moving parts so it can wear outMagnetic tape is serial access so it can be slow to retrieve files |
| Optical |  | Easily scratched or brokenOnce data has been written to the disk, most optical disks cannot be overwritten – they become read onlySlow to write data to. |
| Solid state / flash | Very portableImmune to magnetic fieldsTough – not easily damagedFast data access |  |

5. Complete the following table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Media** | **Capacity** | **Cost** | **Speed** | **Portability** | **Reliability & durability** |
| Magnetic hard disk | 1-8TB | Inexpensive for large amounts of data | Fast, but not as fast as an SSD | Not portable if inside a computer.Portable hard drives are available but they are larger and heavier than disks or USB sticks |  |
| Magnetic tape | Up to 330TB (Sony) |  | Serial access so very slow | Portable but fairly large. | Can store data up to 30 yearsSusceptable to magnetic fields |
| Disks – CD, DVD, Blu-Ray (CD) |  | Inexpensive up to approx. 10GB but too expensive for large amounts of data |  | Easy to carry around |  |
| Solid state hard drive | 1-8TB | Expensive per gigabyte of storage | Very fast data access |  | Very reliable. Has a limited number of write/erase cycles |
| USB memory stick |  | Expensive per gigabyte of storage |  |  | Very reliable. Has a limited number of write/erase cycles  |

6. Read the notes about how to calculate storage capacity required:

<http://www.teach-ict.com/2016/GCSE_Computing/OCR_J276/1_3%20storage/secondary/miniweb/pg7.php>

Use the following information to help you answer the questions:

|  |  |
| --- | --- |
| **Data** | **Storage space required** |
| MP3 music file | 4 MB |
| JPG photo | 2 MB |
| Movie  | 5 GB |
| Word document | 50 KB |

6a. You currently have 250 photographs stored on your memory card. You know that you will take around 100 additional photographs whilst on holiday. Calculate the minimum storage sized memory card that you will be needed to hold all of your photographs.

Show your working out.

6b. Sandeep would like to upgrade his computer. On his current computer he has stored 2,000 songs, 10 movies and 1,000 documents. How much space will be taken up on his new hard drive with the files that he already stores?

Show your working out.