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| **Computer Science (9-1)**CPU Set 1 |  |
| Please note that you may see slight differences between this paper and the original.Candidates answer on the Question paper.**OCR supplied materials:**Additional resources may be supplied with this paper.**Other materials required:**•   Pencil•   Ruler (cm/mm)  | **Duration:** Not set       |
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## INSTRUCTIONS TO CANDIDATES

•   Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
•   Use black ink. HB pencil may be used for graphs and diagrams only.
•   Answer **all** the questions, unless your teacher tells you otherwise.
•   Read each question carefully. Make sure you know what you have to do before starting your answer.
•   Where space is provided below the question, please write your answer there.
•   You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number
    and question number(s).

## INFORMATION FOR CANDIDATES

•   The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography
    a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and
    grammar and the use of specialist terminology* is assessed.
•   The number of marks is given in brackets **[ ]** at the end of each question or part question.
•   The total number of marks for this paper is **32**.
•   The total number of marks may take into account some 'either/or' question choices.

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| **1(a).** | Ann wants to purchase a new computer and is looking at two models. The specification of the CPU in each computer is shown in **Fig. 1**.When running a 3D flight simulator, Computer 1 is likely to run faster than Computer 2.Using the information in **Fig. 1**, identify **one** reason for this.  **[1]**  |

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| **(b).** | Identify **four** events that take place during the fetch-execute cycle.    **[4]**  |

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| **2.** | Gareth has a satellite navigation system (Sat Nav) which contains an embedded system. Define what is meant by an ‘embedded system’.  **[1]**  |

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| **3.** | Ann wants to purchase a new computer and is looking at two models. The specification of the CPU in each computer is shown in **Fig. 1**.Explain **one** reason why the cache size affects the performance of the CPU.  **[2]**  |

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| **4.** | Identify **three** devices, other than a Satellite Navigation system, that contain embedded systems.   **[3]**  |

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| **5.** | Here are some statements about the CPU of a computer.Tick **one** box in each row to show whether each of the following statements is true or false.

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| **Statement** | **True** | **False** |
| CPU stands for Central Processing Unit. |   |   |
| The CPU fetches and decodes instructions. |   |   |
| The speed of a CPU is usually measured in GigaHertz (GHz). |   |   |
| If a CPU has many cores, this slows down the computer. |   |   |
| The hard disk drive is part of the CPU. |   |   |

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**[5]**  |

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| **6(a).** | Dipesh is thinking of buying a tablet computer to replace his old desktop computer.Describe how the CPU and RAM work together to enable the tablet computer to operate.       **[3]**  |

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| **(b).** | The tablet computer also uses cache memory. Describe the purpose of cache memory.     **[2]**  |

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| **7.** | Quinn's current computer specification is shown in Fig. 4.**Fig. 4**Describe the benefits of a dual core processor over a single core processor.   **[2]**  |

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| **8(a).** | The CPU has a clock speed of 3.8 GHz.Describe what is meant by a clock speed of 3.8 GHz.   **[2]**  |

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| **(b).** | Alicia has designed a computer using Von Neumann architecture.Describe the purpose of **two** registers that are used by Von Neumann architecture.

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| **[4]** |

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| **(c).** | Alicia says:“My computer has a quad-core processor, so it will run twice as fast as a computer with a dual-core processor”.Explain why this statement is not always true.     **[3]**  |

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**END OF QUESTION paper**

# Mark scheme

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| **Question** | **Answer/Indicative content** | **Marks** | **Guidance** |
| 1 | a |  | It has more cores. | 1 | Although Computer 1 has a lower clock speed than the CPU in Computer 2 it has more cores, which means that it can be faster than Computer 2.Any answer relating to splitting a program into processes that be carried out consecutively will be accepted. |
|  | b |  | * An instruction is fetched from memory
* The instruction is then decoded
* The decoded instruction is then executed so that the CPU performs continuously
* The process is repeated
* The program counter is incremented
* The instruction is transferred to the MDR
* The address of the instruction to be fetched is placed in the MAR
 | 4 | 1 mark is to be awarded for each correct answer to a maximum of 4 marks. |
|  |  |  | **Total** | **5** |  |
| 2 |  |  | * A computer system that is built into another device
 | 1 |  |
|  |  |  | **Total** | **1** |  |
| 3 |  |  | * data is transferred faster (1)…
* …which makes a CPU more efficient (1)
* It is faster to transfer to and from cache (1)…
* …than transferring to and from RAM (1).
 | 2 | 1 mark to be awarded for each correct identification and 1 mark to be awarded for the associated explanation to a maximum of 2 marks. |
|  |  |  | **Total** | **2** |  |
| 4 |  |  | Three devices from:* Dishwasher
* MP3 player
* Washing machine
* Mobile phone
* Manufacturing equipment
 | 3 | 1 mark to be awarded for each correct example identified to a maximum of 3 marks.There are many other examples of devices with embedded systems which may be acceptable. |
|  |  |  | **Total** | **3** |  |
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| **Statement** | **True** | **False** |
| CPU stands for Central Processing Unit | ? |   |
| The CPU fetches and decodes instructions | ? |   |
| The speed of a CPU is usually measured in GigaHertz (GHz) | ? |   |
| If a CPU has many cores, this slows down the computer |   | ? |
| The hard disk drive is part of the CPU |   | ? |

One mark per row | 5 | **?Examiner's Comments?**?This question was generally well answered. |
|  |  |  | **Total** | **5** |  |
| 6 | a |  | * Instructions / programs(currently running) / data are stored in the RAM…
* these are fetched from the RAM by the CPU / Processor
* … where the instructions are executed / instructions are processed / data is processed
 | 3 | If the candidate has described the functions of RAM and the CPU separately, only award the 2nd bullet if it is clearly stated that instructions are fetched from RAM.Mention of the fetch – execute cycle in the CPU is enough to award bullet 3. |
|  | b |  | * To store instructions / data that is frequently used / previously used / next to be used
* Data does not need to be fetched from RAM
* Speeds up access
 | 2 |  |
|  |  |  | **Total** | **5** |  |
| 7 |  |  | 2 from* Tasks can split between the processors…
* …tasks / processes / software / can be processed faster
* …more processes completed per second
* Allows multitasking /Run more than one process / task / instruction / data at a time / per clock cycle…
* … tasks / processes / software / can be processed faster
* …more processes completed per second
 | 2 | MUST have given splitting tasks, or multi-tasking to allow speedFaster can only be given a mark if the first bullet(s) have been given. **Examiner's Comments**This question was answered fairly well, candidates were able to express that two processes could be carried out at once, and they then often got a second mark for identifying that this made it faster. Some candidates could not clearly express what was being processed, or simply stated that it was faster which was insufficient as the actual processes are not carried out faster, it is faster because it is completing two processes at the same time. |
|  |  |  | **Total** | **2** |  |
| 8 | a |  | 1 mark per bullet to max 2* The number of FDE cycles run per given time/second/ the frequency that the clock ‘ticks’
* 3.8 billion cycles/instructions …
* …per second
 | 2AO1 1b (1)AO2 1a (1) | Do not award: how fast the computer is / speed of CPU3.8 = 3,800,000,000 **Examiner’s Comments**This question was answered well with many candidates able to demonstrate an understanding of the clock speed of a computer. Fewer candidates correctly translated the 3.8 GHz into the correct number of instructions/FDE cycles performed. Less able candidates did not identify an appropriate time frame, for example ‘the number of instructions it can process’ has a different meaning to ‘the number of instructions it can process per second’. Another common misconception was it is the number of instructions it can perform at a time, a processor can only perform one instruction at a time. |
|  | b |  | 1 mark per bullet to max 2 per register* MAR / memory address register
* Stores the address/location where data will be **read/written/accessed/fetched**/ address/location of data/instruction being **processed**/ address/location of data/instruction next to be **processed**
* MDR / memory data register
* Stores the data/instruction that is **fetched/read** from memory/ stores the data that is to be written to memory/ stores the data/instruction from the address in the MAR/ data/instruction next to be **processed**
* Program counter
* Stores the address/location of the next instruction to be run/ stores the address/location of the current instruction being run
* Accumulator
* Stores the result of manipulation/process/calculation
 | 4AO1 1a (2)AO1 1b (2) | MAR stores address is not enough for descriptionMDR stores the data is not enough for descriptionAllow:* Current instruction register / IR
* Stores the instruction currently being processed

Accept MBR / Memory buffer register for MDR**Examiner’s Comments**Many candidates were able to accurately name two registers. The more able were able to accurately describe the purpose of these registers. Some candidates were not specific enough in their responses to gain the descriptive marks, or repeated the name of a register without the purpose, e.g. ‘The memory address register stores the address of the data’. |
|  | c |  | 1 mark per bullet to max 3e.g.* Software may be designed to run on 1 core and not multiple cores/ depends on the task(s)
* …some tasks cannot be split across cores
* Clock speed also affects speed/ dual core may have a faster clock speed/ quad-core may have slower clock speed
* …so one task may be run faster/slower
* RAM size also affects speed/ Quad-core may have less RAM/ amount of VM being used
* Cache size also affects speed/ Quad-core may have less cache
 | 3AO1 1b (1)AO2 2b (2) | Allow marks for other components that could affect the speed e.g. secondary storage access speed, onboard GPU.Award description of concurrent processing. **Examiner’s Comments**Most candidates were able to identify other features that could also have an impact on the speed of the computer such as the processor speed, amount of RAM etc. The more able candidates were also able to identify that the tasks being performed will also impact on the speed, for example how software may not be optimised for quad-core, or that a process may have to wait for a different process to finish execution before it can be processed. |
|  |  |  | **Total** | **9** |  |