1   A computer has a Central Processing Unit (CPU).

Give **three** characteristics of a CPU that can affect its performance.

1 _____

2 _____

3 _____ **[3]**

2(a) The specification of two CPUs is shown in **Fig. 1**.

Computer 1	Computer 2
Clock Speed: 1 GHz	Clock Speed: 1.4 GHz
Cache size: 2 MB	Cache size: 2 MB
Number of Cores: 4	Number of Cores: 2

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]**

(b) Identify **two** other parts of a computer that are not in **Fig. 1**, which could improve the performance of the computers.

1 _____

2 _____

[2]

(c) Explain **one** reason why the cache size affects the performance of the CPU.

_____

_____

_____

[2]

3   Kerry wants to buy a new computer, but she does not understand what the different parts of a computer do.

Kerry has heard of a CPU but does not know what it is.

   i. The following sentences describe the purpose of a CPU.

Complete the sentences by filling in the missing words.

CPU stands for ....

It is the part of the computer that fetches and executes the ....

that are stored in ....

The CPU contains the Arithmetic .... Unit (ALU) and

the .... Unit (CU).

[5]

  ii. Kerry is looking at two computers; one has a single core processor and the other has a dual core processor.

Explain why having a dual core processor might improve the performance of the computer.

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[2]

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 iii. One computer has 64 kilobytes of cache and the other has 512 kilobytes of cache.

Explain how the cache size can affect the performance of the CPU.

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[2]

4(a)   The CPU has a clock speed of 3.8 GHz.

Describe what is meant by a clock speed of 3.8 GHz.

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[2]

(b) 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.

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[3]

5   Quinn's current computer specification is shown in Fig. 4.

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1.5 GHz Dual Core Processor
1GB RAM
100GB Hard Drive
64KB Cache
Touchscreen
Integrated camera and speakers
2 × USB 3.0 ports
2 × USB 2.0 ports
Blu-ray drive
2GB Graphics Card
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Fig. 4

Describe the benefits of a dual core processor over a single core processor.

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[2]

6(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**.

Fig. 1

Computer 1	Computer 2
Clock Speed: 1 GHz	Clock Speed: 1.4 GHz
Cache size: 2 MB	Cache size: 2 MB
Number of Cores: 4	Number of Cores: 2

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]

(b) Identify **two** internal components that are not in **Fig. 1**, which could improve the performance of the computers.

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[2]

(c) Explain **one** reason why the cache size affects the performance of the CPU.

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[2]

7(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]

(b) The tablet computer also uses cache memory. Describe the purpose of cache memory.

-- [2]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1			1 mark each to max 3 • Clock speed • Cache size • Number of cores	3	'clock' 'cache' 'speed' 'cores' on its own is NE. **Examiner's Comments** Candidates were often able to identify at least one characteristic of a CPU, most commonly the clock speed and number of cores. Some responses were not precise enough as to the characteristics, for example stating 'clock' or 'core' without reference to the speed of the clock, or the number of cores, which were too ambiguous.
			Total	3	
2	a		It has more cores.	1 (AO2 1a)	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		RAM SSD HDD Graphics card (GPU)	2 (AO2 1a)	Marks can be awarded for other appropriate responses: e.g. Motherboard Sound card
	c		• 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 (AO2 1a)	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	5	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
3		i	1 mark for each completed word CPU stands for <u>Central Processing Unit</u>. It is the part of the computer that fetches and executes the <u>instructions</u> that are stored in **(main)** <u>memory</u>. The CPU contains the Arithmetic <u>Logic</u> Unit (ALU) and the <u>Control</u> Unit (CU).	5 AO1 1a (5)	Accept: • RAM/registers in place of "memory" • bod cache/MDR/CIR in place of memory • 'and Logic' in place of Logic • ignore 'data' if they put 'data and instructions' but no mark for data on its own • Do not award command for instructions • Bod central processor unit • Bod logical <u>Examiner's Comments</u> This question required candidates to identify the missing key words in the sentences. Candidates tackled this question well and many were able to identify several correct missing words. CPU was regularly given correctly, as was Logic and Control. Candidates found the other two words more challenging. Instructions was often replaced by data, which is too vague because data is not executed as required in the questions. Memory was the most common answer for the third space, but some candidates were more specific and correctly identified registers, or memory data register. A small number of candidates put memory address register which was incorrect due to it not storing instructions, but the address of the instructions.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		ii	1 mark per bullet to max 2 • Dual core is 2 processors/cores // double the number of processors/cores • Parallel processing can take place • … which means each processor can execute a separate instruction **at the same time** // each processor can run a different part of the program **at the same time** // each core can process instructions **independently** of each other • ...which enables multitasking • Some processes/software **cannot** be split between two processors so it does not increase the performance	2 AO1 1b (1) AO2 1b (1)	• Needs the notion of the processors acting at the same time i.e. not just 'it can run twice as many instructions' without 'at the same time'. • Do not award more instructions per second - this could be achieved by having a faster clock speed. • Allow FDE for 'executing instructions'. • Do not allow 'cores can split the tasks' – need to be how i.e. one task for each core to run at the same time. • BOD run more than one program at once Examiner's Comments This question required candidates to consider the reasons why the performance was improved. This 'why' was missed by some candidates who repeated the question by explaining that a dual core processor improved the performance. Some candidates identified that it meant more processes could be run per second, but this was too vague because it is not one core that is completing more instructions per second, but two cores that can both process instructions at the same time; the latter part being required for the mark to be given.

Question			Answer/Indicative content	Marks	Guidance
		iii	1 mark per bullet to max 2 • Cache stores frequently/recently/next to be used instructions/data • …that can be **accessed** faster than **accessing** them from <u>RAM</u> • …which means more cache improves the performance of the CPU // less cache decreases the performance of the CPU • Too much cache can be detrimental … • …as it will take longer to find the instructions in cache	2 AO1 1b (2)	• No mark for just defining cache as being fast memory or close to the CPU. • No mark for cache is faster than RAM - faster at what? • Bod - More cache makes the processing faster • Bod - More cache makes the computer run faster **Examiner's Comments** This question required an understanding of how the cache size improves the performance, as opposed to the why of the previous question. This required candidates to demonstrate an understanding of what cache is and how it affects the computer. Many candidates were able to identify that cache stored frequently used instructions, but fewer were able to demonstrate an understanding that the more cache meant an improved performance. Some candidates gave the improved performance but without a context i.e. that the computer with more cache improved the performance.
			Total	9	

Question			Answer/Indicative content	Marks	Guidance
4	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	2 AO1 1b (1) AO2 1a (1)	Do not award: how fast the computer is // speed of CPU 3.8 = 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.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance

	b		1 mark per bullet to max 3
			e.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
				3
				AO1 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	5	

Question			Answer/Indicative content	Marks	Guidance
5			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 speed Faster 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	
6	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		RAM SSD HDD Graphics card (GPU)	2	Marks can be awarded for other appropriate responses: E.g. Motherboard Sound card
	c		• 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	5	

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Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
7	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	