Question			Answer/Indicative content	Marks	Guidance
1	a		1 mark per bullet to max 4: • The **contents** of the Program Counter/PC are **copied/sent** to the Memory Address Register/ MAR • The address is **sent/transferred** along the address bus • The control unit **sends/transfers** a (read) signal along the control bus • Contents stored in the memory address are **sent/transferred** along the data bus • Contents (from memory) are stored in the Memory Data Register/MDR • ...and **sent/copied** to the Current Instruction Register/ CIR • The Program Counter/PC is incremented	4	Accept IR/Instruction Register for CIR/Current instruction Register Accept MBR/Memory Buffer Register for MDR/Memory Data Register Examiner's Comments Candidates who had good knowledge of the FDE cycle were able to gain 3 or 4 marks on this question. Some candidates did not have a good understanding of what a register or a bus is and tended to say they did something other than transport or temporarily store. Many however gave clear and correct responses. Misconception Some candidates gave responses which mentioned a register fetching the data or passing data. A register is a temporary store for data/instructions/addresses and as such doesn't fetch or pass anything. Exemplar 1 The PC holds the next instruction's address which is copied to the ~~RAM~~ MAR, memory address register. The Program Counter is incremented. The address from the MAR is sent on the address bus to the memory. Simultaneously a fetch/read signal is sent on the control bus by the control unit. The data or instruction goes on the data bus and is copied into the Memory Data Register. It is then copied into the CIR [4] This candidate has shown a clear understanding of the role of the buses and registers in the fetch part of the FDE cycle.
	b		• Program Counter // PC	1	Examiner's Comments Candidates who understood the FDE cycle gained the mark. Those that did not tended to mention a register used in the fetch or decode stages.

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Question			Answer/Indicative content	Marks	Guidance
	c		1 mark per bullet: • Allows the next instruction to be fetched **whilst** the previous one is being decoded/executed //allows the overlapping of different parts of the FDE • It **increases** throughput // **increases** the number of **instructions** processed **in a set period of time** • It prevents the CPU having to wait // prevents idle components	3	DNA responses that talk about the FDE running **faster**. Allow a diagram demonstrating pipelining for MP1. Allow 'it will take less time to do the same amount of instructions' for MP2 BOD 'processes' for 'instructions' for MP2. DNA 'more efficient' on its own for MP2 DNA points if clearly discussing multiple cores. Examiner's Comments Many candidates were able to gain a mark for an instruction being fetched at the same time as another is decoded. Some candidates discussed multiple cores which were mentioned in the question stem but did not apply to this question. Candidates should have access to previous mark schemes.
	d	i	1 mark per bullet to max 3: • 0 • 1, 2, 4 • 8 with no numbers after it	3	CAO Examiner's Comments Most candidates were able to gain at least one mark for the first output on this question with many gaining full marks. A small minority of candidates simply copied the outputs given in the question stem.

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Question			Answer/Indicative content	Marks	Guidance
		ii	1 mark for each correct line. START LDA MAX BRZ END LDA A OUT **LDA B** STA TEMP **LDA A** ADD B STA B **LDA TEMP** STA A LDA MAX SUB ONE STA MAX BRA STAR T END HLT A DAT 0 B DAT 1 **TEMP** DAT 0 MAX DAT 5 ONE DAT 1	4	CAO Case for mnemonics can be ignored. Case for A, B, TEMP must be all caps. Penalise first error and allow FT. Examiner's Comments Most candidates were able to get the mark for the final answer gap and there was a good range of marks across the cohort.
	e		1 mark per bullet to max 3: • Immediate • Indirect • Indexed	3	DNA direct BOD 'index' for MP3 Examiner's Comments Most candidates were able to give indirect as a mode of memory addressing and there were many candidates who gained full marks on this question. A small number of candidates gave responses like by reference or value, and some gave direct which was mentioned in the question stem.

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Question			Answer/Indicative content	Marks	Guidance
	f		1 mark per bullet to max 2: • **Quicker/more efficient** to <u>translate</u> • Makes more efficient use of the CPU // memory // system resources // where a system may have limited resources • The programmer wants direct control over hardware/memory // to access machine specific functionality • Code might be written for a specific architecture • Compilers/interpreters may not be available	2	MP1 must be a comparison e.g. faster/quicker not just fast/quick <u>Examiner's Comments</u> More successful candidates were able to give two valid reasons. Less successful candidates tended to give responses like it is easier to read or easier for the computer to understand. Some candidates were confused between an assembler and compilers/interpreters. The most common correct responses were the programmer wanting direct control over the hardware and it needing to be written for specific hardware.
	g		1 mark per bullet to max 3: • Allows **more active/running/temporary** data in RAM • It reduces the need to use virtual memory • RAM is faster to access than VM/secondary storage... • ...because **data** in VM/SS has to be swapped with **data** in RAM first • Use of RAM rather than VM reduces the risk of disk thrashing • Faster bootup/ shutdown time // reduces load/access time	3	MP1 must imply more/larger amount of data Allow 'instructions/programs/apps/processes/tasks' for data. MP2 - BOD 'no need for Virtual Memory'. <u>Examiner's Comments</u> Most candidates were able to gain 1 or 2 marks on this question. Some confused primary with secondary saying that adding more RAM meant there was less need to use primary memory. Some confused RAM with Cache.
			Total	**23**	

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Question			Answer/Indicative content	Marks	Guidance
2	a		1 mark max for input device and 1 mark max for reason: • Heart rate sensor • Detects athlete's electrical activity / heart rate • GPS (receiver) • Mapping the athlete's **movement / position/ speed** • Accelerometer/gyroscope/motion sensor • To track the players acceleration/speed/movement/ counting steps/measuring orientation • Button • To allow the athlete to turn it on/off	2	Allow other suitable input devices as long as they are suitable for the scenario and an input device e.g. thermometers, light and UV sensors, skin response sensors, magnetometers, gyrometer, ECG No FT for use if incorrect device Use must be related to the fitness tracker scenario <u>Examiner's Comments</u> The majority of candidates were able to state the name of a device, but many did not apply the use of their named input device to the scenario and gave responses related to a generic use of the device for example giving a heart rate sensor or monitor and then saying the use was to monitor the heart rate with no reference to the fitness tracker. A few gave devices which were unsuitable for an embedded system carried in a shirt such as keyboard and touchscreen.

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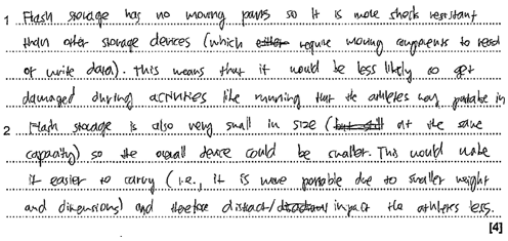
Question			Answer/Indicative content	Marks	Guidance
	b		1 mark for reason and 1 mark for expansion up to a maximum of 4 marks. • Durable/flash has no moving parts... • ...so will be resistant to damage if the player runs/falls/collides with something • Low power usage... • ...won't need recharging/will last during an event • Small **physical size**/portable... • ...so it can fit on a shirt/be unobtrusive/be worn // won't affect the athlete's performance • Fast/real-time read/write speed... • ...needed to rapidly record athlete's data	4	Mark across whole answer space Expansion must relate to scenario DNA 'small' on its own DNA anything to do with capacity <u>Examiner's Comments</u> The majority of candidates were able to give a reason such as durable/no moving parts/ small physical size. Candidates who related the reason to why it would be suitable for the fitness tracker were able to gain full marks. Some candidates did not apply their response to the question stem well and instead talked about things like smart watches. Exemplar 2  1 Flash storage has no moving parts so it is more shock resistant than other storage devices (which ~~either~~ require moving components to read or write data). this means that it would be less likely to get damaged during activities like running that the athletes may partake in 2 Flash storage is also very small in size (~~but still~~ at the same capacity) so the overall device could be smaller. This would make it easier to carry (i.e., it is more portable due to smaller weight and dimensions) and therefore distract/~~dissatisfy~~ injure the athletes less. [4] The candidate has clearly given two reasons with good application to the scenario.
	c	i	1 mark per bullet to max 3: • Contains the computer start up instructions • Loads **settings/configuration** (CMOS/NVRAM) • Initialises/checks hardware/peripheral devices are available/work // carry out a POST check... • ...and **reports** errors • Determines the drive on which the OS is stored • Finds/loads the bootstrap/operating system/kernel (into main memory)	3	DNA 'boots up' on its own <u>Examiner's Comments</u> Many candidates were able to gain at least one or two marks for saying the BIOS finds/loads the operating system and/or checks hardware.

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Question			Answer/Indicative content	Marks	Guidance
		ii	Mark from one group to max 2: • Storing firmware/ config/ operation instructions/ operating system/ device drivers... • ...that can't be overwritten // doesn't need to be updated • ...so that access is faster OR • Storing security settings/encryption keys/digital signatures... • ...that must be maintained/can't be changed OR • Could be used as primary storage... • ...so no need to load programs into memory • ...so would save time loading up the program OR • Could be used as secondary storage... • ....so the device will not need additional storage... • ....to reduce the size of the device	2	Examiner's Comments Strong candidates were able to give a use such as store the operating system and an advantage. Many though, gave a very good description of what ROM is but did not give a different use and so were unable to gain any marks. A few candidates said it could store the BIOS which had already been given in the question. A few candidates talked about microwaves and washing machines which was not relevant to this scenario

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Question			Answer/Indicative content	Marks	Guidance
	d	i	2 marks from each group to max 4: • Resource/memory management e.g. • Moving data between RAM and secondary storage/ virtual memory // paging and/or segmentation • Allocating/deallocating memory • Manage hardware/peripherals e.g. • Tracking all devices connected to the system • Device drivers • File management e.g. • Storing files in secondary storage • Searching for //copying // moving // renaming files/folders • Security/user management e.g. • Controlling who can access the system //Managing user profiles • Controlling who can access certain resources on the system // Managing access rights • Provide a user interface e.g. • Allowing the user to interact with the software/hardware/computer • Providing utilities e.g. • Used to monitor // manage // maintain the computer • To manage the security • Providing a platform on which to run software e.g. • Allows additional software to be installed on the computer • To allow the user to complete additional tasks	4	DNA handle interrupts or manage scheduling. Allow any reasonable description that matches with the role. Mark in groups. <u>Examiner's Comments</u> This was generally well answered and the majority of candidates could give two roles. Less successful candidates were then unable to follow through with a reasonable description. More successful candidates were able to give two roles plus relevant and correct descriptions. Some described scheduling and interrupts which were given in the question and gained no marks.

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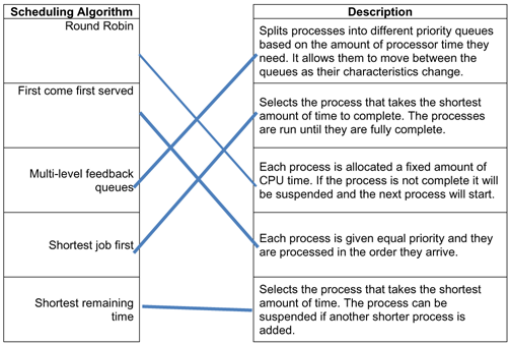
Question			Answer/Indicative content	Marks	Guidance
		ii	1 mark for each correct match.  	5	Examiner's Comments Generally well answered and most candidates gained full marks. Those that did not tended to confuse shortest remaining time with shortest job first but were still able to gain three marks.
	e		**Mark Band 3-High Level (7-9 marks)** The candidate demonstrates a thorough knowledge and understanding of each of the cultural issues. The material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated. *A mark band 3 answer will cover all three points relating to layout, colour and character sets and the cultural impacts of these on the design of the program. The examples will be relevant to the pitch-side program and the needs of the athletes and will go on to evaluate why it is important to ensure these considerations are made.* **Mark Band 2-Mid Level (4-6 marks)** The candidate demonstrates reasonable knowledge and understanding of most cultural issues; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. There is a line of reasoning presented with	9	Points may include but **aren't limited to**: **AO1 Knowledge and Understanding** Accessibility, colour blindness etc are not relevant to context. Cultural issues are about how different groups of people with particular beliefs, practices or languages may be affected by something. The layout is an important factor to consider. This will determine where items will be placed on the screen. Where items are placed on the screen can massively impact how easily people can use them. The layout which is suitable for one country may not be suitable for another. Colour should be carefully considered. Humans have their own personal perception of different colours and will use this to determine what it means. Colour can be used to confirm messages to the audience, e.g. if our interactions with the software has been successful or not. However, colours can mean different things in different cultures. A character set is a list of characters that can be recognised by the hardware and software. There are various different character sets such as ASCII and UNICODE. **AO2 Application** Western audiences will often read from left to right and top to bottom. However, other countries around the world read from right

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Question	Answer/Indicative content	Marks	Guidance
	some structure. The information presented is in the most part relevant and supported by some evidence. *A mark band 2 answer will cover at least two of layout, colour and character sets and will expand the points, relating these to cultural considerations, the pitch-side program and/or the needs of the athletes although these may not be balanced.* Mark Band 1-Low Level (1-3 marks) The candidate demonstrates a basic knowledge of some cultural issues; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear. *A mark band 1 answer will contain some basic, relevant points related to layout, colour and/or character sets. It may not be linked to cultural considerations or the context of the pitch-side program or athlete's needs.* 0 mark No attempt to answer the question or response is not worthy of credit.		to left. Athletes are from around the world and this needs to be considered. Traditionally, green often indicates that something is positive or that an interaction with the computer has been successful. Red often indicates something negative or that an interaction with the computer has not been successful. However, these colours may have different meanings and could be seen as offensive in different cultures. Designers therefore need to ensure they don't offend any particular culture as the app is for international athletes. There are many different character sets. The ASCII character set can only represent 128/256 characters which would be suitable for English and European languages. However, this would not be a suitable character set for other world-wide languages and if used, it would mean that characters could not be displayed which would affect the athletes' use of the app. AO3 Evaluation As the software is being used by different cultures, it is important that the user interface can be used and understood by all audiences otherwise people may choose not to use the fitness trackers e.g. using icons rather than words could be more universally understood by the athletes. The programmer needs to consider the typical layout, colours and characters used in different cultures and ensure these are taken into consideration to ensure that groups of people are not offended and will still understand the words, data and charts. Designers could release different versions of the software for different parts of the world or make sure the program has the ability for settings to be changed to overcome any potential issues and allow the athletes to customise their experience. <u>Examiner's Comments</u> There were a good range of Level 2 responses with good discussions for at least two of the bullet points and related to

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Question			Answer/Indicative content	Marks	Guidance
					different cultures. Some candidates were unable to apply their knowledge to different cultures and instead discussed accessibility concerns. The candidates with Level 3 responses gave good discussions of all three bullet points and related it to different cultures and the athletes. They were also able to discuss how the programmer could go about this. Assessment for learning Candidates should be aware that in level of response questions application of knowledge to the scenario is needed to get into the Level 2 and Level 3 mark bands.
			Total	29	

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3</td><td>a</td><td></td><td>1 mark for each correct application software

<table><tr><th>Task</th><th>Application Software</th></tr><tr><td>Creating graphics such as a logo</td><td>Graphics/image editing software</td></tr><tr><td>Writing letters to clients to confirm their appointment date and time</td><td>Word processing software</td></tr><tr><td>Calculating the company profits at the end of each month</td><td>Spreadsheet/Accounting software</td></tr><tr><td>Storing, searching and updating client details and purchases</td><td>Database software</td></tr><tr><td>Creating brochures and flyers about the organisation</td><td>Desktop publishing software // DTP</td></tr></table></td><td>5</td><td>Allow any sensible software.
e.g. text editor for WP
e.g. photo/image editor for row 1

BOD publication editor for DTP

DNA brand names - ignore brand name if application type is also given.

<u>Examiner’s Comments</u>

Many candidates were able to score at least 4 marks on this question. Those who gave brand names were not given marks as is standard for these types of question. Few candidates were able to give DTP for the fifth application type. Many gave email for the second application type which would not be the most appropriate for writing letters to clients.</td></tr>
<tr><td></td><td>b</td><td></td><td>1 mark for:

• Reduced hardware is needed on computers // reduced hardware costs
• Improved security by keeping all software running from one physical device
• Easier/cheaper to manage as only one physical device runs the programs.
• Can add/remove resources/memory/processes to the VM
• If it is infected by malware it can be deleted and recreated // the rest of the system isn’t affected/is protected against malware
• No direct access to hardware
• Resources can be used more flexibly between the machines</td><td>1</td><td><u>Examiner’s Comments</u>

There were some good responses to this question with many giving the response that Malware would not affect the server. Some talked about being able to try out different operating systems which was not relevant to this scenario.</td></tr>
</table>

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Question			Answer/Indicative content	Marks	Guidance
	c		1 mark per bullet to max 3: • Lossless will not **permanently** remove data • Lossless can be fully reconstructed/restored • Quality (of text/graphics/sound) is not lost • Any loss of text would be noticeable/would make it unreadable/unusable • Lossless rewrites data in a more efficient format	3	Accept reverse points e.g. lossy will delete data **permanently** Examiner's Comments This is a common topic in previous papers and most candidates were able to gain at least one mark with more successful candidates gaining all three. Some candidates gave responses that were too vague and did not relate to the question stem.
	d	i	1 mark per bullet to max 2: • Combines/links code/programs to files/software libraries... • ...to form a single executable file	2	Allow one mark for valid description of static and/or dynamic linkers e.g. Static linkers combine code and libraries into one file // Dynamic linkers link/add addresses to libraries Examiner's Comments The majority of candidates were able to gain one mark on this question for stating that a linker links code with libraries but few went on to then describe it forming a single executable file.
		ii	1 mark per bullet to max 2: • It is part of the operating system • Loads an executable file (into memory)... • ...from secondary storage • Loads the required software libraries	2	MP2 - Allow loads applications/programs Examiner's Comments Many candidates confused loaders with compilers and IDEs and talked about being able to use libraries in source code or loading code into the compiler.
			Total	13	

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Question			Answer/Indicative content	Marks	Guidance
4	a	i	1000 0100	1	CAO Examiner's Comments This was generally well answered with the majority of candidates gaining full marks. Those that did not had either got it completely wrong or had missed or added an extra zero.
		ii	Sign and magnitude	1	Accept: One's complement Examiner's Comments This was generally well answered and the majority of candidates gained one mark.
	b		12A • 1 mark for 12 • 1 mark for A	2	Must be in correct order. Examiner's Comments This was generally well answered and the majority of candidates gained two marks.
	c		1 mark per bullet to max 3: • Converting exponent to **6** • Converting mantissa to **1001110.1** // moving binary point **6** to the **right** • **-49.5**	3	MP2 - if flipped = **110001.1** Correct answer, with any binary working gets full marks Examiner's Comments The majority of candidates were able to gain a mark for converting the exponent to 6 and many were able to gain the second mark for moving the point 6 places to the right. Many candidates gained full marks although some were unable to convert the binary number back to denary to give -49.5
	d		1 mark per bullet to max 4: • Reducing exponent **to 4** // reducing exponent **by 3** • New mantissa starts **01011**... • ... and is written out to 8 bits making **01011000** • New exponent of **0100**	4	Correct mantissa and exponent, with any binary working gets full marks Examiner's Comments There were a range of responses with more successful candidates gaining full marks. Some candidates lost marks for incorrectly writing the final mantissa to 8 bits.

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Question			Answer/Indicative content	Marks	Guidance
	e		1 mark per bullet to max 2: • 1101 0000 • Correct working out/ 6 carries shown	2	0 mark for denary calculations with no carries shown. Examiner's Comments The majority of candidates were able to gain full marks on this question showing accurate working out and a correct response.
			Total	13	

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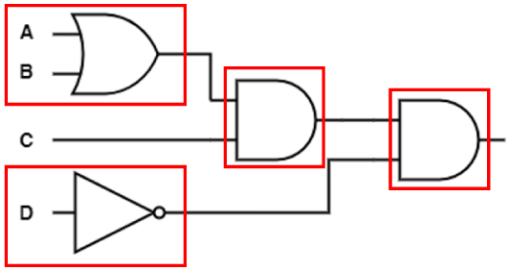
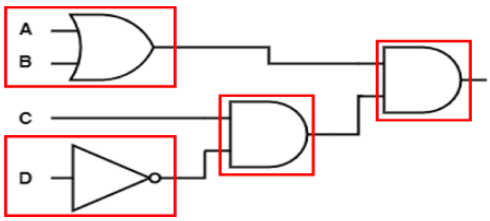
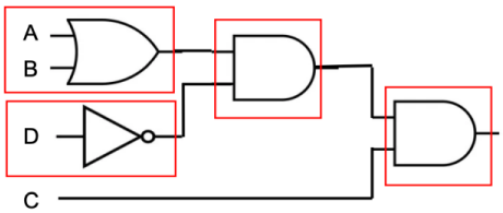
Question			Answer/Indicative content	Marks	Guidance
5	a		1 mark for each correct area **including labelled inputs**  **Alternatives (1 mark per area):**   	4	Max 3 if any additional gates. NOT gate must have only one input, AND/OR gates must have two inputs NOT gate must have circle Ignore any names on gates Examiner's Comments There were a range of marks on this question. More successful candidates gave all four gates accurately, but most candidates were able to gain at least one or two marks. Some candidates were unaware of what a logic circuit was and instead produced a range of different diagrams including flow charts.
	b	i	¬ (A ∧ B)	1	Accept NOT (A AND B) / other correct notations e.g. $\overline{A.B}$ ¬ must be the correct way round Examiner's Comments Many candidates gained full marks with the most common error being ¬(A v B)
		ii	B	1	Examiner's Comments Almost all candidates were able to gain a mark on this question.

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Question			Answer/Indicative content	Marks	Guidance
		iii	• 1 mark for A • 1 mark for v (B ∧ C) A v (B ∧ C)	2	Doesn't need brackets Allow other correct notation e.g. A+B.C Allow either order e.g. (B∧C) v A Allow Av(BC) / AvBC <u>Examiner's Comments</u> The majority of candidates recognised that distribution meant that there was only one A following simplification but the most common error for the second mark was again to use OR instead of AND for B AND C
			Total	8	

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Question			Answer/Indicative content	Marks	Guidance

6	a		**Mark Band 3-High Level (9-12 marks)**
			The candidate demonstrates a thorough knowledge and understanding of search indexing and page rank. The material is generally accurate and detailed.
			
			The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation.
			
			The candidate is able to assess the extent to which page rank and search engine optimization is important to online visibility.
			
			There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.
			
			A mark band 3 answer will explain in detail how search indexing happens and the factors affecting PageRank scores. There will be clear evaluative points that identify how to improve PageRank score.
			
			Mark Band 2-Mid Level (5-8 marks) The candidate demonstrates reasonable knowledge and understanding of search indexing and page rank; the material is generally accurate but at times underdeveloped.
			
			The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed.
			
			Evidence/examples are for the most part implicitly relevant to the explanation.
			
			The candidate makes a reasonable attempt to come to a conclusion as to why page rank and search engine optimisation are important to online visibility.
			
			There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.
			
			A mark band 2 answer will cover both search indexing and page ranking and will expand the points, explaining what
				12	Points may include but aren't limited to:
					
					AO1 Knowledge and Understanding
					Search engine indexing:
					
					• Search engine indexing is where a database of key words is kept with links to relevant pages stored with the keyword
					• Words are stored along with their position on a page
					• Bots (spider/crawlers) will "crawl" the web finding web pages and looking for key words on them
					• The will navigate from page to page following hyperlinks
					• They are then sent back to the search engine's database
					• When you search for a website, you are not searching on the web, you are searching in the search providers database
					
					PageRank:
					
					• Used to find and rank website pages and then list the results in a search engine. If a website has a higher score, it will appear higher in the list of search results.
					• More links from more important pages, ranks a page higher
					• Stored as a weighted, directed graph
					  ◦ Pages are nodes
					  ◦ Hyperlinks are edges in one direction
					  ◦ Weightings are calculated by page rank
					
					AO2 Application
					To get more of presence they will need to...
					
					• Make effective use of meta tags that effectively describe the contents of the website.
					• Make effective use of H1 tags using suitable headings that describes the content of the website
					• Increase the number of quality of incoming links from other websites, ideally those with a high PageRank score themselves
					• Increase the number of outgoing links
					• Key words can be stored in meta tags,

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Question	Answer/Indicative content	Marks	Guidance
	information is collected during indexing and factors that affect PageRank scores although these may not be balanced. There should be some attempt to identify how to improve PageRank score. Mark Band 1-Low Level (1-4 marks) The candidate demonstrates a basic knowledge of search indexing or page rank; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear. *A mark band 1 answer will contain some basic, relevant facts about what search indexing is and/or what PageRank means. They may not discuss how the company can improve PageRank.* 0 mark No attempt to answer the question or response is not worthy of credit.		title tags or header tags (h1, h2 etc) • Damping factor is used to quash a PageRank based on the idea that a user will only click through a certain number of links AO3 Evaluation • PageRank algorithm is only one algorithm that is used to Rank websites. • To get a better presence on the internet, the company will need to consider who links to their page, the more popular the better • They could potentially work with other companies who have established websites and get incoming links from those sites • It's important that a company ensures their site is malware free/secure as this can impact on their PageRank score <u>Examiner's Comments</u> Many candidates were able to discuss some factors that affect PageRank and how the website could improve it. Far less were able to discuss search engine indexing correctly. Some were able to apply their knowledge to the scenario. More successful candidates were able to give a good description of both search engine indexing and PageRank as well as relevant suggestions for how the website could improve their PageRank.

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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>b</td><td></td><td>1 mark for each correct row.

<table><tr><th>Task</th><th>Client Side</th><th>Server Side</th></tr><tr><td>Loading the website HTML code</td><td>✓</td><td></td></tr><tr><td>Applying CSS styles to a website</td><td>✓</td><td></td></tr><tr><td>Running JavaScript code to check that the customer surname has been entered on the order form</td><td>✓</td><td></td></tr><tr><td>Running queries on the database to check if an item is available in stock</td><td></td><td>✓</td></tr></table></td><td>4</td><td>Accept alternatives to ticks in the boxes so long as it is clear which side is marked.

Examiner's Comments

Most candidates were able to gain 2 or 3 marks on this question with many gaining all 4 marks. The most common error was ticking server side for Running JavaScript to check the surname.</td></tr>
<tr><td></td><td>c</td><td></td><td>1 mark per bullet to max 2:

1 mark for:

• A set of rules for communication/ transmission/transfer of data between devices

1 mark max from:

• The sending system has no direct control over the way the receiving system responds
• Allows standardisation as different devices have different OS/hardware
• Protocols allow for data to be exchanged in a predictable way/ in the correct format</td><td>2</td><td>Not 'a rule' - must be plural

MP1 not a set of instructions

MP1 accept standards / an agreement

Examiner's Comments

Most candidates were able to explain that a protocol is a set of rules for communication between devices. Few then went on to explain what that meant and so the majority of candidates gained one mark.</td></tr>
</table>

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Question	Answer/Indicative content	Marks	Guidance
d	1 mark for hardware and 1 mark for expansion to 6 marks max • **Router** e.g. • Connect networks together • Assign IP address to devices • Examines data packets and forwards them • **Cable/ Ethernet** e.g. • Carries digital data from one device/NIC to the next • Connects wired devices to the network • **Gateway** e.g. • Connects different types of network • Translates protocols from one network to another • **Bridge** e.g. • Connects different network segments • **Repeater** • Receives a signal and retransmits it • **Network Interface Card // NIC** e.g. • Gives each device a MAC address / unique ID • Allows a computer system to interface with a network • **Wireless Access Point // WAP** e.g. • Allows wireless devices to communicate with each other • Sends and receives radio waves • Examines data packets and forwards them • **Switch** e.g. • Connects multiple wired devices to the network • Receives data and forwards it to the intended recipient • Examines data packets and forwards them • Routes based on MAC addresses • **Hub** e.g. • Receives data from a device and broadcasts it to **all** devices connected to it • **Modem** e.g. • Changes a signal from digital to analogue	6	2 marks max each. Allow any suitable expansion. Mark in pairs. Allow: **Proxy server** e.g. • Sits between user and computer to route requests through an external server • Creates separation between a user and the site/service • Protects your security/anonymity by hiding IPs <u>Examiner's Comments</u> The majority of candidates could give three different pieces of networking hardware but many were unable to then describe what they did with many putting connects devices for the description of each piece of hardware.

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Question			Answer/Indicative content	Marks	Guidance
			• **Firewall** e.g. • Filters traffic coming in and out of a network		
			Total	24	

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Question			Answer/Indicative content	Marks	Guidance
7			**Mark Band 3-High Level (7-9 marks)** The candidate demonstrates a thorough knowledge and understanding of databases. The material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated. *A mark band 3 answer will cover benefits and disadvantages of both flat file and relational databases. The expansions will relate to Rosa's needs and will go on to evaluate why a relational database is most appropriate.* **Mark Band 2-Mid Level (4-6 marks)** The candidate demonstrates reasonable knowledge and understanding of databases; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence. *A mark band 2 answer will cover features of both flat file and relational databases and will expand the points, relating these to benefits and drawbacks and size of Rosa's data set although these may not be balanced. There will be an attempt to recommend which type is suitable.* **Mark Band 1-Low Level (1-3 marks)** The candidate demonstrates a basic knowledge of databases; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to	9	Points may include but aren't limited to: **AO1 Knowledge and Understanding** A flat file database stores data in a single table, often in a plain text file. Usually, each line will hold a single record and delimiters such as commas are used to separate this into different fields. **Benefits:** • They are easy to set up as only one table is needed • All records are stored in one place **Drawbacks:** • Tables can contain lots of redundant data which increases the amount of storage space needed • Searching the database can be slower as there is more data to search • The database can be more difficult to manage and possibly expand in the future A relational database stores data in multiple different tables. These are linked together using relationships created by primary and foreign keys. **Benefits:** • There is less duplication of information so less redundant data which can reduce the file size • The database is easier to manage and easier to expand in the future • Searching the database may be faster as there is less data / not all tables need to be searched • It can be more secure as different tables means different people could have different access **Drawbacks:** • They are generally more difficult to set up and need more technical knowledge to do things like normalisation. • Data is spread out between multiple tables. Some tables may be link tables which only display key fields /

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Question	Answer/Indicative content	Marks	Guidance
	apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear. *A mark band 1 answer will contain some basic, relevant points related to features of flat file and/or relational databases. It may not be linked to Rosa's specific needs.* 0 mark No attempt to answer the question or response is not worthy of credit.		references • They are more expensive as you will need a DBMS rather than just a basic file AO2 Application • Given that Rosa currently has 150 members, a flat file database will be suitable • However, as the business expands, using a flat file database may prove problematic • She could end up with a lot of redundant data as each time a new booking/appointment is made, it may store repeated data. • The more data Rosa has, the more likely there could be inconsistencies if data is edited/updated and her data would lose integrity • A relational database would be more efficient. • Membership details can be stored once and then their membership ID number can then be used to make a booking • A relational database will also allow her to expand even further in the future as additional tables can be added. However, the database will need to be normalised to ensure data is consistent, in the same format and that dependencies are reduced AO3 Evaluation The most suitable database for Rosa would be a relational database. Although this is more complex and the data needs to be normalised, it will store less repeated data when her company expands. It will also allow the database to be easily maintained and expanded in the future and will be easier to keep data secure, which is important. <u>Examiner's Comments</u> There were some really good responses to this question. More successful candidates were able to explain the features of both types of database as well as giving relevant benefits and drawbacks of each which they then applied to the scenario well and gave a recommendation. Some candidates gave good descriptions of the

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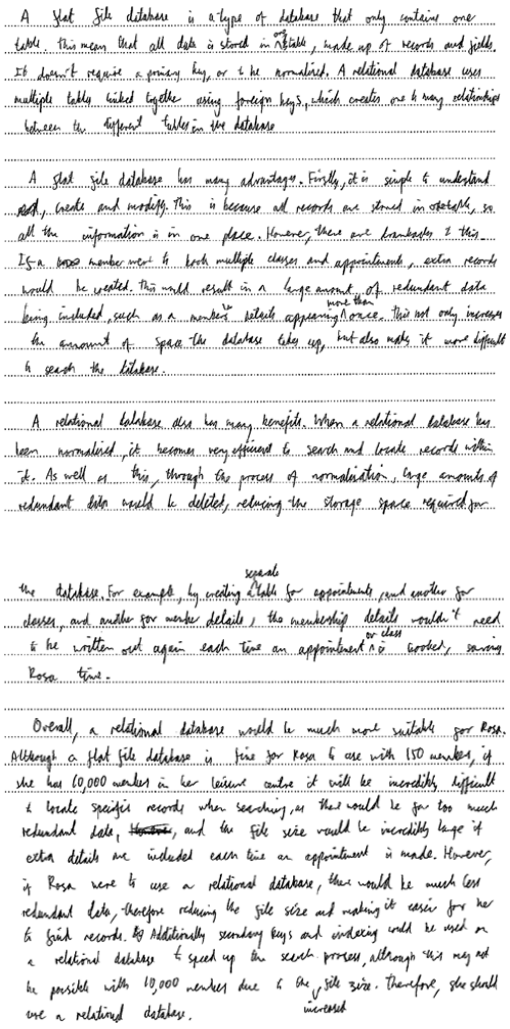
Question	Answer/Indicative content	Marks	Guidance
			features of each type but were unable to apply their knowledge to the scenario other than saying the membership was going to increase. There were a number of candidates who confused a database with a table stating that a relational database was a number of related databases and not a number of related tables. **Misconception** The main misconception was to confuse database with table although some candidates also confused the different keys used in a relational database and what they were used for. Exemplar 3  A flat file database is a type of database that only contains one table this means that all data is stored in a table, made up of records and fields. It doesn't require a primary key, or to be normalised. A relational database uses multiple tables linked together using foreign keys, which creates one to many relationships between the different tables in the database A flat file database has many advantages. Firstly, it is simple to understand add, create and modify. This is because all records are stored in one table, so all the information is in one place. However, there are drawbacks to this. If a large number were to book multiple classes and appointments, extra records would be created. This would result in a large amount of redundant data being included, such as a members details appearing more than once. This not only increases the amount of space the database takes up, but also makes it more difficult to search the database. A relational database also has many benefits. When a relational database has been normalised, it becomes very efficient to search and locate records within it. As well as this, through the process of normalisation, large amounts of redundant data would be deleted, reducing the storage space required for the database. For example, by creating a table for appointments and another for classes, and another for member details, the membership details wouldn't need to be written out again each time an appointment or class is booked, saving Rosa time. Overall, a relational database would be much more suitable for Rosa. Although a flat file database is fine for Rosa to use with 150 members, if she has 10,000 members in her leisure centre it will be incredibly difficult to locate specific records when searching, as there would be far too much redundant data, ~~therefore~~, and the file size would be incredibly large if extra details are included each time an appointment is made. However, if Rosa were to use a relational database, there would be much less redundant data, therefore reducing the file size and making it easier for her to find records. By additionally secondary keys and indexing would be used on a relational database to speed up the search process, although this may not be possible with 10,000 members due to the file size. Therefore, she should use a relational database. The candidate has shown good application to the scenario as well as benefits and

Question			Answer/Indicative content	Marks	Guidance
					drawbacks of both database types. They have made a valid recommendation which is justified.
			Total	9	

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>8</td><td>a</td><td></td><td>

- Typed as array/string and set to the variable <code>towns</code>
- 2 dimensions set to 8 and 3 **in brackets**

Examples

```
array towns(8,3)
string towns[][] = new string [8][3]
array towns [8][3] as string
```

</td><td>2</td><td>For MP1 accept any suitable attempt at typing as an array, for example <code>towns = [], towns( )</code>

For MP2 accept any suitable attempt to set to 2 dimensions of the correct size

Allow 7, 2 as array index

Allow column major notation
i.e. <code>array towns [3,8]</code>

<u>Examiner's Comments</u>

Many candidates were able to gain full marks with most being able to gain one. Many candidates did not specify the number of elements in the array which was given in the question and tended to give responses such as towns = [ ] and as such only gained one mark.</td></tr>
<tr><td></td><td>b</td><td>i</td><td>

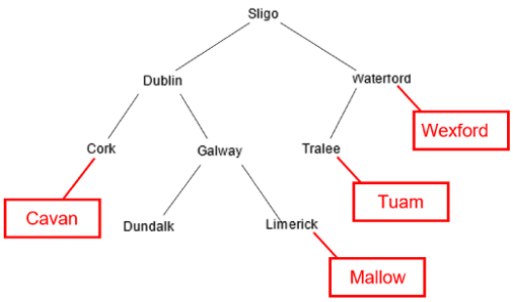
	Left	Data	Right	Marking Guidance
0	1	Sligo	3	1 Mark
1	2	Dublin	4	
2	null	Cork	null	1 Mark
3	6	Waterford	null	
4	7	Galway	5	1 Mark
5	null	Limerick	null	
6	null	Tralee	null	1 Mark
7	null	Dundalk	null	

</td><td>4</td><td>Allow -1 or Ø for <code>null</code>

FT for 0/blank used as null after first error.

<u>Examiner's Comments</u>

The question states that the first and third column contain a pointer and the second contains the data. The biggest error by far was candidates putting data in the first and third column instead of a pointer which meant that many only gained a mark for having null in the last two rows. More successful candidates were able to gain full marks.</td></tr>
<tr><td></td><td></td><td>ii</td><td>1 mark for each correct town.

 
</td><td>4</td><td>If same town added more than once BOD if one in the right place

Ignore basic spelling mistakes and case

Towns must be to left or right of the node above - DNA nodes straight below.

<u>Examiner's Comments</u>

This was generally well answered and many candidates gained full marks with many candidates writing out the alphabet beneath the question to aid then in placing the new towns.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>10</td><td></td></tr>
</table>

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Question	Answer/Indicative content	Marks	Guidance

9	1 mark per bullet to max 5:
	
	• Suitable logic for class dog declaration
	
	• Suitable logic to define the 4 (private) attributes: **`name, breed, height, weight`**
	
	• Suitable logic to declare a public method for constructor (e.g. new or class name)...
	
	• ....taking only 4 different parameters in any order.
	
	• Suitable logic to set the values of each attribute
	
	MP4 - if it is obvious the candidate has used Pythonic syntax: allow the additional 5th parameter representing the object e.g. `self, turtle` but this must be the first parameter listed.
	
	MP2 - If they have done the above BP2 can be considered implicitly met (Python doesn't require attributes to be declared outside the constructor)
		5	Mark in a vertical line against each MP.
			
			Ignore data types in attribute names
			
			Allow colon/empty brackets at the end of class def
			
			Example Solutions
			Pseudocode style
			`class Dog`
			`  private name`
			`  private breed`
			`  private height`
			`  private weight`
			`  public procedure new (nameIn, breedIn, heightIn, weightIn)`
			`  name = nameIn`
			`  breed = breedIn`
			`  height = heightIn`
			`  weight = weightIn`
			`endclass`
			
			Java / C# Style
			Class Dog
			
			`{`
			`  private String name`
			`  private String breed`
			`  private float height`
			`  private float weight`
			
			`  public void Dog(String name, String`
			`  breed, float height, float weight)`
			`  {`
			`  this.name = name`
			`  this.breed = breed`
			`  this.height = height`
			`  this.weight = weight`
			`  }`
			`}`
			
			Python Style
			`class Dog:`
			`  def __init__(self, name, breed, height, weight):`
			`  self.name = name`
			`  self.breed = breed`
			`  self.height = height`
			`  self.weight = weight`
			
			Examiner's Comments

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Question			Answer/Indicative content	Marks	Guidance
					There were a range of responses to this question with the most common responses being written in pseudocode or python. There was a clear division between candidates who were comfortable writing Object Oriented Programming (OOP) code and class constructors and those that were not. Less successful candidates with little OOP experience often confused the class declaration with the constructor declaration. A few input the values rather than setting the attributes to the values passed in the parameters.
			Total	5	

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Question			Answer/Indicative content	Marks	Guidance
10	a		1 mark per bullet to max 3: • Allows for mass surveillance of communications • Allows the **monitoring** of an individual's internet activities/history • Allows covert surveillance to be carried out • Can demand access to protected data • Can demand that ISPs/businesses give access to customer communications/history • Can demand that ISPs/businesses install equipment that facilitate surveillance • Can demand that encryption keys are handed over // force individuals to decrypt data • Can keep existence of searches and what found private in court	3	Allow other suitable answers relating to examples of other types of surveillance e.g. CCTV, directed surveillance. MP4 relates to password protected data or accessing data protected under the DPA Examiner's Comments There were a number of candidates who could not accurately name one additional power.
	b		1 mark per bullet to max 3: • Data must be processed **fairly/ lawfully** • Data must be **adequate/ relevant/ not excessive** • Data must be **accurate** and (where necessary) **up to date** • Data must **not be retained for longer than necessary** • Data can only be **used for the purpose** for which it was collected • Data must be **kept secure** • Data must be **processed in accordance with people's rights** • Data must not be transferred outside of the EU without adequate protection // to other countries who do not have equivalent data protection laws	3	Accept: Right to see their own data/change if incorrect Examiner's Comments This was generally well answered and candidates showed good understanding of the Data Protection Act (DPA) principles.
			Total	**6**	

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