



**2008 Computing**

**Higher**

**Finalised Marking Instructions**

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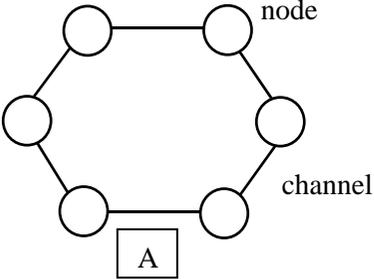
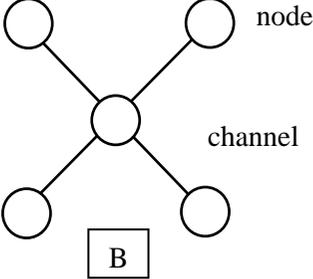
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**SECTION I**

<b>1</b>	Images are stored as <i>bit-mapped</i> or <i>vector</i> graphics.		
	<b>(a)</b>	<b>(i)</b> Describe how <b>bit-mapped</b> images are stored.	<b>1 KU</b>
		<ul style="list-style-type: none"> <li>• An <u>array/grid</u> of pixels</li> <li>• Each dot/pixel has a <u>binary</u> value</li> <li>• Each pixel stored as a bit/byte/binary value/black=1 &amp; white=0</li> <li>• Accept black=1 and white=0 type answer but <b>not</b> the colour of each pixel</li> </ul> <p>Any one from above <b>1 mark</b> (Not “the colour of pixels are stored” or “individual pixels” or “pixel by pixel”)</p>	
		<b>(ii)</b> Describe how <b>vector</b> images are stored.	<b>1 KU</b>
		<ul style="list-style-type: none"> <li>• As a number/list of objects (each of which has attributes defining the objects)</li> <li>• <u>Objects</u> are defined by attributes/mathematical description</li> <li>• Accept an example object used to describe eg rectangle and attributes</li> <li>• Any other valid</li> </ul> <p><b>1 mark</b> for any of the above</p>	
	<b>(b)</b>	Is the above image bit-mapped or vector? Justify your answer.	<b>2 PS</b>
		<p><i>Bit-mapped (1 mark)</i></p> <ul style="list-style-type: none"> <li>• Composed of grid of (individual) pixels</li> <li>• Does not contain/is not comprised of (collection of discrete) objects</li> <li>• It is pixelated</li> <li>• It is a photograph/taken with a digital camera</li> </ul> <p><b>1 mark</b> for any valid bullet point (Not painting or resized)</p>	

<b>2</b>	Anti-virus software uses various techniques to detect viruses. One of these techniques is <i>heuristic detection</i> .	
	(a) Explain how the heuristic detection technique is used to detect a virus.	<b>1 KU</b>
	<ul style="list-style-type: none"> <li>• <i>It looks for a suspicious pattern of behaviour (which was previously associated with a virus)</i></li> <li>• <i>Accept use of a valid example to illustrate concept</i></li> <li>• <i>Any other valid</i></li> </ul> <p><b>1 mark</b></p>	
	(b) Explain why a <i>trojan horse</i> is <b>not</b> classified as a computer virus.	<b>1 PS</b>
	<ul style="list-style-type: none"> <li>• <i>A trojan horse is not self replicating</i></li> <li>• <i>Does not infect other files</i></li> </ul> <p><b>1 mark for any one of the above (do not accept a description of what a trojan horse does)</b></p>	
<b>3</b>	What is the decimal representation of the 8 bit <i>two's complement</i> number 10110110? A     -182 B     -74 C     -53 D     182	<b>1 PS</b>
	'B', -74 (1 mark)	
<b>4</b>	(a) The processor has a number of control lines. What is the function of the <i>reset</i> line?	<b>1 KU</b>
	<ul style="list-style-type: none"> <li>• <i>Returns the system/CPU/processor to its initial state</i></li> <li>• <i>(Saves contents and) clears registers</i></li> </ul> <p><b>1 mark for any valid, Note: do not accept answers relating to rebooting/resetting "computer" to initial state or clearing RAM</b></p>	
	(b) Explain why the <i>address bus</i> in a computer is unidirectional.	<b>1 KU</b>
	<i>The address is sent <u>from the processor</u> to memory only (1 mark)</i>	

5	(a)	A virus checker and a disk defragmenter are utility programs. Name <b>one</b> other utility program.	1 KU
		<i>Disk editor/clean up/disk recovery tools/backup/emulator/other valid (1 mark for any one valid) Not printer driver.</i>	
	(b)	Explain how the use of a <b>disk defragmenter</b> can improve the system performance of a computer.	2 KU
		<ul style="list-style-type: none"> <li>• Arranges data block contiguously (together) (1 mark) speeding up the access time (1 mark)</li> <li>OR</li> <li>• Gathers free space together (1 mark) reducing access time (1 mark)</li> </ul>	

6	<p>Two network topologies are shown below.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>A</p> </div> <div style="text-align: center;">  <p>B</p> </div> </div>		
	(a)	(i) Identify the network topology of Network A.	1 KU
		<i>A is a ring (1 mark)</i>	
		(ii) Identify the network topology of Network B.	1 KU
		<i>B is a star (1 mark)</i>	
	(b)	Which of the above topologies would be <b>least</b> affected by a channel failure?	1 PS
		<i>B, Star (1 mark)</i> <i>Note: the star would lose one node whereas the ring would suffer disruption to all transmissions.</i>	

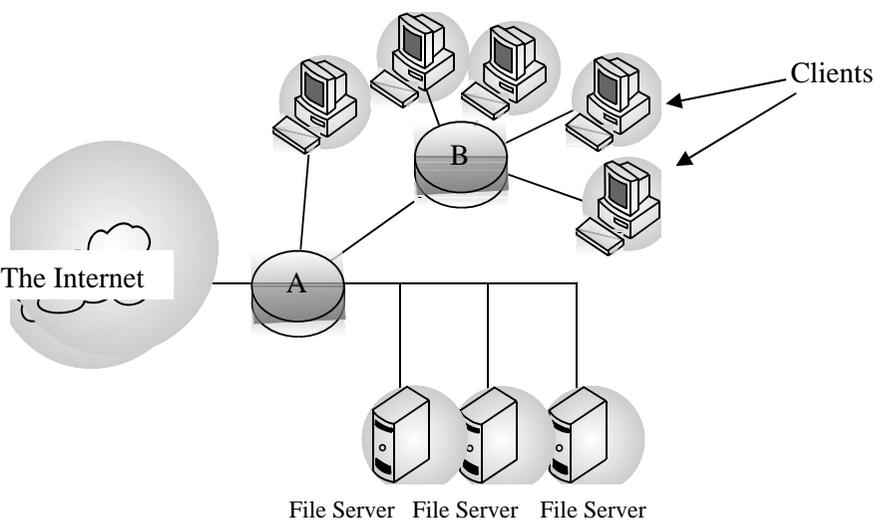
7	Numbers can be stored within a program as <i>integer</i> or <i>real</i> variables. Explain what is meant by an “integer” variable.	1 KU
	<ul style="list-style-type: none"> <li>• <i>No fractional part/decimal stored</i></li> <li>• <i>Stored as a ‘whole’ number</i></li> </ul> <p><i>1 mark for any one of the above. Note: an example of an integer is insufficient</i></p>	
8	One task of the evaluation stage of the software development process is to ensure the program meets the <i>software specification</i> .	
(a)	State <b>two</b> other criteria used to evaluate software.	2 KU
	<p><i>Reliability, robustness, portability, efficiency, maintainability, user interface, readability</i></p> <p><i>1 mark for each of two of the above, 2 max. Not fit for purpose, correctness, budget/cost, compatibility</i></p>	
(b)	Describe what is meant by the phrase “the software development process is an iterative process”.	1 KU
	<p><i>It revisits earlier stages of the software development process (in the light of new information)</i></p> <p><i>(1 mark)</i></p>	
9	A bank manager uses a <i>macro</i> once a month to create an alphabetical list of customers whose account balance is over £5000.	
(a)	State <b>two</b> benefits of using macros for this type of task.	2 KU
	<ul style="list-style-type: none"> <li>• <i>Increased productivity/saves time (since the task will be completed faster than choosing menu choices, dialogue boxes etc.)</i></li> <li>• <i>Customisation of the package by creating your own menu commands/buttons to automate common search/sort</i></li> <li>• <i>Ability to perform complex tasks recorded by another user (with higher skill level)</i></li> <li>• <i>Less chance of human error</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>Any two valid bullets for 1 mark each</i></p>	
(b)	The macro is written in a high level language. State the <b>type</b> of high level language that is used to write macros.	1 KU
	<p><i>Scripting language (1 mark)</i></p>	

10	A program contains the following statement: <code>is_a( rover, dog)</code> . State which <b>type</b> of programming language is being used.	1 PS
	<i>Declarative (1 mark.)</i> <i>Note: Do not accept “Prolog” as this is not a type</i>	
11	A holiday booking website includes a currency converter which asks for the amount in pounds sterling and converts it to euros. Here is the top-level algorithm, including data flow for steps 1 and 2. 1. get amount of pounds (out: <b>pounds</b> ) 2. calculate euros (in: <b>pounds</b> out: <b>euros</b> ) 3. display conversion .....	
(a)	State which <i>design notation</i> is being used.	1 KU
	<i>Pseudocode (1 mark)</i>	
(b)	Step 3 results in the following being displayed on screen: £500 converts to 750 euros. State the <i>data flow</i> for step 3.	2 PS
	<i>In: pounds</i> <i>In: euros</i> <i>(1 mark for each correct parameter)</i>	
(c)	Identify whether the <b>pounds</b> variable in step 1 should be passed <i>by value</i> or passed <i>by reference</i> . Explain your answer.	2 PS
	<i>By reference (1 mark)</i> <ul style="list-style-type: none"> <li>• <i>the value passed into the subroutine, (changed) and passed back out</i></li> <li>• <i>the variable itself is passed in and out</i></li> <li>• <i>the dataflow states that it is an out parameter</i></li> </ul> <i>1 mark for any valid justification, Note: correct justification of “by value” may get second mark</i>	
12	Explain the purpose of a CASE statement in a high level language.	2 KU
	<ul style="list-style-type: none"> <li>• <i>Performs decision or selection</i></li> <li>• <i>Involving two or more choices</i></li> <li>• <i>Avoids the use of multiple or nested If statements</i></li> <li>• <i>Increases clarity/readability</i></li> <li>• <i>Any other valid</i></li> </ul> <i>1 mark for each of two bullet points</i>	

**SECTION II**

13	When designing a new computer the manufacturer could improve system performance by increasing the <i>clock speed</i> or adding more <i>RAM</i> .		
	(a)	(i) Describe one <b>other</b> way to improve the system performance <b>and</b> explain why it would be effective.	2 KU
		<ul style="list-style-type: none"> <li>• Increase the width of the data bus (<b>1 mark</b>) more data fetched from memory in each F/E cycle (<b>1 mark</b>)</li> <li>• Increase the amount of cache memory (<b>1 mark</b>) reduces access to slower RAM (<b>1 mark</b>)</li> <li>• Increase the number of registers (<b>1 mark</b>) more fast access storage within the CPU (<b>1 mark</b>)</li> <li>• Install faster access hard drive (<b>1 mark</b>) reduce time taken to load/save data (<b>1 mark</b>)</li> <li>• Install dual processors (<b>1 mark</b>) to increase throughput of instructions (<b>1 mark</b>)</li> </ul> <p>Any one of the above or other valid answer</p>	
		(ii) Explain why it is <b>not</b> possible to keep improving performance by increasing clock speed.	1 PS
		<ul style="list-style-type: none"> <li>• Overheating of processor</li> <li>• Physical limitation of other components such as switching speed of memory, speed of data bus, etc (<b>Not</b> word size etc)</li> </ul> <p>1 mark for any one of the above or other valid answer</p>	
	(b)	(i) Describe how <i>FLOPS</i> <b>and</b> <i>application based tests</i> are used to measure system performance.	2 KU
		<p><i>FLOPS</i> – counts the number of floating point operations per second  <i>Application based tests</i> – measure the actual time taken to perform a practical task</p> <p>1 mark for any one of the above or other valid answer</p>	
		(ii) Explain why application based tests could be described as the best measure of system performance.	1 PS
		<ul style="list-style-type: none"> <li>• Tests used are real-world uses/related to the actual tasks done by the customer</li> <li>• Are not dependant on one hardware feature of the computer</li> </ul> <p>1 mark for any one of the above or other valid answer</p>	
		(iii) Explain why FLOPS could be described as the best measure of system performance.	1 PS
		<ul style="list-style-type: none"> <li>• Measure actual work done by the processor</li> <li>• Independent of instruction complexity/word size/application task</li> </ul> <p>1 mark for any one of the above or other valid answer</p>	

	<p><b>(c)</b> A new computer system has a 3 GHz processor with a 64-bit data bus and a 32-bit address bus. Calculate the maximum amount of memory that can be addressed by this computer. Show all working and express your answer in appropriate units.</p>	<b>3 PS</b>
	<p> <math>2^{32}</math> (1 mark) x 64 (1 mark) bits <span style="float: right;">OR <math>2^{32}</math> (1 mark) x 8 (1 mark) bytes</span>            = 274877906944 bits = 34359738368 bytes            = 32 Gb (1 mark)         </p> <p><i>Full credit must be given where the correct answer is supplied without working</i></p>	
	<p><b>(d)</b> Describe how a processor distinguishes one memory location from another.</p>	<b>1 KU</b>
	<p><i>Each location has a <u>unique</u> (binary) address (1 mark)</i></p>	

14	The proposed layout of a new office network is shown below. Cables are used to connect the network.		
			
(a)	A router and a hub are used in the above network.		
(i)	State which device, A or B, is the router. State <b>one</b> reason to justify your choice of device.	<b>2 PS</b>	
	<p><i>A is the router (1 mark)</i></p> <ul style="list-style-type: none"> <li>• used to connect the LAN to the Internet</li> <li>• used to connect LANs to telecommunication lines</li> <li>• used to direct packets using IP address</li> </ul> <p><i>1 mark for any one valid justification</i></p>		
(ii)	State which device, A or B, is the hub. State <b>one</b> reason to justify your choice of device.	<b>2 PS</b>	
	<p><i>B is the hub (1 mark)</i></p> <ul style="list-style-type: none"> <li>• used on LAN to connect stations</li> <li>• cheap method of connecting station to a LAN</li> <li>• does not require complex routing at this level</li> </ul> <p><i>1 mark for any one valid justification</i></p>		

	<b>(b)</b>	After the network has been installed, it is discovered that data traffic on the network is slow.	
	<b>(i)</b>	State <b>one</b> technical change which could be made to improve network performance.	<b>1 PS</b>
		<ul style="list-style-type: none"> <li>• Upgrade/install a switch instead of a hub</li> <li>• Upgrade/install cables with a higher bandwidth</li> <li>• Upgrade/install network cards which support higher bandwidth</li> <li>• Any other valid</li> </ul> <p><i>1 mark for any one valid technical change</i></p>	
	<b>(ii)</b>	Explain how this change will improve network performance.	<b>1 PS</b>
		<ul style="list-style-type: none"> <li>• (Upgrade/install a switch instead of a hub) as signals are directed to individual station rather than all stations reducing network traffic</li> <li>• (Upgrade/install cables with a higher bandwidth capability) increasing data transfer rate</li> <li>• (Upgrade/install network cards which support higher bandwidth) increasing data transfer rate</li> </ul> <p><i>1 mark for any one valid matching the answer to part (i)</i></p>	
	<b>(c)</b>	Name a <b>type</b> of server that allows Web pages to be accessed within a LAN.	<b>1 KU</b>
		<p><i>Web server or proxy server (1 mark)</i></p> <p><i>Not internet server</i></p>	

<b>15</b>	James wants to make copies of some photographs. He intends to use a scanner to capture the photographs and an ink jet printer to print the final images.		
	<b>(a)</b>	State the function of the operating system that is responsible for the data transfer between the processor and scanner.	<b>1 KU</b>
		<i>Input/output (management system/function) (1 mark)</i> <i>Accept I/O</i>	
	<b>(b)</b>	<b>(i)</b> Explain why saving the scanned image as a <i>gif</i> would <b>not</b> be appropriate in this case.	<b>1 PS</b>
		<i>gif only supports 256 colours/uses 8 bit colour/has a limited range of colours (1 mark)</i>	
		<b>(ii)</b> State a suitable file format for saving the file.	<b>1 PS</b>
		<i>Bmp, jpeg, png, tiff, ...</i>  <i>1 mark for any one valid bitmap format</i>	
	<b>(c)</b>	The Scanner is set to a resolution of 1200 dpi using 24 bit colour depth and the photographs are 6 inches by 8 inches. Calculate the uncompressed size of the file. Express your answer in appropriate units. Show all working.	<b>3 PS</b>
		<i>6 x 8 x 1200 x 1200 (1 mark) x 24 (1 mark)</i> <i>= 1658880000 bits = 207360000 bytes</i> <i>= 197.8 Mbytes (1 mark)</i>  <i>3 marks must be allocated if the correct solution is written without working</i>	
	<b>(d)</b>	One function of the printer interface is to inform the processor that it is ready to receive the next photograph. State the name of this function.	<b>1 KU</b>
		<i>Status signals (1 mark)</i> <i>Not status info/data</i>	
	<b>(e)</b>	State <b>one</b> advantage of using <i>serial</i> over <i>parallel</i> transmission when sending data to a printer.	<b>1 KU</b>
		<ul style="list-style-type: none"> <li>• <i>Serial printer can send data over a longer cable/greater distance</i></li> <li>• <i>Serial does not suffer from skew</i></li> </ul> <i>1 mark for any one valid point</i>	

	<p><b>(f)</b> State <b>one</b> technical characteristic that the printer should have. Justify your answer.</p>	<p><b>1 PS</b> <b>1 KU</b></p>
	<ul style="list-style-type: none"> <li>• <i>High Resolution (of at least 1200 dpi) – to match the resolution of the scanned image</i></li> <li>• <i>High bit depth (of at least 24 bits) – to match the scanned image</i></li> <li>• <i>(larger) buffer – as the print jobs are large/photos have large file size</i></li> <li>• <i>correct interface – to connect to James’ computer</i></li> <li>• <i>speed of printing (ppm) – may want to print a number of photos/large photo quickly</i></li> <li>• <i>any other valid</i></li> </ul> <p><i><b>1 mark</b> for a valid characteristic and <b>1 mark</b> for a valid justification <u>relating to the context</u></i>  <i><b>Note: Simplistic answers such as “high quality” are unacceptable for the first mark</b></i></p>	
	<p><b>(g)</b> When James prints his images he discovers lines across some of them. The lines are where the original photographs had been folded over.</p> <p>Explain why he would use a bit-mapped package to remove the lines.</p>	<p><b>2 PS</b></p>
	<ul style="list-style-type: none"> <li>• <i>Image must be edited at pixel level</i></li> <li>• <i>Each pixel in the image will have to be edited <u>to match surrounding pixels</u></i></li> <li>• <i>No (discrete) objects to manipulate</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i><b>1 mark</b> for each of two valid bullet points</i></p>	

16	<p>An international athletics competition between eight countries has a number of events. Here are the results for one race.</p> <table border="1"> <thead> <tr> <th>Lane Number</th> <th>Country</th> <th>Time (secs)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Ireland</td> <td>40.23</td> </tr> <tr> <td>2</td> <td>Italy</td> <td>41.05</td> </tr> <tr> <td>3</td> <td>England</td> <td>42.88</td> </tr> <tr> <td>4</td> <td>France</td> <td>39.89</td> </tr> <tr> <td>5</td> <td>Germany</td> <td>40.55</td> </tr> <tr> <td>6</td> <td>Poland</td> <td>40.01</td> </tr> <tr> <td>7</td> <td>Scotland</td> <td>39.87</td> </tr> <tr> <td>8</td> <td>Wales</td> <td>42.55</td> </tr> </tbody> </table> <p>The stadium's computer system has a program which processes and displays the results.</p>	Lane Number	Country	Time (secs)	1	Ireland	40.23	2	Italy	41.05	3	England	42.88	4	France	39.89	5	Germany	40.55	6	Poland	40.01	7	Scotland	39.87	8	Wales	42.55	
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	<p>(a) State <b>two</b> system requirements that would have been specified for the installation of the program.</p>	2 KU																											
	<ul style="list-style-type: none"> <li>• Amount of (available) RAM/memory</li> <li>• Minimum clock speed/powerful processor</li> <li>• Processor type</li> <li>• Version of OS</li> <li>• Identify peripherals required.</li> <li>• Sufficient storage capacity</li> <li>• Any other valid</li> </ul> <p><i>1 mark for each of two valid points</i></p>																												
	<p>(b) The program is modular. State <b>two</b> benefits of creating modular code.</p>	2 KU																											
	<ul style="list-style-type: none"> <li>• Sections of code can be assigned to different programmers</li> <li>• Modules can be tested individually</li> <li>• Easier maintenance as more readable</li> <li>• Availability of module library</li> <li>• Individual modules can be amended/replaced</li> <li>• Any other valid</li> </ul> <p><i>1 mark for each of two valid points</i></p>																												

	<p>(c) At the end of a race, messages are displayed. For example:</p> <div style="border: 1px solid black; padding: 5px; display: inline-block; margin: 10px auto;"> <b>Winner: Sco 39·87</b> </div> <p>The winning country for a race is stored in a string variable called <b>winner</b>. Using code from a programming environment with which you are familiar, show how to extract the first three characters from the variable <b>winner</b>.</p>	<b>2 PS</b>
	<ul style="list-style-type: none"> <li>• <i>mid(winner,1,3)</i></li> <li>• <i>left(winner,3)</i></li> <li>• <i>winner.substring(0,3)</i></li> <li>• <i>concat(winner[1],winner[2],winner[3])</i></li> <li>• <i>winner[1]+winner[2]+ winner[3]</i></li> <li>• <i>winner[1:3]</i></li> <li>• <i>any other valid</i></li> </ul> <p><b>1 mark</b> for a correct function, <b>1 mark for correct range</b> <i>Note: where function is unnecessary (ie bullets 5 &amp; 6), 1 mark for each of the range values should be awarded</i></p>	

	<b>(d)</b>	The program stores the list of race times in a single data structure.					
	<b>(i)</b>	State the data structure and data type used to store the race times.	<b>2 PS</b>				
		<i>array (1 mark) of real/single/float (1 mark)</i>					
	<b>(ii)</b>	The program must find the fastest time for a race. Use pseudocode to design an algorithm to find the fastest time.	<b>4 PS</b>				
		<p><i>There are a number of expressions of the algorithm</i></p> <table border="1"> <tr> <td> <p><i>Set fastest to first time in list (1 mark)</i>  <i>Loop from 2 to 8 [for rest of array items] (1 mark, with end loop)</i>  <i>    If array(current)&lt;fastest then (1 mark, with end if)</i>  <i>        Set fastest to array(current) (1 mark)</i>  <i>    End if</i>  <i>End loop</i></p> </td> <td> <p><i>Set fastest to 1 000 000 [number over range] (1 mark)</i>  <i>Loop 8 times or each array item (1 mark, with end loop)</i>  <i>    If array(current)&lt;fastest then (1 mark, with end if)</i>  <i>        Set fastest to array(current) (1 mark)</i>  <i>    End if</i>  <i>End loop</i></p> </td> </tr> <tr> <td> <p><i>Set fastest to 1 (1 mark)</i>  <i>Loop from 2 to 8 [for rest of array items] (1 mark, with end loop)</i>  <i>    If array(current)&lt;array(fastest) then (1 mark, with end if)</i>  <i>        Set fastest to current (1 mark)</i>  <i>    End if</i>  <i>End loop</i></p> <p><b>Note:see (iii)</b></p> </td> <td> <p><i>In summary, 1 mark for each of the following:</i></p> <ul style="list-style-type: none"> <li>• <i>Setting initial value</i></li> <li>• <i>Loop (with end) for traversal of array</i></li> <li>• <i>Comparison of current element with min value (with end if)</i></li> <li>• <i>Assignment of new min value</i></li> </ul> </td> </tr> </table>	<p><i>Set fastest to first time in list (1 mark)</i>  <i>Loop from 2 to 8 [for rest of array items] (1 mark, with end loop)</i>  <i>    If array(current)&lt;fastest then (1 mark, with end if)</i>  <i>        Set fastest to array(current) (1 mark)</i>  <i>    End if</i>  <i>End loop</i></p>	<p><i>Set fastest to 1 000 000 [number over range] (1 mark)</i>  <i>Loop 8 times or each array item (1 mark, with end loop)</i>  <i>    If array(current)&lt;fastest then (1 mark, with end if)</i>  <i>        Set fastest to array(current) (1 mark)</i>  <i>    End if</i>  <i>End loop</i></p>	<p><i>Set fastest to 1 (1 mark)</i>  <i>Loop from 2 to 8 [for rest of array items] (1 mark, with end loop)</i>  <i>    If array(current)&lt;array(fastest) then (1 mark, with end if)</i>  <i>        Set fastest to current (1 mark)</i>  <i>    End if</i>  <i>End loop</i></p> <p><b>Note:see (iii)</b></p>	<p><i>In summary, 1 mark for each of the following:</i></p> <ul style="list-style-type: none"> <li>• <i>Setting initial value</i></li> <li>• <i>Loop (with end) for traversal of array</i></li> <li>• <i>Comparison of current element with min value (with end if)</i></li> <li>• <i>Assignment of new min value</i></li> </ul>	
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	<b>(iii)</b>	It is suggested that it would be preferable for the algorithm to find the <b>lane number</b> of the fastest time rather than the fastest time. Explain how this could be achieved.	<b>1 PS</b>				
		<p><i>Each time the fastest is reassigned, set a position variable equal to the loop counter (Set fastest to current).</i></p> <p><i>Note: the candidate may have elected to solve part (ii) in this way (see box 3 above). If so, award the mark here.</i></p>					

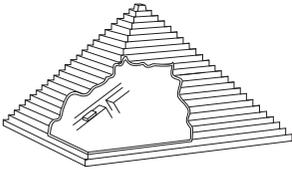
17	<p>Entucom is a television broadcaster that gives customers access to various services. Customers will access these services using their television and a set-top box with wireless keyboard and mouse.</p> <div style="text-align: center;"> </div> <p>The television broadcaster employs a software development company to provide the range of software required.</p>		
	(a)	The software development company appoints a <i>systems analyst</i> during the analysis stage of the software development process.	
	(i)	Describe <b>two</b> tasks carried out by the systems analyst.	<b>2 KU</b>
		<ul style="list-style-type: none"> <li>• <i>Liaise with client and project team</i></li> <li>• <i>Investigates current system</i></li> <li>• <i>Observe workplace</i></li> <li>• <i>Writes the software specification/program specification/ORD/requirements specification</i></li> <li>• <i>Allow requirements elicitation techniques</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>1 mark for each of two valid points</i></p>	
	(ii)	State <b>two</b> benefits that the analysis stage has for the <b>remaining</b> stages of the software development process.	<b>2 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Results in a legal document for which both client and company are accountable</i></li> <li>• <i>Software specification informs all future stages</i></li> <li>• <i>Software specification validates future stages</i></li> <li>• <i>Saves wasted time and effort designing and creating software which is not what client wants</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>1 mark for each of two valid points</i></p>	

	<b>(b)</b>	During implementation, the software development company consider the use of either a <i>procedural</i> or an <i>event-driven</i> language.	
	<b>(i)</b>	Describe <b>two</b> similarities of <b>procedural</b> and <b>event-driven</b> languages.	<b>2 KU</b>
		<ul style="list-style-type: none"> <li>• <i>Uses a range of data types</i></li> <li>• <i>Sequence of control instructions</i></li> <li>• <i>Similar control structures such as selection (if etc) and repetition (loops)</i></li> <li>• <i>Both are modular</i></li> <li>• <i>Any other valid (but Higher-level) point</i></li> </ul> <p><i>1 mark for each of two valid points. Note: "They are both HLL/compiled/translated" or other SG-type answers are insufficient</i></p>	
	<b>(ii)</b>	State <b>two</b> reasons why a programmer would use an <b>event-driven</b> language to develop software.	<b>2 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Has specialised routines for event handling, creation of windows/buttons etc</i></li> <li>• <i>Applications with a graphical interface are suited to code being activated by events</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>1 mark for each of two valid points</i></p>	

	(c)	During the development of the software, <i>module libraries</i> are used. The modules limit the <i>scope</i> of certain variables.	
	(i)	What is a <b>module library</b> ?	<b>1 KU</b>
		<i>A set of pre-written/pre-tested subroutines/functions/code (for use in the development of software)</i>	
	(ii)	Describe <b>one</b> way in which the <b>scope</b> of a variable may be limited.	<b>1 KU</b>
		<ul style="list-style-type: none"> <li>• <i>Local variable can only be seen/accessed in the module of code in which it is created</i></li> <li>• <i>Create local variable</i></li> <li>• <i>Use parameter passing</i></li> </ul> <p><i>1 mark for any one valid point</i></p>	
	(iii)	Explain why the programmer might want to <b>limit</b> the scope of a variable.	<b>2 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Variables cannot be accidentally altered by other parts of the program</i></li> <li>• <i>Variables will not conflict with variable with the same name in other modules</i></li> <li>• <i>Aids maintainability</i></li> <li>• <i>Aids modularity</i></li> </ul> <p><i>1 mark for each of two valid points</i></p>	

	<b>(d)</b> The software developed should be subject to testing using a comprehensive set of <b>test data</b> . State <b>two</b> other methods of testing comprehensively.	<b>2 PS</b>
	<ul style="list-style-type: none"> <li>• <i>Testing all of the individual modules independently</i></li> <li>• <i>Testing modules work together</i></li> <li>• <i>Acceptance/beta/field testing</i></li> <li>• <i>Use an independent test group</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>1 mark for each of two valid points. Note: Use of valid/extreme/exceptional data IS a comprehensive set of test data Not exhaustive.</i></p>	
	<b>(e)</b> Entucom insist that the software is <i>portable</i> . Explain why portability is important in this situation.	<b>1 PS</b>
	<ul style="list-style-type: none"> <li>• <i>Customers will have a range of hardware ie various types of TVs and various set-top boxes.</i></li> <li>• <i>The software will be required to run on a variety of hardware other than the one it was designed on.</i></li> </ul> <p><i>1 mark for either point, must have context</i></p>	
	<b>(f)</b> New set-top boxes may be developed in the future. State which type of maintenance could be required to ensure the software works with the new boxes. Explain your answer.	<b>2 PS</b>
	<i>Adaptive maintenance (1 mark) – since it is the environment that is being changed (1 mark)</i>	

**SECTION III Part A – Artificial Intelligence**

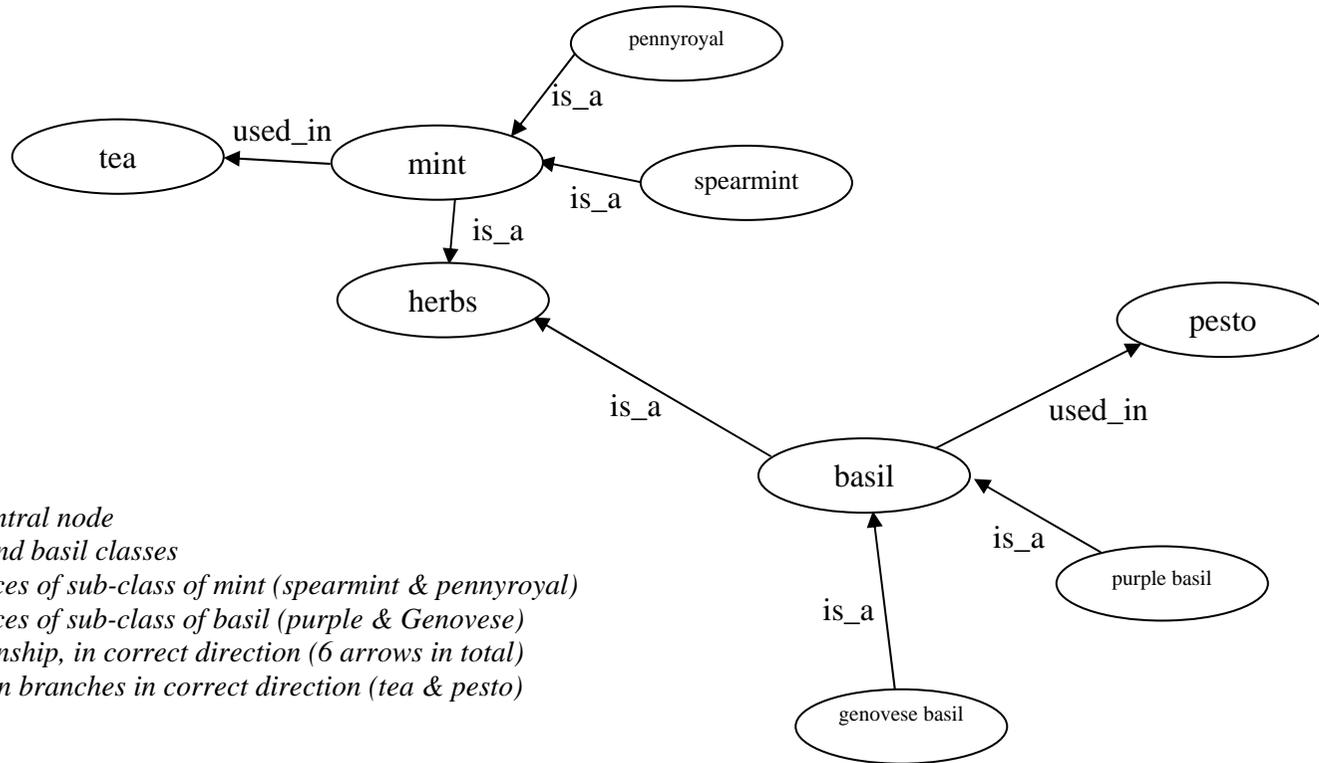
18	<p>Archaeologists are still exploring areas of the Great Pyramids in Egypt. These pyramids have a maze of tunnels with sharp turns and sudden drops. Unknown routes through tunnels are explored by robots such as Pyramid Rover. The robot is operated by humans from a control room.</p>	
	<div style="display: flex; align-items: center; justify-content: center;">  <div style="margin-left: 20px;"> <p>Pyramid Rover</p> </div> </div>	
	<p>(a) State <b>two</b> reasons why Pyramid Rover has its movement controlled by humans.</p>	<b>2 PS</b>
	<ul style="list-style-type: none"> <li>• <i>Need human control to stop damage to walls/robot etc</i></li> <li>• <i>Need control to force examination of items of interest along the tunnels</i></li> <li>• <i>Unknown items so limited vision recognition to aid navigation</i></li> <li>• <i>Uncertain/no route map (for path planning)</i></li> <li>• <i>Humans can decide/choose/control path</i></li> <li>• <i>Any other valid reason</i></li> </ul> <p><i>1 mark for each of two valid reasons</i></p>	
	<p>(b) Describe <b>two</b> practical problems that had to be overcome when the Pyramid Rover was designed.</p>	<b>2 PS</b>
	<ul style="list-style-type: none"> <li>• <i>Power supply: battery or umbilical cable</i></li> <li>• <i>Ability to move over surface if uneven (legs, wheels or caterpillar track)</i></li> <li>• <i>Processor power/light sources to cope with vision systems</i></li> <li>• <i>Potential return of artefacts</i></li> <li>• <i>Ability to move in sloping tunnels</i></li> <li>• <i>Small physical size to allow navigation of small tunnels</i></li> <li>• <i>Ability to turn round/reverse in dead end tunnels</i></li> <li>• <i>Robust/ruggedised to cope with terrain/damage</i></li> <li>• <i>Any other valid point</i></li> </ul> <p><i>1 mark for each of two valid problems</i></p>	

	(c)	Despite having its movement controlled, Pyramid Rover is classed as an <i>intelligent robot</i> , rather than a <i>dumb robot</i> .	
	(i)	Describe <b>one</b> situation where Pyramid Rover would <b>need</b> intelligence as well as, or instead of, user control.	<b>1PS</b>
		<ul style="list-style-type: none"> <li>• <i>Stops in front of an unidentified obstacle/detects danger</i></li> <li>• <i>If control is broken or Rover develops a fault</i></li> <li>• <i>Where Rover has to make independent choices</i></li> <li>• <i>Learning a route/creating an internal map</i></li> <li>• <i>Any other valid situation</i></li> </ul> <p><i>Any one situation for 1 mark</i></p>	
	(ii)	Explain how Pyramid Rover would apply intelligence in this situation.	<b>1 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Emergency stopping (in front of an unidentified obstacle)</i></li> <li>• <i>It can navigate back to control room (if control is broken or Rover develops a fault)</i></li> <li>• <i>It can choose shortest/safest route between two points</i></li> <li>• <i>Any other valid application of intelligence to described situation</i></li> </ul> <p><i>Any one appropriate explanation of solution to context described in part (i) for 1 mark</i></p>	
	(d)	After using the control software on Pyramid Rover, the archaeologists ask for several new features to be added. Name this type of software maintenance.	<b>1 KU</b>
		<i>Perfective (1 mark)</i>	

19	Computer games have been available since the 1960s.		
	(a)	State <b>two</b> differences that a <b>user</b> of modern computer games would notice compared to these early games.	<b>2 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Totally different style of game available eg simulation</i></li> <li>• <i>More complex (realistic) graphics/higher resolution</i></li> <li>• <i>Improved user interface/interactivity</i></li> <li>• <i>Multiplayer games</i></li> <li>• <i>Games will play strategies/show intelligence</i></li> <li>• <i>Games will have realistic sounds</i></li> <li>• <i>Greater variety of input devices available</i></li> <li>• <i>Any other valid difference</i></li> </ul> <p><i>Any two differences for 1 mark each. (Note: Not social context ie levels of violence, etc)</i></p>	
	(b)	State <b>two</b> benefits that modern software development environments offer programmers of current games.	<b>2 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Availability of event driven languages rather than programming in machine code</i></li> <li>• <i>Specialised graphics routines</i></li> <li>• <i>Better software development tools eg dedicated/graphics module libraries, error reporting tools, compiler/interpreters</i></li> <li>• <i>Rapid development environments</i></li> <li>• <i>Complex data types and file handling routines built in to languages</i></li> <li>• <i>Any other valid benefit</i></li> </ul> <p><i>Any two benefits for 1 mark each</i>  <i>Note that hardware developments are not appropriate here</i></p>	

	(c)	(i)	Explain how the use of parallel processors has aided the performance of computer games.	<b>2 PS</b>
			<ul style="list-style-type: none"> <li>• <i>Different actions can be processed simultaneously</i></li> <li>• <i>A specific example eg character moving, change of sound effect</i></li> <li>• <i>Faster image rendering/3D graphics etc</i></li> <li>• <i>Ability to evaluate multiple strategies and select best</i></li> <li>• <i>Faster response to user input/actions</i></li> </ul> <p><i>1 mark for each of two valid points</i></p>	
		(ii)	Other than parallel processing, state <b>two</b> other advances in hardware which have led to improvements in the performance of computer games.	<b>2 KU</b>
			<ul style="list-style-type: none"> <li>• <i>Increased memory (RAM/ROM)</i></li> <li>• <i>Faster processors</i></li> <li>• <i>Increased cache</i></li> <li>• <i>Better, more varied input/output devices</i></li> <li>• <i>Improved graphics cards empower higher resolution monitors</i></li> <li>• <i>Better sound card for improved audio</i></li> <li>• <i>Improved graphics cards/more video RAM</i></li> <li>• <i>Faster peripherals (hard disk access rates)</i></li> <li>• <i>Any other valid advance</i></li> </ul> <p><i>Any two valid advances for 1 mark each</i></p>	
		(iii)	Explain how each of these advances has led to this improvement in performance.	<b>2 PS</b>
			<ul style="list-style-type: none"> <li>• <i>Increased memory to hold larger and more complex programs</i></li> <li>• <i>Faster processors to manipulate data faster</i></li> <li>• <i>Increased cache to reduce time taken for fetch/execute cycle</i></li> <li>• <i>Varied input devices to give more realistic experience eg sensors in controller</i></li> <li>• <i>Higher resolution monitors to display clearer images</i></li> <li>• <i>Improved audio for better sound effects (eg surround sound)</i></li> <li>• <i>Improved colour depth for realistic graphics</i></li> </ul> <p><i>Any two valid explanations matching the two advances named in part (ii) – 1 mark each</i></p>	

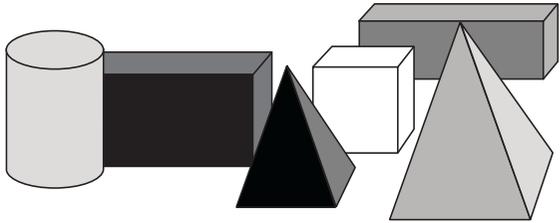
20	(a)	Artificial Intelligence programming languages are categorised as either <i>functional</i> or <i>declarative</i> (logic).		
	(i)	Name a functional language.		1 KU
		<i>LISP (1 mark)</i>		
	(ii)	Name a declarative language.		1 KU
		<i>Prolog (1 mark)</i>		
	(iii)	State whether the following section of code is written using a functional or a declarative language.  <pre>(defun eliza ()   "Respond to user input using pattern matching rules."   (loop    (print 'eliza&gt;)    (write (flatten (use-eliza-rules (read))) :pretty t)))</pre>		1 PS
		<i>functional (code is common LISP) (1 mark)</i>		
	(b)	<p><i>Semantic nets</i> are used to represent knowledge before coding. Use a semantic net to represent the following information about some herbs.</p> <p><i>Mint and basil are herbs.</i> <i>Pennyroyal and spearmint are types of mint.</i> <i>Genovese basil and purple basil are two types of basil.</i> <i>Mints can be used in making tea,</i> <i>basil is used in the making of pesto.</i></p> 		6 PS



- 1 mark** for herbs as central node
- 1 mark** for both mint and basil classes
- 1 mark** for both instances of sub-class of mint (spearmint & pennyroyal)
- 1 mark** for both instances of sub-class of basil (purple & Genovese)
- 1 mark** for is\_a relationship, in correct direction (6 arrows in total)
- 1 mark** for both used\_in branches in correct direction (tea & pesto)

6 marks maximum

Note: candidates may not use 'is\_a' and 'used\_in', allow any appropriate names for the relationships

21	<p>SHRDLU is a program which uses <i>natural language processing (NLP)</i> to manipulate blocks of various colours, shapes and sizes. An initial setup of the objects is shown below.</p>  <p>SHRDLU understands commands such as:  put the grey cylinder on top of the black block  put the white cube in front of the grey block</p>		
(a)	Here are two commands from a SHRDLU dialogue. What is the problem with each command?		
	(i)	put it on its side	1 PS
		<ul style="list-style-type: none"> <li>Unclear as to what 'it' refers to</li> <li>Which side is "it" to be put on</li> </ul> <b>1 mark for either point</b>	
	(ii)	put the pyramid on the grey block	1 PS
		<i>Ambiguity as to which pyramid to move, choice of two available (1 mark)</i>	
(b)	SHRDLU will accept the command grasp the grey block  Explain why SHRDLU might not understand the following command : grip the grey block		1 PS
	<i>The word "grip" might not be in SHRDLU's dictionary/memory/program</i>  <b>1 mark for any reasonable description. Note that rephrasing the question is insufficient ie "SHRDLU does not understand grip"</b>		

	(c) State <b>one</b> reason why there are more problems with natural language processing than with more formal programming languages.	<b>1 KU</b>
	<ul style="list-style-type: none"> <li>• <i>Formal languages have small vocabulary/NLP has to cope with ‘millions’ of possible words</i></li> <li>• <i>Formal languages have clearly defined and unambiguous words/NLP is subject to colloquialisms, ambiguity etc</i></li> <li>• <i>Formal languages use strict grammar/NLP accepts deviations</i></li> <li>• <i>Any other valid reason</i></li> </ul> <p><i><b>1 mark</b> for any valid point</i></p>	
	(d) In speech recognition software, there are four main stages of NLP. The first is speech recognition and the last is speech synthesis. Name the remaining <b>two</b> stages.	<b>2 KU</b>
	<ul style="list-style-type: none"> <li>• <i>Natural language understanding (<b>1 mark</b>)</i></li> <li>• <i>Natural language generation (<b>1 mark</b>)</i></li> </ul> <p><i>Do not accept NLU/NLG</i></p>	
	(e) Eliza is an application of NLP. Explain how Eliza responds to user input.	<b>2 KU</b>
	<ul style="list-style-type: none"> <li>• <i>Extracts keywords from user input</i></li> <li>• <i>Uses a bank of responses suited to the keyword</i></li> <li>• <i>Generates an appropriate response</i></li> <li>• <i>Uses a generic response if no suitable response found</i></li> </ul> <p><i><b>1 mark</b> for each of two bullet points</i></p>	

22	<p>There have been nine manned Apollo space flights to the moon. Six have landed astronauts on the surface of the moon. Two of the crew would land on the moon whilst the other would remain in orbit.</p> <p>The following is an extract from a knowledge base recording space expeditions to the moon.</p> <p>1 apollo(7, schirra, eisele, cunningham). <i>On Apollo 7, Schirra, Eisele and Cunningham were the crew.</i></p> <p>2 apollo(8, borman, lovell, anders).</p> <p>3 apollo(11, armstrong, collins, aldrin).</p> <p>4 apollo(12, conrad, gordon, bean).</p> <p>5 apollo(13, lovell, swigert, haise).</p> <p>6 apollo(16, young, mattingly, duke).</p> <p>7 apollo(17, cernan, evans, schmitt).</p> <p>8 crew_landed_on_moon(A) IF apollo(A, _, _, _) AND <i>A landed on the moon if A was an Apollo mission and the flight was after Apollo 10 and A was <b>not</b> 13.</i>  A&gt;10 AND  not(A=13).</p> <p>9 walked_on_moon(X, Z) IF apollo(A, X, _, Z) AND <i>Astronauts X and Z walked on the moon if X and Z were the first and third crew members of Apollo A and Apollo A landed on the moon.</i>  crew_landed_on_moon (A).</p> <p><b>Note:</b> The underscore( ‘ _ ’ ) in lines 8 and 9 is used when the value of the argument is irrelevant to the rule and can be ignored.</p>		
	<b>(a)</b> Use the line numbers to identify an example of each of the following in the above program:		
	<b>(i)</b> a fact; <i>any of lines 1 to 7 (1 mark)</i>	<b>1 KU</b>	
	<b>(ii)</b> a rule. <i>line 8 or line 9 (1 mark)</i>	<b>1 KU</b>	

	<b>(b)</b> Name the <b>two</b> search techniques used in artificial intelligence.	<b>2 KU</b>
	<i>depth first</i> <i>breadth first (1 mark each)</i> <i>Accept heuristic and exhaustive</i>	
	<b>(c)</b> State the solution to the query: ?apollo(A, armstrong, Y, aldrin).	<b>2 PS</b>
	<i>A=11 (1 mark), Y=collins (1 mark)</i> <i>'A=', and 'Y=' are needed for the marks to be given, '11' and 'collins' are not enough</i>	
	<b>(d)</b> Trace the first solution to the query: ? walked_on_moon(conrad, bean).  In your answer, you will be given credit for the correct use of the terms “sub-goal” and “instantiated”.	<b>8 PS</b>
	<p><i>match at line 9 with X instantiated to 'conrad' and Z instantiated to 'bean'</i> <i><u>first sub-goal is apollo(A, conrad, _, bean)</u></i> } (1 mark)</p> <p><i><u>match at line 4 with A instantiated to '12'</u></i> (1 mark)</p> <p><i>return to line 9, second sub-goal is crew_landed_on_moon(12)</i> <i>match at line 8 with <u>first sub-goal apollo(12, _, _, )</u> match at line 4</i> } (1 mark)</p> <p><i>return to line 8 with <u>second sub-goal A&gt;10</u> (which gives 12&gt;10) which is true</i> (1 mark)</p> <p><i>return to line 8 with third sub-goal <u>not(A=13)</u> which gives 12=13 as false so the sub-goal is true</i> (1 mark)</p> <p><i>solution to <u>query is true</u></i> (1 mark)</p> <p><i>Note: underlined parts are the main points of the trace. In addition:</i> <i>Award 1 mark for at least one correct use of the term 'instantiation/instantiated'</i> <i>Award 1 mark for at least one correct use of the term 'sub-goal'</i></p>	
	<b>(e)</b> Explain why there is a problem with the solution to the following query: ?walked_on_moon(duke, young).	<b>2 PS</b>
	<i>The query returns the answer false but they did walk on the moon. (1 mark)</i> <i>The order of names in the query is the wrong way round. (1 mark)</i>	

**SECTION III Part B – Computer Networking**

23	Ditton High School plans to set up a network of computers throughout the school. The school is made up of three separate buildings. Within each building a wired network is created. Wireless technology is used to share data between the buildings.	
	(a) Describe <b>one</b> economic reason why the school would have chosen to connect the school buildings using wireless technology.	<b>1 PS</b>
	<ul style="list-style-type: none"> <li>• <i>Save on the cost of laying the cables/digging up school grounds</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>1 mark for any valid point. Do not accept the simplistic “no need to buy cables” answer</i></p>	
	(b) Describe <b>two</b> reasons in favour of using a <i>star</i> topology rather than a <i>bus</i> topology in each of the separate buildings.	<b>2 PS</b>
	<ul style="list-style-type: none"> <li>• <i>Lots of users, potential for a very busy central line with lots of collisions in a bus – star reduces this</i></li> <li>• <i>Channel failure in a star will not affect the entire network</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>1 mark for each of two valid points</i></p>	
	(c) The school network consists of 256 devices. Which <i>class</i> of IP address should be used within the network?	<b>1 PS</b>
	<p><i>Class B (1 mark)</i>  <i>Accept C only with justification.</i></p>	
	(d) Describe <b>one</b> implication of a network being allocated an inappropriate class of IP address.	<b>1 PS</b>
	<ul style="list-style-type: none"> <li>• <i>Will have insufficient addresses <u>for each of the devices on the network</u></i></li> <li>• <i>Many addresses will go unused</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>1 mark for any 1 valid response</i></p>	

	Two methods used by the school to protect the network and the pupils are a <i>firewall</i> and a <i>walled garden</i> .	
(e)	Describe how a <b>firewall</b> protects a local area network with an Internet connection from outside attacks.	<b>1 KU</b>
	<ul style="list-style-type: none"> <li>• <i>Compares the originating IP address to a list of IP addresses it will accept data from</i></li> <li>• <i>Decides whether the port that the data is using is appropriate</i></li> </ul> <p><i>Any 1 valid point</i></p>	
(f)	Why would the school have decided to set up a <b>walled garden</b> ?	<b>2 PS</b>
	<ul style="list-style-type: none"> <li>• <i>To protect the pupils whilst they are online.</i></li> <li>• <i>By only allowing access to permitted web sites/do not access unsuitable materials</i></li> <li>• <i>Any other valid</i></li> </ul> <p><b>1 mark</b> for each point</p>	

24	Mel is creating a website to show images and video clips from a recent holiday. The homepage contains the title “Mel’s Website”. The title is in bold and italics.	
	(a) Write the <i>HTML</i> code required for the title.	3 PS
	<p><code>&lt;i&gt;&lt;b&gt;Mel’s Website&lt;/b&gt;&lt;/i&gt;&lt;/title&gt; OR &lt;title&gt;&lt;i&gt;&lt;strong&gt;Mel’s Website&lt;/strong&gt;&lt;/i&gt;</code></p> <ul style="list-style-type: none"> <li>• <b>1 mark</b> for correct use of <code>&lt;i&gt;</code> tag</li> <li>• <b>1 mark</b> for correct use of <code>&lt;b&gt;</code> or <code>&lt;strong&gt;</code> tag</li> <li>• <b>1 mark</b> for correct nesting of tags ie <code>&lt;i&gt;&lt;b&gt; &lt;/b&gt;&lt;/i&gt;</code></li> </ul> <p><i>Note: nesting might be different but valid ie <code>&lt;b&gt;&lt;i&gt;Mel’s Website&lt;/i&gt;&lt;/b&gt;</code></i>  <i>Ignore any “outer” tags eg <code>&lt;title&gt;</code>,<code>&lt;head&gt;</code>,<code>&lt;h1&gt;</code> etc</i></p>	
	(b) Mel publishes her webpage and submits the page to various <i>meta-search engines</i> . Describe how a <b>meta-search engine</b> operates.	2 KU
	<ul style="list-style-type: none"> <li>• <i>Queries other search engine</i></li> <li>• <i>Groups the responses</i></li> </ul> <p><b>1 mark for each point</b></p>	
	(c) Describe in detail how the increase in the availability of ADSL connections has affected the design of web pages.	2 PS
	<ul style="list-style-type: none"> <li>• <i>Web pages can now include a range of multimedia elements/Higher resolution graphics available (web 2.0)</i></li> <li>• <i>As the time taken to download these elements has been reduced</i></li> </ul> <p><b>1 mark for each point</b></p>	

	<b>(d)</b>	The TCP/IP protocol will be used when uploading certain files. Describe <b>two</b> operations carried out by the TCP part of the protocol.	<b>2 KU</b>
		<ul style="list-style-type: none"> <li>• <i>Splitting the file into packets</i></li> <li>• <i>Adding a sequence number to each packet</i></li> <li>• <i>Re-assembling the packets at the destination</i></li> </ul> <p><i>1 mark for each of two points</i></p>	
	<b>(e)</b>	State which layer of the <i>OSI model</i> is described by the following:	
	<b>(i)</b>	“provides a means for the user to access information on a network using appropriate software”;	<b>1 KU</b>
		<i>Application layer (1 mark)</i>	
	<b>(ii)</b>	“translates data into a format suitable for the other layers to deal with”.	<b>1 KU</b>
		<i>Presentation layer (1 mark)</i>	
	<b>(f)</b>	The OSI model describes seven layers or levels. State <b>one</b> benefit of breaking the process of network communication into different layers.	<b>1 PS</b>
		<i>Changes to one layer do not impact upon the other layers (1 mark)</i>	

25	Module libraries are to be used in the development of a piece of software that will be used to transfer data across a local area network.		
	(a)	State <b>two</b> reasons why the use of module libraries speeds up the development of software.	<b>2 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Code is already written</i></li> <li>• <i>Code already tested</i></li> <li>• <i>Code already documented</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>Any two, 1 mark each</i></p>	
	(b)	The program can allow data to be sent <i>synchronously</i> or <i>asynchronously</i> . Describe asynchronous data transmission.	<b>2 KU</b>
		<ul style="list-style-type: none"> <li>• <i>Two clocks are not synchronised/machines are working independently/no timing mechanism required</i></li> <li>• <i>Each byte of data requires a start and stop bit</i></li> <li>• <i>Other valid</i></li> </ul> <p><i>1 mark for each of two valid points</i></p>	
	(c)	Data can be sent using <i>packet switching</i> or <i>circuit switching</i> . Describe fully <b>one</b> advantage of packet switching over circuit switching.	<b>3 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Packets do not have to follow same route</i></li> <li>• <i>So each packet takes the most efficient route</i></li> <li>• <i>Improving network performance</i></li> <li>• <i>Security may be improved as individual packets are intercepted rather than whole message/file</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>1 mark for each of three valid points</i></p>	

	<b>(d)</b>	Error checking is an essential component of data transmission. <i>Parity check</i> is one method of error checking.	
	<b>(i)</b>	Describe <b>one</b> instance where a parity check would not detect an error that has occurred during transmission. You should use an example to illustrate your answer.	<b>2 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Where an even number of bits have changed from origin to destination</i></li> <li>• <i>Eg 11111111 changed to 11111100 during transfer</i></li> </ul> <p><i>OR</i></p> <ul style="list-style-type: none"> <li>• <i>Where sender and receiver are using different parities</i></li> <li>• <i>Eg 11111111 (even parity) changed to 11111101 during transfer but receiver working under odd parity</i></li> </ul> <p><i>1 mark for instance, 1 mark for example</i></p>	
	<b>(ii)</b>	Name <b>one</b> other method of <b>detecting</b> data transfer errors within a network.	<b>1 KU</b>
		<i>Cyclic Redundancy Check/CRC (1 mark)</i>	
	<b>(iii)</b>	Describe how this method works.	<b>2 KU</b>
		<ul style="list-style-type: none"> <li>• <i>Performing a calculation at origin <b>and</b> send result with data</i></li> <li>• <i>Perform (same) calculation at destination and comparing the answers</i></li> </ul> <p><i>1 mark for each point</i></p>	
	<b>(e)</b>	“Error checking increases data transfer time whilst improving network performance.” Justify this statement.	<b>2 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Extra time is taken to perform error checking tasks (increasing transfer time)</i></li> <li>• <i>Reduces the number of transmission errors that go undiscovered (improving performance)</i></li> </ul> <p><i>OR</i></p> <ul style="list-style-type: none"> <li>• <i>Extra data is sent eg checksum/parity (increasing transfer time)</i></li> <li>• <i>Reduces the number of transmission errors that go undiscovered (improving performance)</i></li> </ul> <p><i>1 mark point and 1 mark for relevant justification</i></p>	

26	Gordon frequently accesses websites as part of his work as a salesman.		
	(a)	Gordon enters the URL of a site he wishes to visit. This URL is sent to a <i>domain name server</i> to be resolved. What occurs during domain name resolution?	2 KU
		<ul style="list-style-type: none"> <li>• <i>The DNS converts the URL into an IP address</i></li> <li>• <i>DNS looks up URL on database to find related IP</i></li> <li>• <i>IP establishes which web server/device hosts the file</i></li> </ul> <p><i>1 mark for each of two valid points</i></p>	
	(b)	Describe <b>two</b> reasons why a domain name server may be unable to resolve a URL.	2 PS
		<ul style="list-style-type: none"> <li>• <i>Incorrectly entered URL/URL not valid</i></li> <li>• <i>This particular URL to IP mapping is not present on this DNS</i></li> </ul> <p><i>1 mark for each of the two points</i></p>	

	(c)	Gordon lives in a rural village where high speed Internet access is not available through telephone or cable lines. However, he often works at home using his laptop to connect to the company server.	
	(i)	State <b>one</b> way in which Gordon could obtain high speed Internet access.	<b>1 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Through satellite connection</i></li> <li>• <i>Through electricity cables</i></li> <li>• <i>Mobile broadband</i></li> </ul> <p><i>1 mark for any valid</i></p>	
	(ii)	Describe <b>two</b> security issues that Gordon’s employers will have to consider when allowing their employees to remotely access the company server.	<b>2 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Need to authenticate the user</i></li> <li>• <i>Need to ensure user permissions are set correctly</i></li> <li>• <i>Need to ensure that data is not intercepted during transmission</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>1 mark for each of two valid points.</i>  <i>Note: More general answers about dangers of external access must go beyond simplistic SG-type responses ie “they could get hackers”</i></p>	
	(iii)	Other than allocating usernames and passwords, describe how each of the security issues you have described in part (ii) could be overcome.	<b>2 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Use a “callback” facility to ensure correct phone line being used</i></li> <li>• <i>Encrypt data giving each employee a <u>restricted</u> key</i></li> <li>• <i>Use a secure protocol such as HTTPS</i></li> <li>• <i>Allocate minimum necessary access to each user</i></li> </ul> <p><i>1 mark for each of two points. Note: Candidate response must be beyond simplistic SG-type answers and must relate to part (ii)</i></p>	

	<b>(d)</b>	Gordon creates a <i>wireless personal area network (WPAN)</i> .		
		<b>(i)</b>	Other than a desktop or laptop computer, state <b>two</b> other devices commonly found in a WPAN.	<b>2 PS</b>
			<ul style="list-style-type: none"> <li>• <i>Mobile phone</i></li> <li>• <i>Palmtop/PDA</i></li> <li>• <i>Music/MP3 player</i></li> <li>• <i>Digital (still or video) camera</i></li> <li>• <i>printer/headphones</i></li> </ul> <p><i>1 mark for each of two valid points.</i></p>	
		<b>(ii)</b>	Describe <b>two</b> reasons why Gordon would create a WPAN with these devices.	<b>2 PS</b>
			<ul style="list-style-type: none"> <li>• <i>Save clutter of cables</i></li> <li>• <i>To exchange data between them (eg from camera to computer)</i></li> <li>• <i>Synchronise information on devices (eg address book)</i></li> </ul> <p><i>1 mark for each of two valid points</i></p>	
Gordon's managers are concerned over possible misuse of the IT equipment issued to their staff. They begin to check the content of their employee's e-mails.				
	<b>(e)</b>	<b>(i)</b>	State the Law which allows the managers to carry out these checks.	<b>1 KU</b>
			<i>Regulation of Investigatory Powers Act (1 mark) Note: Not "RIPA" or RIP Act</i>	
		<b>(ii)</b>	Describe <b>two</b> other surveillance activities that this Law allows employers or the police to carry out.	<b>2 KU</b>
			<ul style="list-style-type: none"> <li>• <i>Checking Internet history</i></li> <li>• <i>Access decryption keys/encrypted data</i></li> <li>• <i>Undercover officers/surveillance</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>1 mark for each of two valid points. Note: As email is in the stem, generic "monitor communication" responses are insufficient</i></p>	

**SECTION III Part C – Multimedia Technology**

27	A multimedia application called “Chef” is to be created to accompany a new cookbook. The software development process is applied to the creation of “Chef” software.		
	(a)	The purpose of the multimedia application is one aspect which must be investigated during the <i>analysis</i> stage. State <b>two</b> other aspects which must also be investigated.	2 KU
		<ul style="list-style-type: none"> <li>• <i>Typical users</i></li> <li>• <i>Hardware requirements</i></li> <li>• <i>Software compatibility</i></li> <li>• <i>Multimedia components</i></li> <li>• <i>Inputs/outputs/boundaries</i></li> <li>• <i>Functions/features</i></li> <li>• <i>Budget</i></li> <li>• <i>Timescale</i></li> </ul> <p><i>1 mark for each of two valid points</i></p>	
	(b)	Presentation software allows the inclusion of media elements and the use of hyperlinks to move between pages. Describe <b>two</b> advanced features of authoring software which make it more suitable for creating a multimedia application.	2 PS
		<ul style="list-style-type: none"> <li>• <i>Use of timeline to synchronise events which are happening simultaneously</i></li> <li>• <i>Use of scripting to control objects on screen</i></li> </ul> <p><i>1 mark for each of two items</i> <i>NOT WYSIWYG</i></p>	
	(c)	Describe <b>two</b> ways in which “Chef” should be tested.	2 PS
		<ul style="list-style-type: none"> <li>• <i>Check that all links are correct/go to correct location</i></li> <li>• <i>Check that all media elements play correctly</i></li> <li>• <i>Accept beta testing description</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>1 mark for each valid test. NOT: check links, check video</i></p>	

	<b>(d)</b>	When “Chef” is released, it is distributed along with software used to view the application.	
	<b>(i)</b>	State <b>two</b> benefits of this distribution method for the user.	<b>2 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Do not need to obtain/find/download/buy viewer</i></li> <li>• <i>Do not need to check compatibility of other viewers</i></li> <li>• <i>Player software will take less space in backing storage than the software used to create the application</i></li> <li>• <i>Player software will not take as much processor time as the software used to create the application</i></li> <li>• <i>Player software will use less memory than the software used to create the application</i></li> <li>• <i>Do not need to buy expensive software used to create the application</i></li> </ul> <p><i>1 mark for each of two benefits</i></p>	
	<b>(ii)</b>	State <b>one</b> benefit of this distribution method for the software development team.	<b>1 PS</b>
		<ul style="list-style-type: none"> <li>• <i>No need to test application with other viewers</i></li> <li>• <i>User cannot edit the application</i></li> <li>• <i>other valid</i></li> </ul> <p><i>1 mark for any valid</i></p>	
The performance of a multimedia application can depend on the hardware components of the system. These could include a powerful processor and the use of <i>holographic storage</i> .			
	<b>(e)</b>	Explain how the use of a more powerful processor will benefit the performance of a multimedia application.	<b>2 PS</b>
		<p><i>Multimedia elements (video/sound) require much processing to compress/process/display (1 mark)</i></p> <p><i>Powerful/fast processors enable this to happen within real time/reasonable time (1 mark)</i></p>	
	<b>(f)</b>	Explain how <b>holographic storage</b> can be used to store terabytes of data.	<b>2 KU</b>
		<p><i>Stores data in a number of 3D images (1 mark)</i></p> <p><i>Hundreds of images may be saved in different layers/full <u>depth</u> of medium (1 mark)</i></p>	

	<b>(g)</b> Other than processing and storage, name <b>one</b> development in computer <b>hardware</b> and describe how it has supported advances in multimedia.	<b>2 PS</b>
	<ul style="list-style-type: none"> <li>• <i>Real or 3D display technology – user can engage with an object/situation, gain more info through added depth</i></li> <li>• <i>Increased capacity of RAM – more video/sound can be held while editing/processing</i></li> <li>• <i>Firewire/USB – easy connection of hardware eg digital video camera, and fast access times</i></li> <li>• <i>High resolution monitors – allow high definition video</i></li> <li>• <i>Graphics card – onboard processor for video allowing main processor to do other tasks</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>1 mark for name, 1 mark for description which must have multimedia context</i></p>	

28	<p>The image shown below is being used in the advertising campaign for a new dog biscuit called “Bonzo Bites”.</p> <div> </div>	
(a)	<p>The original image is a bitmap file. Explain the purpose of a <i>CLUT</i> in this file format.</p>	<b>1 KU</b>
	<ul style="list-style-type: none"> <li>• <i>The RGB colour code for each colour used in the image is stored in the colour lookup table</i></li> <li>• <i>A local palette storing the selection of colours used in the image</i></li> </ul> <p><i>1 mark for any valid point</i></p>	
(b)	<p>Describe a benefit of using a CLUT when applying effects to a bitmap image.</p>	<b>1 PS</b>
	<ul style="list-style-type: none"> <li>• <i>Changes to the palette affect the whole screen at once, so faster than editing pixel by pixel</i></li> <li>• <i>Can be used to produce special effects which would be much slower to produce by updating pixels</i></li> </ul> <p><i>1 mark for any valid point</i></p>	
	<p>The biscuit name was created using graphics software. It was saved as a graphic file type. It is shown below.</p> <div> <h1 style="text-align: center;">Bonzo Bites</h1> </div>	

	<b>(c)</b>	<b>(i)</b>	State the technique that could be applied to the text to improve its appearance.	<b>1 PS</b>
			<i>anti-aliasing (1 mark)</i>	
		<b>(ii)</b>	Explain how the use of this technique improves the appearance of the text.	<b>2 KU</b>
			<ul style="list-style-type: none"> <li>• <i>Simulates extra resolution</i></li> <li>• <i>Blurs/smooths the edge</i></li> <li>• <i>By changing colour of pixels along the jaggy edge</i></li> </ul> <p><i>1 mark for any two points</i></p>	
	<p>The text is added onto the image. The text appears in a white box as shown below.</p> <div style="text-align: center;">  </div>			
	<b>(d)</b>	<b>(i)</b>	Name the feature which will avoid showing the white box.	<b>1 PS</b>
			<i>Transparency/opacity (1 mark)</i>	
		<b>(ii)</b>	Name <b>one</b> graphics file format that provides this feature.	<b>1 KU</b>
			<i>GIF, PNG (1 mark)</i>	

	<b>(e)</b>	The image file is edited and saved as a compressed bitmap file.	
	<b>(i)</b>	Describe how the <i>RLE</i> compression method reduces the file size.	<b>2 KU</b>
		<i>(Areas of a particular colour) compressed by storing the colour to repeat (1 mark)</i> <i>And the number of pixels to repeat for (1 mark)</i>	
	<b>(ii)</b>	Explain why this compression method may <b>not</b> be effective on this image file.	<b>2 PS</b>
		<i>The image does not contain that many large blocks of the same colour (1 mark)</i> <i>Therefore the amount of compression will be limited (1 mark)</i>	
	<b>(f)</b>	<i>Object oriented data storage is more efficient than bitmap storage.</i>	
	<b>(i)</b>	Explain when this statement is <b>not</b> true.	<b>2 PS</b>
		<i>As the complexity of the image/number of objects increases the file size increases (1 mark)</i> <i>A bitmap image will have a constant file size, regardless of complexity (1 mark)</i>	
	<b>(ii)</b>	Name and describe <b>one</b> file type suitable for 3D object oriented data storage.	<b>2 KU</b>
		<i>VRML/WRL – plain text file of individual object descriptions/stores objects and their attributes</i>  <i>1 mark for name, 1 mark for description</i>	

29	A website is being developed for Write Rhymes, a company that writes poems and rhymes.		
	(a)	A video clip is placed on the home page. It contains a child introducing the company by reciting a rhyme. The video will be played using <i>streaming</i> .	
	(i)	What is meant by the term “streaming”?	1 KU
		<ul style="list-style-type: none"> <li>• <i>Data is played as it is received</i></li> <li>• <i>Playing a remote file</i></li> </ul> <p><i>1 mark for any one point</i></p>	
	(ii)	Describe <b>one</b> reason why it was decided to stream the video clip.	1 PS
		<ul style="list-style-type: none"> <li>• <i>Do not want visitors to have to <u>wait</u> for the complete video to download.</i></li> <li>• <i>Do not want user to have a copy of the video file</i></li> </ul> <p><i>1 mark for any one point</i></p>	
	(b)	The video clip was recorded using 15 frames per second in 24 bit colour depth with 600 x 800 pixels. The clip lasts for 2 minutes. Calculate the file size of the video clip. Ignore sound and compression in your calculation. Show all working and express your answer in appropriate units.	3 PS
		<p><i>= 15 fps x 3 bytes x 600 x 800 (1 mark) x 120 seconds (1 mark)</i>  <i>/1024/1024/1024 = 2.41 Gigabytes (1 mark)</i></p> <p><i>3 marks must be allocated if the correct solution is written without working</i></p>	
	(c)	The font used on each page was specially created for Write Rhymes. When the pages are viewed by potential customers they see a substitute font instead. What should have been done to ensure this font is shown correctly?	1 PS
		<ul style="list-style-type: none"> <li>• <i>Embedded font should have been used</i></li> <li>• <i>Make the font available to download</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>1 mark any valid point</i></p>	

	<b>(d)</b>	On the birthday rhyme page, audio clips of sample rhymes can be played. Each rhyme is stored as a <i>RIFF</i> file.	
	<b>(i)</b>	Name the <i>codec</i> used by RIFF.	<b>1 KU</b>
		<i>ADPCM (1 mark)</i>	
	<b>(ii)</b>	Describe the technique used for compression by this <i>codec</i> .	<b>1 KU</b>
		<i>Saves the difference between each sample, to reduce amount of data to be stored (1 mark)</i> <i>Allow valid description of compression if it matches candidates answer to (i)</i>	
	<b>(e)</b>	The rhymes are recorded in mono. Explain why the recording was not made in stereo.	<b>1 PS</b>
		<i>Take less storage space OR mono quality is adequate for speech (1 mark for either)</i>	
	<b>(f)</b>	Copyright is held by Write Rhymes for all content on the website. Describe <b>two</b> examples of how users could breach copyright.	<b>2 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Media elements could be copied from website and used without permission</i></li> <li>• <i>Media elements could be edited without permission and distributed</i></li> <li>• <i>Media elements could be sold as user's own material</i></li> <li>• <i>Any other valid</i></li> </ul> <p><i>1 mark for each of two examples</i></p>	

<b>30</b>	A choir use a recording studio to produce their own CD.		
	<b>(a)</b>	The vocals for each track are captured using <i>digitised sound</i> . Explain the term “digitised sound”.	<b>1 KU</b>
		<ul style="list-style-type: none"> <li>• <i>Sound is sampled (captured) at regular intervals</i></li> <li>• <i>Converting <u>analogue</u> into digital form</i></li> </ul> <p><i>1 mark for any valid point</i></p>	
	<b>(b)</b>	The backing music for each track is an instrumental MIDI file.	
	<b>(i)</b>	State <b>one</b> reason why MIDI would produce a high quality sound.	<b>1 PS</b>
		<i>No background noise as data is digitally created and stored (1 mark)</i>	
	<b>(ii)</b>	MIDI has a small file size compared to digitised sound. State <b>one</b> further benefit that MIDI has over digitised sound.	<b>1 KU</b>
		<ul style="list-style-type: none"> <li>• <i>All individual notes/instruments can be edited/have effects applied</i></li> <li>• <i>Accept an example of an attribute that could be edited eg tempo</i></li> <li>• <i>Can be edited as a text file.</i></li> </ul> <p><i>1 mark any valid</i></p>	
	<b>(iii)</b>	State <b>two</b> reasons why some musical artists do not use MIDI.	<b>2 PS</b>
		<ul style="list-style-type: none"> <li>• <i>Does not contain vocals</i></li> <li>• <i>Not as realistic as digitised sound</i></li> <li>• <i>Can depend on quality of sound card</i></li> <li>• <i>Artist values interpretation/skill level/performance</i></li> </ul> <p><i>1 mark for each of two valid points</i></p>	

	<p>(c) The vocals and backing music are combined to produce each completed track. Name <b>two</b> features of sound editing software and explain how <b>each</b> may be used to improve the completed track.</p>	<b>4 PS</b>
	<p><i>Fade – used to prevent abrupt starts and stops, may be applied to vocals at the end of a track</i>  <i>Normalising – digitised sound is stretched to use full dynamic range available, to make sound clearer</i>  <i>Echo – give effect of a large area, may make choir sound as if they are in a church</i>  <i>Resampling – change the frequency of the sample rate</i></p> <p><i>Any other valid</i></p> <p><b><i>1 mark</i></b> for each name, <b><i>1 mark</i></b> for how it is used in this situation  <b><i>NOT: clipping, delete/cut because of scenario</i></b></p>	

[END OF MARKING INSTRUCTIONS]