



2012 Computing

Higher

Finalised Marking Instructions

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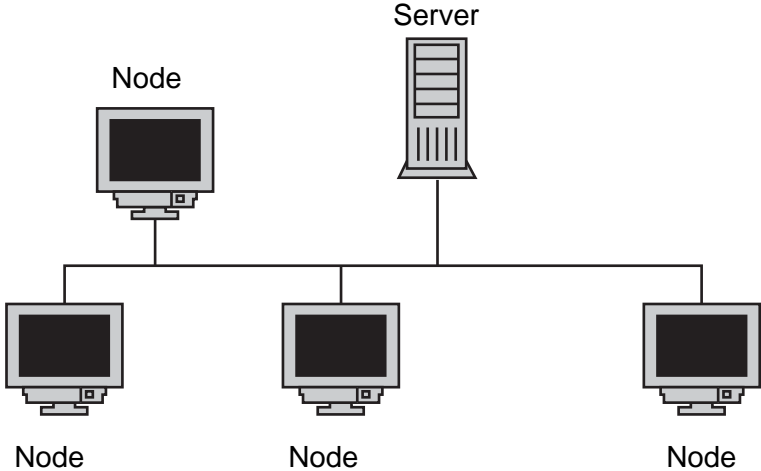
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SECTION I

1.	Write the ten digit binary number 1001001001 as a positive integer.	1 PS
	<i>585 (1 mark)</i>	
2.	A computer system uses <i>floating point representation</i> to store <i>real</i> numbers.	
(a)	State the part of floating point representation that determines the range of numbers stored.	1 KU
	<i>Exponent (1 mark)</i>	
(b)	State the part of floating point representation that determines the precision of numbers stored.	1 KU
	<i>Mantissa (1 mark)</i>	
3.	Ali has created a poster using <i>bitmapped</i> graphic software. Describe how a bitmapped graphic is stored.	2 KU
	<ul style="list-style-type: none"> • <i>Each pixel represented as a binary number</i> • <i>As a (2D) <u>array/grid</u> of pixels</i> • <i>Colour (of pixel) represented by (unique) binary value/notion of bit depth</i> <i>(1 mark for each of two valid points)</i>	
4.	<i>Protocol conversion</i> and <i>buffering</i> are two functions of an interface. State two other functions of an interface.	2 KU
	<ul style="list-style-type: none"> • <i>Voltage conversion</i> • <i>Data format conversion/serial to parallel/analogue to digital</i> • <i>Handling of status signals (accept a valid example)</i> <i>(Any two correct answers 1 mark each)</i>	

5.	The table shows types of computer memory listed in descending order of <i>speed of access</i> (fastest first). Identify the two missing types (1) and (3).	<table border="1"> <tr><td>(1)</td></tr> <tr><td>(2) Cache</td></tr> <tr><td>(3)</td></tr> <tr><td>(4) Backing store</td></tr> </table>	(1)	(2) Cache	(3)	(4) Backing store	2 PS
(1)							
(2) Cache							
(3)							
(4) Backing store							
<ul style="list-style-type: none"> • (1) Registers • (3) RAM/ROM/Main Memory <p>(1 mark each)</p>							
6.	Audrey creates and saves a new document to the hard disk.						
	(a)	State two tasks carried out by the <i>file management</i> part of the operating system during this save operation	2 KU				
		<p><i>The file management system will:</i></p> <ul style="list-style-type: none"> • Decide where on backing store the file will be saved • Allocate/record address of (start of) file (or blocks/parts thereof) • Ensure that file does not overwrite existing/valid data • Define access rights • Record the creation date • Update the file directory (regarding file or parts/blocks) • Any other valid <p>(1 mark each for any two correct answers) Note: many candidates make incorrect reference to “locating file”</p>					
		(b)	State one task carried out by the <i>input/output management</i> part of the operating system during this save operation.	1 KU			
		<ul style="list-style-type: none"> • Copies/transfers the blocks of <u>data</u> from main memory to the hard disk • Handles errors during data transfer • Inputting user commands for save via mouse click etc • Any other valid (1 mark) <p>Note: valid answer must relate to objects at lower level than file</p>					

7.	<p>The diagram below shows the layout of a small LAN.</p> 	
(a)	Name this network <i>topology</i> .	1 PS
	<i>Bus (Topology) (1 mark)</i>	
(b)	The network shown above is a <i>client server</i> network. State one advantage of a client server network over a <i>peer-to-peer</i> Network.	1 KU
	<ul style="list-style-type: none"> • <i>Better security/control of access</i> • <i>Efficient backup of centralised files</i> • <i>File/application sharing is simpler to set up</i> • <i>Any other valid (1 mark)</i> 	
(c)	A device is required to connect this network to the Internet. Name this device.	1 PS
	<ul style="list-style-type: none"> • <i>A router</i> • <i>A (cable) modem</i> • <i>Any other valid (1 mark)</i> <p><i>Note: NIC is not valid, as this connects a device to the network only</i></p>	

8.	The software development process is <i>iterative</i> . Explain how the word iterative applies to this process.	2 KU
	<ul style="list-style-type: none"> • <i>The process may revisit an earlier stage (1 mark)</i> • <i>In the light of experience/information gained (1 mark)</i> 	
9.	Many software development projects use <i>top-down design</i> . Explain the process of top-down design.	1 KU
	<i>A problem is broken down into smaller/easier to solve (sub-)problems. (1 mark)</i>	
10.	Name one graphical design notation.	1 KU
	<ul style="list-style-type: none"> • <i>Structure chart/diagram</i> • <i>Flowchart</i> • <i>Semantic net</i> • <i>Any other valid</i> <i>(1 mark for 1 point)</i>	
11.	An <i>interpreter</i> may be used in the software development process.	
(a)	Name one stage of the software development process where the interpreter may be used.	1 KU
	<i>Implementation/testing/maintenance (1 mark)</i>	
(b)	Explain how the interpreter is used in the stage named in part (a).	1 PS
	<i>Implementation: lines of code are translated and executed in turn, reporting syntax errors</i> <i>Testing: test all (or part) of code to help identify line where error occurs</i> <i>Maintenance: as above</i> <i>(1 mark for any valid explanation of use in stage named in (a))</i> <i>Note: accept generic answer describing interpretation “translate and execute each line in turn”</i>	

12.	Describe one difference between a <i>scripting</i> language and a <i>procedural</i> language.		2 PS
<ul style="list-style-type: none"> • <i>Scripting language is embedded within an application (1 mark) whereas a procedural is stand-alone (1 mark)</i> • <i>Keywords within a scripting language are specific to parent application (1 mark) whereas in a procedural, keywords are more general (1 mark)</i> • <i>Programmer has control over data types/might have access to low level commands/operations in a procedural language (1 mark) whereas data types are embedded in a scripting language (1 mark)</i> <p><i>(2 marks awarded as shown within any one point)</i> <i>Note : To state a difference by negating a valid statement is not enough for the second mark. Macros do not set these languages apart.</i></p>			
13.	(a)	State what is meant by a <i>boolean</i> variable.	1 KU
<i>A variable which can have only 2 values - true/false (OR yes/no OR on/off) (1 mark)</i>			
	(b)	Explain how a boolean variable could be used in a <i>linear search</i> algorithm.	1 PS
<ul style="list-style-type: none"> • <i>Used to terminate the loop</i> • <i>Used to show the presence of the item in the list</i> <p><i>(1 mark for one point)</i></p>			
14.	Software should be both <i>reliable and robust</i> . Explain the terms “reliable” and “robust”.		2 KU
<p>1 mark for one of the following definitions of reliable...</p> <ul style="list-style-type: none"> • <i>Will give correct output to valid data</i> • <i>Will not stop due to design flaws/errors</i> • <i>Free from design and coding bugs</i> <p><i>Robust software will not crash when invalid data is entered (or similar) (1 mark)</i> <i>Note: Candidates may use valid/correct interchangeably</i></p>			

15.	State one way in which documentation produced at the <i>testing</i> stage of the software development process will be used during <i>corrective</i> maintenance.	1 PS
	<ul style="list-style-type: none"> • <i>Will detail test data originally used so that re-testing on that data will not need to be done again</i> • <i>Details the original test data which did not find the error</i> • <i>Allows identification of new data sets that should be tested</i> <p>(1 mark for valid response)</p>	
16.	State two characteristics of programming code that improve <i>maintainability</i> .	2 KU
	<ul style="list-style-type: none"> • <i>Use of meaningful variable names</i> • <i>Use of internal comments</i> • <i>Effective use of white space (such as appropriate indentations and blank lines)</i> • <i>Use of procedures/modularity/subroutines/functions</i> • <i>Use of parameter passing/local variables</i> • <i>Use of module libraries</i> • <i>Use of formatted keywords</i> • <i>Any other valid</i> <p>(1 mark for each of two points)</p>	

SECTION II

<p>17.</p>	<p>Tara, who works for Consumer Friend Magazine, has produced the following table:</p> <table border="1" data-bbox="414 295 1657 654" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="5" style="background-color: #cccccc;">Consumer Friend Magazine</th> </tr> <tr> <th>Processor</th> <th>Clock Speed (GHz)</th> <th>MIPS</th> <th>MegaFLOPs</th> <th>Data Bus Width (Bits)</th> </tr> </thead> <tbody> <tr> <td>Inrel Core Gi</td> <td>3.2</td> <td>72,495</td> <td>63,933</td> <td>64</td> </tr> <tr> <td>Atheton E</td> <td>2.8</td> <td>73,665</td> <td>63,105</td> <td>64</td> </tr> <tr> <td>Motorilla T</td> <td>2.0</td> <td>49,924</td> <td>51,150</td> <td>128</td> </tr> </tbody> </table> <p>NOTE: One MegaFLOP = One Million FLOPs</p>	Consumer Friend Magazine					Processor	Clock Speed (GHz)	MIPS	MegaFLOPs	Data Bus Width (Bits)	Inrel Core Gi	3.2	72,495	63,933	64	Atheton E	2.8	73,665	63,105	64	Motorilla T	2.0	49,924	51,150	128	
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<p>(a)</p>	<p>Explain why clock speed alone is not considered a good measure of processor performance.</p>	<p>1 KU</p>																									
	<ul style="list-style-type: none"> • <i>Clock Speed does not take other important architectural features into consideration (such as data bus width)</i> • <i>Clock Speed is not a measure of actual throughput.</i> • <i>Clock Speed is only valid if the processors being compared have the same architecture.</i> <p>(1 mark for any of the above)</p>																										
<p>(b)</p>	<p>Tara states that the Atheton E is better than the Inrel Core Gi as it has a higher MIPS result. Explain why Tara may be incorrect.</p>	<p>2 PS</p>																									
	<ul style="list-style-type: none"> • <i>FLOPS result may be more reliable as (logic/arithmetic) operations independent of level of complexity</i> • <i>Complexity of instructions used can vary (and therefore skew the results with MIPS)</i> • <i>MIPS test may have been performed with small/simple machine instructions</i> <p>(1 mark for each of two points)</p>																										

	(c)	<p>A computer containing the Motorilla T has a 32 bit address bus, a 128 bit data bus and 24 control lines. Calculate the maximum addressable memory of this computer.</p> <p>Show all working. State your answer using appropriate units.</p>	3 PS
		<p><i>Addressable memory = $2^{32} \times 128$ (2 marks, 1 for each part)</i></p> <p><i>= 549755813888 bits = 68719476736 bytes</i></p> <p><i>= 67108864 Kbytes = 65536 Mbytes = 64Gbytes. (1 mark)</i></p>	
	(d)	<p>All processors contain an <i>ALU</i> and a <i>control unit</i>.</p>	
	(i)	<p>State one logic operation performed by the ALU.</p>	1 PS
		<p><i>Any valid, ie AND, OR, NOT, =,<,<=,>,>=,<>,etc (1 mark)</i></p> <p><i>Note: accept descriptions of above ("comparison of values")</i></p> <p><i>or actual machine code instructions (BNE - Branch if not equal)</i></p>	
	(ii)	<p>Describe the purpose of the control unit.</p>	1 KU
		<ul style="list-style-type: none"> • <i>Synchronise processor instructions/operations</i> • <i>Control the flow of data/instructions within CPU</i> • <i>Activate and/or respond to control lines</i> • <i>Control fetch execute cycle</i> • <i>Decode and execute instructions.</i> <p><i>(1 mark for any valid point)</i></p>	
	(e)	<p>The manufacturers of the Inrel Core Gi are considering using a wider data bus in a new processor design. State one reason why this will improve processor performance.</p>	1 PS
		<p><i>More data can be carried in a single instruction cycle/at one time (1 mark)</i></p>	

18.	A system called EarthWatch gathers data from weather stations all over the world. Each station uses a <i>terminal</i> to enter data into the EarthWatch <i>mainframe</i> .		
	(a)	Apart from the physical size or the cost of a mainframe, explain one difference between a mainframe with terminals and a network of computers.	2 KU
		<ul style="list-style-type: none"> • <i>Each computer on a network has its own built in processor/RAM/backing storage (1 mark)</i> • <i>A terminal is reliant on the processor/RAM/backing storage capacity of the mainframe (1 mark)</i> • <i>A mainframe will have many thousands of processors/massive ram space/backing storage (1 mark)</i> • <i>Much more than any individual computer on a computer network (1 mark)</i> <i>(Valid point with reason, 2 marks)</i>	
	(b)	The mainframe's hard disk system has been continually storing weather data for 5 years. A message appeared on the main screen stating that the data file could not be stored on the hard disk due to lack of storage space. However, there is enough space on the mainframe's hard disk system.	
	(i)	Explain the most likely cause of this apparent lack of storage.	2 PS
		<ul style="list-style-type: none"> • <i>The available free space is fragmented, file fragments/space spread out over the disks</i> • <i>Large section of (contiguous) free space required to store the file</i> OR <ul style="list-style-type: none"> • <i>Disk contains unidentified bad sectors</i> • <i>These are unavailable for storing of data</i> OR <ul style="list-style-type: none"> • <i>Disk space used by copies of virus that does not show in file table</i> • <i>But these blocks are unavailable for storing data</i> <i>(1 mark for each bullet in pair, other valid answers are possible)</i>	
	(ii)	Name a piece of software which could solve the problem identified in (i).	1 PS
		<i>A defragmenter OR disk editor OR anti-virus (1 mark for software related to part (i))</i>	
	(iii)	State the class of software that the item named in (ii) belongs to.	1 KU
		<i>Utility software/system utility/utility (1 mark)</i>	

	<p>(c) Each EarthWatch weather station contains 10 terminals connected to a file server situated 80 metres from the terminals. State a suitable transmission medium to connect the terminals to the server. Explain your reasoning.</p>	<p>2 PS</p>
	<p><i>Copper/UTP/fibre optic/co-axial/wireless/WiFi (1 mark)</i> <i>Any valid reason (range/bandwidth/security) that allows at least 80 metres range with large files (1 mark)</i> <i>Note: Do not accept brand names such as Bluetooth, Ethernet</i></p>	
	<p>(d) The EarthWatch mainframe performs many memory read operations per second. Write down the steps involved in a single memory read operation. Name the <i>bus</i> or <i>control lines</i> involved at each step.</p>	<p>3 PS</p>
	<p><i>Address (of the data to be read) placed on the address bus (by the processor) (1 mark)</i> <i>The read line is set high/activated (1 mark)</i> <i>Data (from the memory location) transferred (to the processor) using the data bus (1 mark)</i> <i>Note: order must be correct for full marks, max two marks for correct steps in wrong order</i></p>	

19.	Harry is an expert on human linguistics. He is currently studying a data file on his computer containing 3000 ancient Chinese characters.		
	(a)	State whether this file is an <i>ASCII</i> file or a <i>UNICODE</i> file. Explain your reasoning.	2 PS
		<i>Unicode (1 mark)</i> <i>Unicode can represent all 3000 chars, ASCII can only represent up to 256/8 bit (1 mark) Note "double jeopardy"</i>	
	(b)	Harry buys a printer to print the characters. Apart from cost, name two other relevant characteristics of a printer.	2 KU
		<ul style="list-style-type: none"> • <i>DPI/Resolution</i> • <i>Compatibility/interface</i> • <i>Buffer capacity</i> • <i>Speed/PPM</i> • <i>Physical size/portable</i> <i>(1 mark each of two)</i> <i>Note: Colour depth not relevant to context</i>	
	(c)	Harry is concerned that this data file may contain a <i>file virus</i> .	
	(i)	Explain whether Harry's concern is justified.	2 PS
		<i>A file virus cannot infect a data file (1 mark) only an executable file (1 mark)</i>	
	(ii)	State what is meant by a computer virus.	1 KU
		<i>A virus is (self-)replicating code (1 mark)</i>	
	(iii)	State one action of a virus.	1 PS
		<i>Camouflage, watching, delivery, replication (any valid for 1 mark)</i>	

	(d) Harry saves a picture of each character in GIF format. State two characteristics of the GIF format.	2 KU
	<ul style="list-style-type: none"> • <u>8 bit colour/8 bits per pixel/256 colours</u> • <i>Bitmapped format</i> • <i>Transparency</i> • <i>(Lossless) compression {but not lossy compression}</i> • <i>Supports simple animation</i> • <i>Standard file format (high level of compatibility)</i> <p><i>(Any two valid answers, 1 mark each)</i></p>	

20.	Martin is a systems analyst. He has just been given a new project to work on.		
(a)	(i)	Explain why Martin will interview the client during the <i>analysis</i> stage.	1 KU
		<ul style="list-style-type: none"> • <i>(Interview client management) to establish <u>precisely</u> what is needed/ elicit details</i> • <i>(Interview current users of the system) to establish good/bad points of current system</i> • <i>Any other valid explanation</i> <i>(1 mark for 1 point)</i>	
	(ii)	State two other techniques that Martin may use during the analysis.	2 KU
		<ul style="list-style-type: none"> • <i>Issue questionnaires</i> • <i>Make observation notes/observe current practice</i> • <i>Examine sources of information/company documentation</i> <i>(1 mark for each of two valid points)</i>	
(b)	Martin is responsible for producing a document at the end of the analysis stage.		
	(i)	Name this document.	1 KU
		<i>Software specification/program specification/ORD (1 mark)</i> <i>Note: requirement/system spec is too vague</i>	
	(ii)	State two reasons why this document has to be agreed with the client before it is finalised.	2 PS
		<ul style="list-style-type: none"> • <i>Formalises the <u>details</u> of the software to be produced</i> • <i>It will form part of a legal agreement/contract</i> • <i>If one of client's needs is omitted from the document, it will not be done as part of the initial contract</i> • <i>Additional features cannot be added into software without new contract</i> <i>Any other valid reason</i> <i>(1 mark for each of 2 points)</i>	

	(c) Explain how a systems analyst could be involved in the testing stage of a project.	1 PS
	<ul style="list-style-type: none"> • <i>Contribute to the provision of test data</i> • <i>Plan structure of testing to match boundaries/analysis</i> • <i>Validate test data to be used at testing stage</i> • <i>Validate test results against specification</i> <p><i>Any other valid (1 mark for any valid response)</i></p>	
	(d) When Martin was at University, he earned money by being part of <i>independent test groups</i> . Explain why he cannot be part of the independent test group assigned to this project.	1 PS
	<p><i>Since he has involvement with the project he doesn't qualify (1 mark)</i> <i>Note : 'he is not independent' needs qualification to get the mark</i></p>	
	(e) Effective testing of the software needs to be both <i>systematic</i> and <i>comprehensive</i> . Explain the terms “systematic” and “comprehensive”.	2 KU
	<p><i>Systematic</i></p> <ul style="list-style-type: none"> • <i>Tests individual subroutines, then modules, up to whole system testing</i> • <i>Methodical/logical/planned checking of software (1 mark)</i> <p><i>Comprehensive</i></p> <ul style="list-style-type: none"> • <i>Uses normal/extreme/exceptional data</i> • <i>Test software in as many cases as possible/full range (1 mark)</i> 	
	(f) Towards the end of the project, Martin is told that the project is running over budget. State the job title of the person who has the responsibility for the project budget.	1 KU
	<i>Project manager (1 mark)</i>	

21. Over the summer, a garden centre has been running a “tallest sunflower” competition.



Entrants have completed an online entry form to provide their name and the height of their sunflower. These have been collated into two lists. Samples from these lists are shown below.

Name of entrant
Eildih Brown
Helen Atkins
Mark Ames
Jenna Wylie

Height of sunflower (metres)
2.15
1.79
2.32
1.41

(a) State the *data structure* and *data type* used to store the list of heights.

2 PS

(1-D) Array (**1 mark**) of real (accept single/double/float) (**1 mark**)

	(b) Using <i>pseudocode</i> , design an algorithm to find and display the name of the person growing the tallest sunflower.	6 PS
	<p> <i>tallest = height[1]</i> (see below for assignments) <i>name_of_winner = name[1]</i> <i>loop to end of list</i> (1 mark for loop with termination) <i>if height[position]>tallest then</i> (1 mark for IF and termination 1 mark for correct condition) <i>tallest = height[position]</i> (see below for assignments) <i>name_of_winner = name[position]</i> <i>end if</i> <i>end loop</i> <i>display name_of_winner</i> (1 mark) </p> <p><i>Note: There are 4 assignments for a total of 2 marks – 1 mark for any two assignments</i></p> <p><u>OR</u></p> <p> <i>max = 1</i> (1 mark) <i>for position = 1 to end of list do</i> (1 mark for loop with termination) <i>if height[position]> height[max] then</i> (1 mark for IF and termination, 1 mark for correct condition) <i>max = position</i> (1 mark) <i>end if</i> <i>end loop</i> <i>display name[max]</i> (1 mark) </p> <p><i>Note: Other correct expressions are possible. Exam paper shows four entrants so accept loop four times</i></p>	


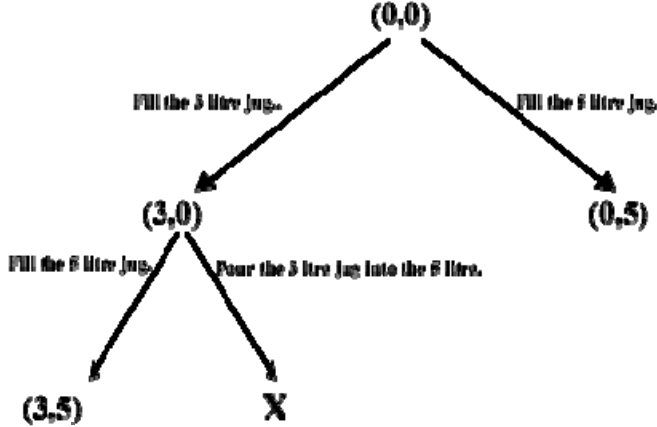
	(c)	The garden centre wants to give a consolation prize to the grower of the shortest sunflower. A number of changes need to be made to the pseudocode you wrote in part (b).	
	(i)	State one change that you would make to your pseudocode from part (b).	1 PS
		<ul style="list-style-type: none"> • <i>Change initial condition to smallest = height[1]</i> • <i>Change > to < OR 'change greater than to less than'</i> • <i>Change variable names to eg tallest to smallest / max to min (as appropriate to candidate answer in (b))</i> • <i>Change output line</i> <p><i>(1 mark for 1 point as shown)</i></p>	
	(ii)	Explain why this change is necessary.	1 PS
		<ul style="list-style-type: none"> • <i>Change initial condition to smallest = height[1] which can be reset when a lower value is found</i> • <i>Change > to < since looking for smaller values than the current one</i> • <i>Change variable names to eg tallest to smallest/max to min to reflect meaningful variable names</i> • <i>Change output line to reflect change in variable name/new context if name is in descriptive text</i> • <i>Accept responses referring to the fact that "<u>find min</u>", rather than "<u>find max</u>", is required as these are not named in the question</i> <p><i>(1 mark for one explanation)</i></p>	

22.	<p>A travel agent uses a suite of software to help advertise holidays and make bookings. Part of the pseudocode that was written for the software is :</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> <pre> if cost per person is less than 500 set band to 'cheap' end if if cost per person is greater than or equal to 500 AND cost per person is less than 2000 set band to 'medium' end if if cost per person is greater than or equal to 2000 set band to 'expensive' end if </pre> </div>	
(a)	By using a holiday cost per person of £495, explain why this pseudocode would not produce <i>efficient</i> code.	2 PS
	<i>The first IF is true, but the second and third IFs will still be evaluated (1 mark) wasting processor time (1 mark)</i>	

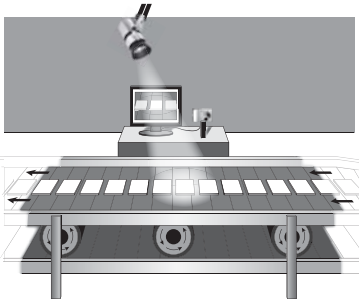
	(b) Show how these lines could be rewritten in a more efficient way.	2 PS
	<p><u>Nested IF</u> IF cost per person is less than 500 set band to 'cheap' ELSE IF (cost per person less than 2000) set band to 'medium'; ELSE Set band to 'expensive'; (END IF)</p> <p>OR ... CASE statement</p> <p>CASE cost per person OF IS < 500 : set band to 'cheap'; IS < 2000 : set band to 'medium'; Otherwise Set band to 'expensive' (END CASE)</p> <p><i>(1 mark for concept of nested IF or CASE; 1 mark for all conditions/assignments correct within nested IF or CASE)</i> <i>Note: Other valid responses are possible. Accept other syntax in pseudocode. Second mark is contingent on the first</i></p>	
	(c) When the above is implemented as a subroutine, state whether the variable "cost per person" would be passed by <i>reference</i> or <i>value</i> . Justify your answer.	2 PS
	<i>By value (1 mark) since the value is not being changed in the procedure (1 mark). Note "double jeopardy"</i>	
	Each holiday booking is assigned a unique reference code. The software which creates this code uses <i>concatenation</i> within a <i>user-defined function</i> .	
	(d) Explain the term <i>concatenation</i> .	1 KU
	<i>Concatenation : Joining/adding together of (sub-)strings (1 mark)</i>	
	(e) Explain the term <i>function</i> .	2 KU
	<i>A (self-contained/discrete/named) module/unit/block/section of code (1 mark)</i> <i>which has a value/returns a single value to the calling program (1 mark)</i>	

SECTION III Part A: Artificial Intelligence


23	The Turing Test can be used during the development of <i>chatterbots</i> .	
	(a) State the purpose of the Turing Test.	1 KU
	<i>Test a system/device/program for presence of (artificial) intelligence (or similar) (1 mark)</i>	
	(b) Describe how a chatterbot attempts to have a meaningful conversation.	2 KU
	<ul style="list-style-type: none"> • <i>Identifies keywords/phrases from human sentence</i> • <i>Matches an appropriate response (from bank)</i> • <i>If there isn't a match, makes a generic response or another start point</i> <i>(Any two - 1 mark each)</i>	
	(c) State two weaknesses that may be present in a chatterbot's conversation with a human.	2 PS
	<ul style="list-style-type: none"> • <i>May fail to store a previous responses</i> • <i>Inability to include current or topical statements</i> • <i>Inability to problem solve in conversation</i> • <i>Inability to comprehend humour/emotion</i> • <i>vocabulary/grammar may be artificial/unusual</i> • <i>Any other reasonable</i> <i>(Any two - 1 mark each)</i>	
	(d) State one improvement in processors and describe how it improves the performance of a chatterbot.	1 KU, 1 PS
	<p><i>Any one of increased clock speed/presence of cache/increased cache/multiple processors (1 mark)</i></p> <p><i>Any valid description of how performance is improved (1 mark) ie</i></p> <ul style="list-style-type: none"> • <i>Multiple threads/queries improving searching/pattern matching</i> • <i>Faster execution producing faster responses</i> 	

24	<p>The water jugs puzzle is a well known artificial intelligence problem. In this puzzle there are two jugs; the jug on the left jug holds three litres and the one on the right holds five litres. Neither has any measuring markers on it. There is a tap that can be used to fill the jugs with water. The goal of the puzzle is to measure exactly four litres of water.</p> <p>A computer is used to find a solution.</p>		
(a)	State the aspect of intelligence which a computer is demonstrating when finding the solution to the water jugs puzzle.	1 PS	
	<i>Problem solving (1 mark)</i>		
(b)	<p>Some people would argue that a computer solving this puzzle does not have artificial intelligence.</p> <p>State one reason which supports this opinion.</p>	1 PS	
	<i>The computer is merely following instructions of the (intelligent) programmer/human. (1 mark)</i>		
	<p>The computer represents both jugs being empty as (0,0). The node (3,0) means that the three litre jug on the left is full and that the five litre jug on the right is empty.</p> <p>It attempts to solve the puzzle by generating the following states:</p>		
(c)	Name this type of diagram.	1 KU	
	<i>Search tree (1 mark)</i>		

	<p>(d) The order of nodes currently in memory is (0,0), (3,0), (0,5) and (3,5). Explain which <i>search technique</i> is being used.</p>	2 PS
	<p><i>Breadth-first (1) because</i></p> <ul style="list-style-type: none"> • <i>All possible descendants from the start state have been generated</i> • <i>Node(0,5) would not be generated yet in depth-first</i> • <i>Node(3,5) would have been discarded in depth-first</i> • <i>Each node in a level is checked before proceeding to the level below</i> <p><i>Any of the bullet points award 1 mark</i></p>	
	<p>(e) State two other search techniques that could be used.</p>	2 KU
	<ul style="list-style-type: none"> • <i>Depth-first (1 mark) and Heuristic (1 mark)</i> <p><i>Note: Other valid AH answers may appear, such as A*, best-first, hill-climbing</i> <i>Note: Avoid double jeopardy with answer in part (d)</i></p>	
	<p>(f) State the node missing from the diagram, marked by the letter X.</p>	1 PS
	<p><i>(0,3) (1 mark)</i></p>	
	<p>(g) The diagram shows three of the possible moves:</p> <ul style="list-style-type: none"> • Fill the 3 litre jug • Fill the 5 litre jug • Pour the 3 litre jug into the 5 litre jug <p>State two other possible moves.</p>	2 PS
	<ul style="list-style-type: none"> • <i>Empty 3 litre jug</i> • <i>Empty 5 litre jug</i> • <i>Fill the 3 litre jug from the 5 litre jug/Pour the 5 litre jug into the 3 litre jug</i> <p><i>(1 mark for each of two valid moves)</i></p>	

25	<p>CeramicSee is a vision system that is used in the quality control of ceramic tiles.</p> <div style="text-align: center;">  </div> <p>CeramicSee rejects tiles with flaws such as:</p> <ul style="list-style-type: none"> • wrong shade or colour • physical damage such as chips or scratches. 	
	<p>(a) Describe two ways in which CeramicSee overcomes common problems with vision systems.</p>	2 PS
	<ul style="list-style-type: none"> • <i>Flat/ two-dimensional viewpoint, eliminating/reducing problems with 3D depth perception</i> • <i>Light variation/shadows have been reduced/eliminated by the use of a lamp</i> • <i>Edge detection of rectangular objects with straight lines is simpler.</i> • <i>Tiles on known background colour/conveyor belt</i> <p><i>(1 mark for each of two valid points)</i></p>	
	<p>(b) The <i>image acquisition</i> stage of CeramicSee uses a digital camera capable of 32 bit colour to capture an image of a tile. Calculate the maximum number of different colours in an image.</p>	1 PS
	<p><i>32 bit colour = 4294967296 (accept 2^{32}) colours (1 mark)</i> <i>Note: Not “4 billion colours”</i></p>	
	<p>(c) Name and describe two other stages of computer vision.</p>	4 KU
	<ul style="list-style-type: none"> • <i>Signal processing (1 mark) convert signal into form that can be understood/digitisation/“clean up” signal (1 mark)</i> • <i>Edge detection (1 mark) identify sharp changes in colour/tone/light as edges, making a wireframe model (1 mark)</i> • <i>Object recognition (1 mark) wireframe model is matched against templates of known objects (1 mark)</i> • <i>Image understanding (1 mark) analysis of collection of objects give sense of whole image (1 mark)</i> 	

	(d) CeramicSee uses an <i>artificial neural system</i> to identify defective tiles. Describe how <i>weights</i> are used in the training of an artificial neural system.	3 PS
	<ul style="list-style-type: none"> • <i>Weights will be initially set</i> • <i>Known inputs will be used and outputs compared to expected</i> • <i>Weights altered/rebalanced to achieve the known output</i> • <i>process repeated until all inputs and outputs match</i> <p><i>(1 mark for each of three valid bullet points)</i></p>	
	(e) State another example of an application that uses an <i>embedded</i> vision system.	1 KU
	<ul style="list-style-type: none"> • <i>Vision system for lane control in a car.</i> • <i>Vision system used to inform sat nav</i> • <i>Any other valid vision system <u>embedded</u> in a larger system</i> <p><i>(1 mark for any valid)</i></p>	

26	<p>Intelligent robots are one application of artificial intelligence. This has resulted in the development of robots for household tasks particularly floor cleaning.</p> <div style="text-align: center;">  <p>Floor cleaning robot</p> </div>	
(a)	State what is meant by the term 'artificial intelligence'.	1 KU
	<ul style="list-style-type: none"> • <i>Machines/computers/programs capable of doing task that would require intelligence if done by human</i> • <i>Ability of system to display/emulate intelligent human behaviour</i> • <i>Any other valid</i> <p><i>(1 mark for valid bullet)</i></p>	
(b)	State one characteristic of an intelligent robot when compared to a dumb robot.	1 KU
	<ul style="list-style-type: none"> • <i>Ability to make decisions independent of external control</i> • <i>The ability to learn/problem solve/etc</i> <p><i>(1 mark for one of these or any other reasonable response)</i></p>	
(c)	Describe two practical difficulties associated with the development and use of an intelligent robot for floor cleaning.	2 KU
	<ul style="list-style-type: none"> • <i>Power supply - battery needs recharging, attaching power cable hinders mobility</i> • <i>Vision system - detecting and avoiding obstacles/stairs</i> • <i>Navigation - planning a path or limiting the path using virtual walls across doorways</i> • <i>Type of terrain - choosing tools for cleaning different surfaces</i> <p><i>(Any two valid points, 1 mark each)</i> <i>Note: the points could come from the same bullet</i></p>	

	(d)	(i)	State one legal implication of the use of an intelligent robot.	1 PS
			<i>Where responsibility lies in the event of an accident (or other valid) (1 mark)</i>	
		(ii)	Explain how a manufacturer of robots can address legal implications.	1 PS
			<ul style="list-style-type: none"> • <i>Use a disclaimer (denying responsibility for accidents caused by not following instructions.)</i> • <i>Any method of avoiding accidents such as audible signals etc</i> • <i>Any other valid</i> <i>(1 mark for any valid point)</i>	

27	<p>An online multi-player game has been created. Each player in the game is a character such as a troll or an orc that can acquire various objects as they move through the game eg a sword or armour. A character can only defeat another if they have the correct object.</p>	
	<p>This knowledge base stores the current state of the game:</p> <ol style="list-style-type: none"> 1. has_found(troll jewel). The troll has found a jewel. 2. has_found(troll sword). 3. has_found(orc armour). 4. has_found(druid potion). 5. has_found(druid lance). 6. is_weapon_against (lance troll). The lance is the weapon to use against a troll. 7. is_weapon_against (sword orc). 8. is_weapon_against (jewel troll). 9. life_points(troll 1000). The troll has 1000 life points. 10. life_points(orc 200). 11. life_points(druid 140). 12. stronger_than(X Y) IF life_points(X A) AND life_points(Y B) AND A>B. Character X is stronger than character Y if X has life point A and character Y has life points B and A is greater than B. 13. can_defeat(X Y) IF has_found(X Z) AND is_weapon_against(Z Y) AND not(X=Y). Character X can defeat character Y if character X has found item Z and Z is the weapon against character Y and character X is not character Y. 	
(a)	<p>State the solution to the following query:</p> <p style="padding-left: 40px;">? has_found(X potion)</p>	1 PS
	<p><i>X=druid (1 mark)</i></p>	

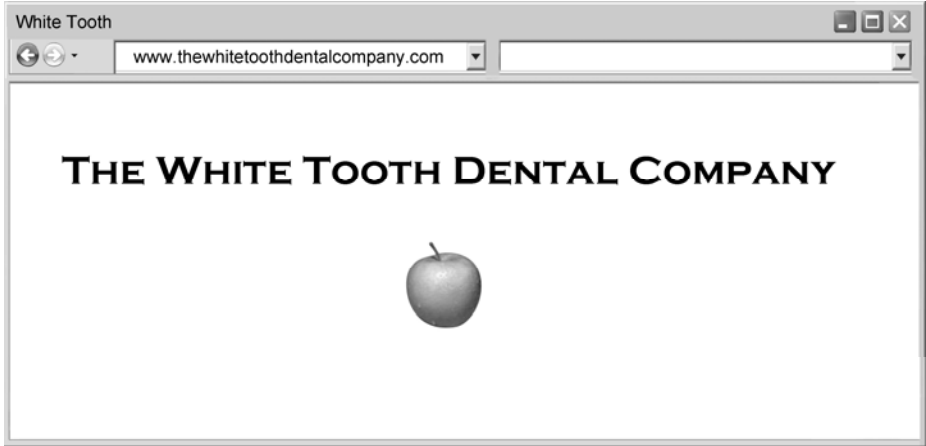
	(b) State the query required to find the weapons that can be used against the troll.	2 PS
	<p>? <i>is_weapon_against</i>(X troll) <i>(1 mark for predicate (is_weapon_against), 1 mark for two arguments in correct order (X troll))</i></p>	
	(c) Explain how the following query would be evaluated: ? not(life_points(troll 800))	2 PS
	<ul style="list-style-type: none"> • <i>life_points(troll, 800) would be false/no.</i> • <i>not(life_points(troll, 800)) would be true</i> <p><i>(1 mark for each bullet point)</i> <i>Note: award a <u>single</u> mark for generic “evaluate life_points(troll, 800) and then negate it/apply NOT”</i></p>	
	(d) Trace the first solution to the query: ? can_defeat(troll Y) In your answer you will be given credit for the correct use of <i>backtrack</i> .	8 PS
	<ul style="list-style-type: none"> • <i>Match at 13 X instantiated to troll, <u>subgoal has found(troll Z)</u></i> • <i>Match at 1 Z instantiated to jewel, <u>subgoal is weapon against(jewel Y)</u></i> • <i>Match at 8, Y=troll, new <u>subgoal troll=troll is true</u></i> • <i><u>not(troll=troll) is false, subgoal fails</u></i> • <i>Backtrack to match at 2, Z instantiated to sword, new subgoal <u>is weapon against(sword, Y)</u></i> • <i>Match at 7, Y=orc <u>not(troll=orc) succeeds</u> (Note: award mark for use of negation if not awarded at step 3/4 previously)</i> • <i><u>Output Y=orc</u></i> <p><i>(1 mark for each bullet point (max 7) plus one for correct use of the term backtrack (step 5))</i></p>	

	(e)	The original software specification stated that a player can defeat an opponent if the player has found the appropriate weapon for that opponent and that they are stronger than the opponent.	
	(i)	<p>The existing rule 13 must have one line added to meet this requirement.</p> <p style="text-align: center;"> can_defeat(X Y) IF has_found(X Z) AND is_weapon_against(Z Y) AND not(X=Y) AND <input style="width: 100px; height: 15px;" type="text"/> </p> <p>State the missing line of the new rule.</p>	2 PS
		<p><i>stronger_than(X Y)</i> (1 mark for predicate (<i>stronger_than</i>), 1 mark for two arguments in correct order (X Y))</p>	
	(ii)	State the type of maintenance that this change to the software is best described as.	1 PS
		<i>Corrective (1 mark)</i>	

SECTION III Part B: Computer Networking

28	It is important that computer networks are designed to agreed standards, such as the Open Systems Interconnection (OSI).		
(a)	(i)	State the name of the <i>layer</i> of the OSI model at which a <i>router</i> functions.	1 PS
		<i>Network (1mark)</i>	
	(ii)	State the name of the <i>layer</i> of the OSI model that carries out <i>data encryption</i> .	1 PS
		<i>Presentation (1 mark)</i>	
(b)	TCP/IP is a set of protocols used in network communication. State the actions carried out by the IP part when transmitting data over a network.		2 KU
		<ul style="list-style-type: none"> • <i>IP adds its own header/address header/source/destination/IP header to each packet.</i> • <i>IP routes the packets around the network.</i> (1 mark for each bullet)	
(c)	Explain how <i>CSMA/CD</i> improves network performance.		2 PS
		<ul style="list-style-type: none"> • <i>It reduces the number of collisions on a network (1 mark) therefore reducing the amount of data that would have to be re-transmitted (1 mark)</i> • <i>It reduces simultaneous transmissions (1 mark) therefore reducing collisions (1 mark)</i> (1 mark for each part of one bullet) Note: answers <u>must</u> refer to improving performance	

	<p>(d) The byte of data below is transmitted across a network. It contains a <i>parity</i> bit.</p> <p style="text-align: center;">1000 1111</p> <p>State which kind of parity was used when sending this data. Justify your answer.</p>	2 PS
	<p><i>Odd Parity</i></p> <ul style="list-style-type: none"> • <i>there is an odd number of ones/zeros</i> • <i>five ones to be transmitted</i> • <i>there was an even number of ones before the parity bit was added</i> <p>(1 mark for Odd Parity and one mark for any one bullet)</p>	
	<p>(e) Data can be sent <i>synchronously</i> or <i>asynchronously</i>. State which of these methods uses start and stop bits and how it uses them.</p>	2 KU
	<p><i>Asynchronous (1 mark)</i></p> <ul style="list-style-type: none"> • <i>Asynchronous uses start and stop bits around each byte/character/word</i> • <i>Synchronous uses a start and stop frame for each packet of data. It does not use a start/stop bit.</i> <p>(1 mark for a valid bullet)</p>	

29.	A local dentist has created a cabled network to connect his four computers and a printer.	
(a)	Explain why the dentist chose to use cables rather than wireless to connect the network.	1 PS
	<ul style="list-style-type: none"> • <i>Security - computers must be physically connected to access the network/harder to intercept data</i> • <i>Less interference/signal drop-off</i> • <i>Bandwidth - Faster transmission speeds</i> <i>(1 mark for any one bullet)</i>	
(b)	The dentist is worried that a hacker may get access to his patient files without his knowledge. Name the type of attack that the dentist is worried about.	1 PS
	<i>Passive Attack (1 mark)</i>	
	<p>A website is being created for the dentist using <i>HTML</i> as shown below:</p> 	
(c)	Write the HTML code for the title tag of this webpage.	2 PS
	<pre><title> White Tooth </title></pre> <i>(1 mark for opening and closing of title tag)</i> <i>(1 mark for White Tooth (Note: Do not accept The White Tooth Dental Company))</i>	

	(d)	The apple image displayed on the web page was captured in <i>true colour</i> . State what is meant by “true colour”.	1 KU
		<p>An image can contain:</p> <ul style="list-style-type: none"> • 16,777,216 colours • 16.7 million colour • 2^{24} colours • 24 bit colour <p>(Any 1 bullet – 1 mark)</p>	
	(e)	The website is published on the Internet. However, the dentist realises that search engines are not finding his website.	
	(i)	State an additional element that should be included in the HTML code in order to help a search engine find the website.	1 PS
		<i>Metatag (with keywords) (1 mark)</i>	
	(ii)	Name the section of the HTML code in which this element should be placed.	1 KU
		<i>Header/head (1 mark)</i>	
	(f)	The dentist would like the website to be viewed on mobile phones. The <i>HTML</i> code will have to be re-written in a different language.	
	(i)	Name the language required to create webpages for mobile phones.	1 KU
		<i>Wireless Markup Language/WML (1 mark)</i>	
	(ii)	State the protocol that allows mobile phones to access the website.	1 KU
		<i>WAP (1 mark)</i>	
	(iii)	State one other type of device that uses this protocol.	1 PS
		<p><i>PDA/palmtop/Pager/2-way Radio/Any other valid (1 mark)</i></p> <p><i>Note: not branded devices (ie iPod)</i></p>	

	(g)	After testing the mobile phone version of the website, an error was found. State the type of <i>maintenance</i> required to fix errors not identified during testing.	1 KU
		<i>Corrective (1 mark)</i>	

30	A teacher requires a username and password to give her remote access to her school server.		
	(a)	Other than <i>TCP/IP</i> , name a protocol which could allow remote access to a server.	1 KU
		<i>Telnet (1 mark)</i>	
	(b)	The school's server has been subjected to a <i>denial of service (DOS) attack</i> .	
	(i)	Describe one possible denial of service attack.	2 KU
		<ul style="list-style-type: none"> • <i>Bandwidth consumption - This degrades the server performance by sending a large number of data packets in a short period of time.</i> • <i>Resource starvation - An attack which is intended to use resources that would bring the network down. For example, an e-mail inbox could be bombarded with e-mails and so would fill up and therefore not allow genuine e-mails through.</i> • <i>Programming flaws - This takes advantage of bugs in networking software.</i> • <i>Attacking the routers - This involves "hi-jacking" data packets and routing them to the target server, which then gets flooded with data packets, or re-directing them to false addresses.</i> • <i>Domain Name Server attacks/IP Spoofing - This involves sending a large number of DNS queries with a spoofed IP address of the target server. The DNS then floods the target server with an excessive amount of replies.</i> <p><i>(1 mark for name and 1 mark for corresponding description)</i></p>	
	(ii)	State two financial implications for the school as a result of this DOS attack.	2 PS
		<ul style="list-style-type: none"> • <i>Cost of determining the nature of the attack</i> • <i>Cost of repair and response to the attack</i> • <i>Cost of devising and implementing safeguards</i> • <i>Cost of additional admin to compensate for loss of network services</i> <p><i>Any other valid cost</i> <i>(1 mark each for any two bullets – max 2)</i> <i>Note: Simplistic answers like "costs a lot" award 0 marks</i></p>	

	(c) The school's server has a <i>firewall</i> . State two ways that a firewall could be used to monitor access to the school network.	2 PS
	<ul style="list-style-type: none"> • <i>Monitors all communication ports/checks packets/block ports</i> • <i>Keeps track of all communications/makes user log</i> • <i>Blocks unauthorised access/prevents unsolicited traffic</i> • <i>IP Filtering</i> <p>(1 mark for each bullet – max 2)</p>	
	(d) Hacking is a security issue that the school will have to consider. Other than a firewall, describe two software methods that the school could employ to try to prevent hackers from gaining unauthorised access to their server.	4 PS
	<ul style="list-style-type: none"> • <i>Authenticate the user (1 mark) - a “callback” facility to correct phone line/IP address (1 mark)</i> • <i>Set user permissions (1 mark) allocating the minimum necessary access to each user/levels of access (1 mark)</i> • <i>Encrypting data (1 mark) to make data unreadable/give each employee a restricted key (1 mark)</i> • <i>Use a secure protocol such as HTTPS (1 mark) to make data unreadable in transit (1 mark)</i> • <i>Other valid method (1 mark) showing how it prevents access (1 mark)</i> <p>(1 mark for each part of any two bullets – max 4)</p> <p><i>Note: walled gardens prevent access from user to outside, <u>not</u> hackers</i></p> <p><i>Note: usernames and passwords are already used (see stem)</i></p>	
	(e) The school is concerned about accidental or malicious loss of data from their server. They have installed a <i>mirror disk</i> . Explain how a mirror disk would help them in this situation.	2 PS
	<ul style="list-style-type: none"> • <i>It creates a backup</i> • <i>Which allows data to be saved to several disks at the same time</i> • <i>Creates an exact /up-to-date copy of the data on the server</i> <p>(Any 2 bullets – 1 mark each – max 2)</p>	

	(f)	The school is concerned about staff and pupils accessing websites from school computers.	
	(i)	Explain how a <i>walled garden</i> would prevent staff and pupils from accessing unsuitable websites.	2 PS
		<ul style="list-style-type: none"> • <i>List of approved website/URLs (in the software)</i> • <i>Only approved websites can be viewed/all others are blocked</i> (1 mark for each bullet – max 2)	
	(ii)	Describe one way that <i>Internet filtering</i> software differs from a walled garden.	1 KU
		<ul style="list-style-type: none"> • <i>Unsuitable websites/URLs are listed in the Internet Filtering software</i> • <i>Websites containing certain keywords/content/file types/domain names can be blocked</i> (1 mark for any one bullet)	
	(g)	The teacher creates a <i>WPAN</i> to connect her laptop, printer and smartphone. Explain one reason why a <i>WPAN</i> would be appropriate for this network.	1 PS
		<ul style="list-style-type: none"> • <i>Uses wireless transmission/no cables</i> • <i>Across a very short range</i> • <i>Low power consumption</i> • <i>Other valid</i> (1 mark for any one valid)	

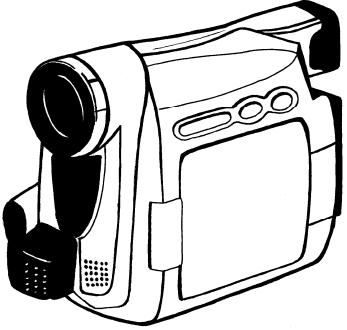
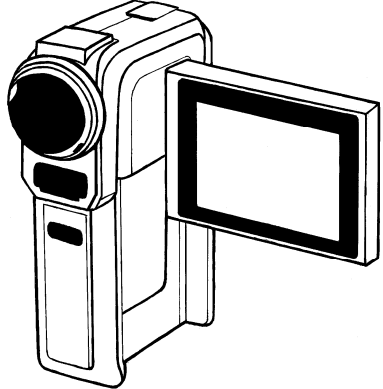
31	A sports centre has a local area network of 10 computers and 2 printers.		
	(a)	Explain why <i>class A IP addressing</i> is not suitable for this network.	1 PS
		<ul style="list-style-type: none"> • <i>Class A allows 16,777,214 addresses ($2^{24} - 2$) (Accept 2^{24})</i> • <i>A small network would use class C (with 254 addresses)</i> • <i>Only 12 IP addresses are needed</i> <p><i>(1 mark for any one bullet)</i></p>	
	(b)	A network interface card is required to provide a physical link to the local area network. The network interface card contains a <i>MAC</i> address. Describe the purpose of a <i>MAC</i> address.	1 KU
		<ul style="list-style-type: none"> • <i>(Uniquely) identifies a computer/device (on a network). (1 mark)</i> <p><i>Note: question asks for purpose of MAC rather than definition</i></p>	
	(c)	When data is transmitted across the network a <i>Cyclic Redundancy Check (CRC)</i> is carried out. Describe how the receiving device does uses <i>CRC</i> .	3 KU
		<ul style="list-style-type: none"> • <i>The original/same calculation is carried out</i> • <i>A comparison is made to the original</i> • <i>If there is a difference, there has been an error/data will need to be retransmitted</i> • <i>If the results match the data will be accepted</i> <p><i>(1 mark for each of three bullets – max 3)</i></p>	

	(d)	The sports centre has a website which allows bookings to be made and paid for online. Members have expressed some security concerns about using their credit cards to pay for bookings online.	
	(i)	Explain how <i>packet switching</i> would increase the security of the transmitted data.	2 PS
		<ul style="list-style-type: none"> • <i>(Splits the data into small parts and) each packet may take a different route to its destination</i> • <i>Unlikely to intercept all packets/the whole file</i> <i>(1 mark for each bullet)</i>	
	(ii)	The sports centre's network can also set up a direct communications link to their head office. State the method of switching which would set up this direct link.	1 PS
		<i>Circuit switching (1 mark)</i>	
	(e)	The sports centre has an <i>ADSL</i> connection to the Internet.	
	(i)	The manager wants to download a 150 Megabyte file. The ADSL connection has a download speed of 8 Megabits per second. Calculate the time taken to download this file. Show all working.	2 PS
		<ul style="list-style-type: none"> • <i>$(150 * 8) = 1,200$ Megabits</i> • <i>$1,200 / 8 = 150$ seconds ($/ 60 = 2.5$ minutes)</i> <i>OR</i> <ul style="list-style-type: none"> • <i>8 megabits per second = 1 megabyte per second</i> • <i>150 megabytes takes 150 seconds ($/ 60 = 2.5$ minutes)</i> <i>(1 mark for each bullet – max 2)</i> <i>Note: avoid double penalising initial error, by using their number in the rest of the question</i>	
	(ii)	When the file was downloaded it took longer than the time calculated in part (i). Suggest two reasons for this increase in download time.	2 PS
		<ul style="list-style-type: none"> • <i>Bad packets needing re-sent/collisions of data</i> • <i>Rest of message frame (parity etc) takes up space and hence bandwidth</i> • <i>Another part of the network may have a slower connection</i> • <i>Sharing bandwidth with other users/processes</i> • <i>Integrity checks on file</i> • <i>Any other valid</i> <i>(1 mark for each of two valid bullets – max 2)</i>	

SECTION III Part C: Multimedia Technology

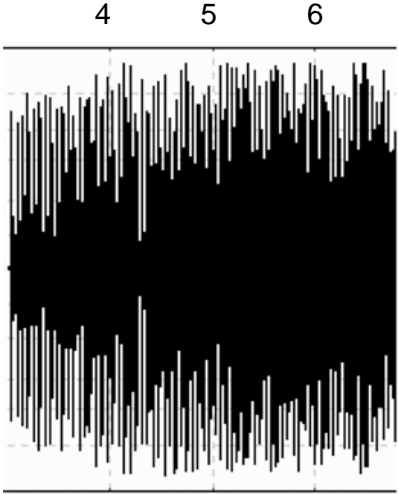
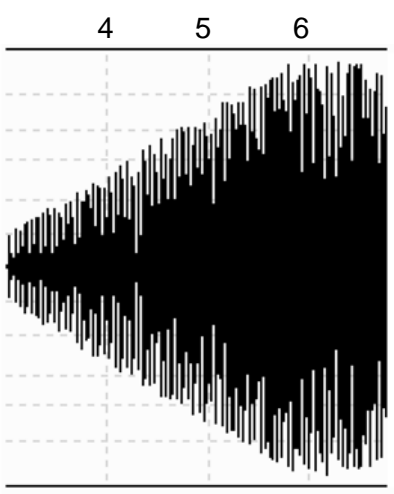
32	Peter is a guitar teacher who uses his website to give pupils access to audio files. The audio files are instrumental tracks for practice between lessons.		
(a)	(i)	The audio files are stored in the <i>MIDI</i> format. One benefit of this file format is its small size. State two other benefits of using the MIDI file format.	2 KU
		<ul style="list-style-type: none"> • <i>Can be replayed on any musical instrument with a MIDI interface (eg keyboard, synthesiser, drum machine)</i> • <i>Accuracy of playback sound not necessary for practise</i> • <i>individual instruments/notes can be edited or have effects added</i> • <i>Backing tracks unlikely to include voice</i> • <i>No interference/white noise/background sounds</i> <p>(1 mark each for any 2 of the above)</p>	
	(ii)	MIDI files are stored using <i>sound attributes</i> such as <i>duration</i> and <i>tempo</i> . Describe the terms “duration” and “tempo”.	2 KU
		<p><i>Duration – length (number of beats) of a <u>note</u> (1 mark)</i></p> <p><i>Tempo – speed at which music is to be replayed/number of beats per minute (bpm) (1 mark)</i></p> <p><i>NB : duration must refer to a note not the track</i></p>	
	(b)	State two reasons why the pupils may prefer the <i>MP3</i> file format to the MIDI file format.	2 PS
		<ul style="list-style-type: none"> • <i>MP3 can be played on a wider variety of players than MIDI (1 mark)</i> • <i>MP3 produces a more natural sound</i> • <i>MIDI sound can vary as same “instrument” may differ between devices</i> <p>(1 mark each for any 2 of the above or other valid)</p> <p><i>Notes: scenario precludes voices. Compression using MP3 will not generally yield a smaller file</i></p>	

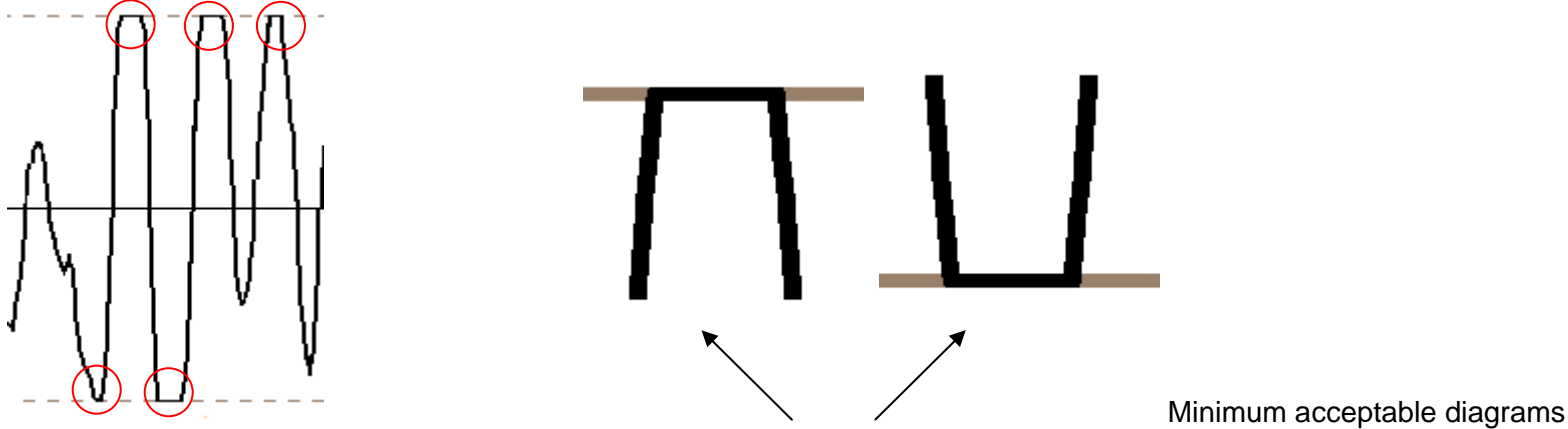
	Peter has demonstration video clips on his website.		
	(c)	The video clips were originally taken using a resolution of 1024 x 768 with a frame rate of 25fps. Calculate the file size of an uncompressed 24 bit video clip which plays for 64 seconds. Show all working. State your answer in megabytes.	3 PS
		<p><i>No. of frames = 64 x 25 = 1600</i> <i>No. of pixels = 1024 x 768 = 786432</i></p> <p><i>File size = No. of frames x No of pixels x bit depth</i> <i>= <u>1600 x 786432 x 24 bits</u> (1 mark for <u>each</u> underlined section)</i> <i>= 30198988800 bits = 3774873600 bytes = 3686400 Kb</i> <i>= 3600 Mb (1 mark)</i></p> <p><i>Note : all 3 marks to be awarded for <u>correct</u> answer with no explanation</i></p>	
	Pupils must <i>stream</i> the video clips to their computer when viewing.		
	(d)	Peter is worried about breach of copyright. Explain how streaming will help avoid this.	1 PS
		<i>No permanent copy on pupil computer (1 mark)</i>	
	(e)	Assuming there are no hardware or software problems, explain why streamed video may pause when viewed on a pupil's computer.	2 PS
		<ul style="list-style-type: none"> • <i>If data buffered is viewed before next block is stored/received</i> • <i>Then video is paused until next block is stored/received</i> <i>(1 mark for each of the above)</i>	

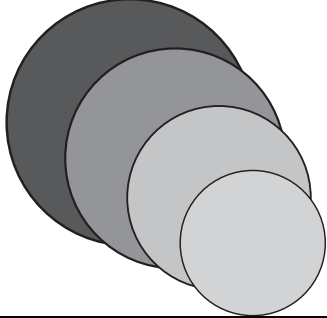
33	EasyVid manufactures video cameras. The EasyVid Super4 digital video camera will be a new digital video camera designed to replace the current EasyVid Power3 digital camera.		
		<p>EasyVid Power3</p> <p>4.1 megapixels Bluetooth & Firewire enabled 40Gb hard disk Video editing software supplied</p>	 <p>EasyVid Super4</p> <p>12 megapixels Bluetooth & USB 3.0 enabled Built-in hardware codecs Built-in 3 in 1 card reader Video editing software supplied</p>
(a)	State two advantages USB 3.0 has over Firewire.		2 PS
	<ul style="list-style-type: none"> • <i>Faster data transfer rate (up to 4.8 Gbits per sec)</i> • <i>USB interface more common on current computer hardware</i> • <i>USB3.0 has backward compatibility with previous USB interfaces</i> <p>(1 mark for any 2 of the above or other valid response)</p>		
(b)	It had been suggested that the EasyVid Super4 should be WiFi enabled. The manufacturer decides not to add a WiFi interface. State one reason other than cost to support their decision.		1 PS
	<ul style="list-style-type: none"> • <i>Wireless connectivity already available (even if limited)</i> • <i>WiFi reduces battery life</i> • <i>Extra weight/ larger device</i> <p>(1 mark for any of the above or other valid response)</p>		
(c)	The EasyVid Super4 has no hard disk. Explain why using removable solid state storage would extend battery life.		2 PS
	<i>No moving parts/motor (1 mark) so less power is required (1 mark)</i>		

	(d)	The manufacturer has built in hardware <i>codecs</i> to the EasyVid Super4. Describe one advantage and one disadvantage to the user of a hardware codec rather than a software codec.	2 PS
		<i>Advantage : faster compression/processing rate (1 mark)</i> <i>Disadvantage : Cannot be (easily) upgraded (1 mark)</i>	
	(e)	Video editing software is provided with both cameras. This includes <i>transition features</i> .	
	(i)	Explain what is meant by a “transition feature”.	1 KU
		<i>Allows an effect to be used when clips are joined together (1 mark)</i>	
	(ii)	Name and describe one effect usually available as a transition.	2 KU
		<ul style="list-style-type: none"> • <i>Wipe – line moves across first clip replacing it with next clip</i> • <i>Fade out/in – clip gradually dwindles to black/emerges from black</i> • <i>Dissolve – first clip gradually morphs into next clip</i> • <i>Hard cut – first clip changes instantly to next clip</i> • <i>Page turn – first clip peels away from screen to show next clip</i> • <i>Other valid answer – with description</i> <i>(1 mark for effect, 1 mark for suitable description)</i>	
	(f)	Explain why neither camera uses an ADC during data transfer to a computer.	1 PS
		<i>EasyVid3 and EasyVid4 data is already captured/stored in digital. (1 mark)</i> <i>Note: Trivial answers such as “they are digital cameras” are not acceptable</i> <i>Responses must make reference to capture/conversion/storage by the camera</i>	

34	The Bestview Camera Club has an annual photographic competition. Presentation software is used to display entries as a slide show.		
	(a)	A design technique suitable for planning the presentation is storyboarding. Describe two features of a storyboard that should be included in the design of the presentation.	2 KU
		<ul style="list-style-type: none"> Shows timing/transitions between screens Gives content of screens eg placement of items/layout, actual content, backgrounds, colour schemes Gives navigation links/hyperlinks <i>(1 mark each for any 2 of the above or other valid reason)</i>	
	Spoken comments about entries are to be recorded for inclusion in the slide show.		
	(b)	Calculate the uncompressed file size of an 8 bit, 24 second stereo recording sampled at 11kHz. Show all working. State your answer in appropriate units.	3 PS
		<i>File size = 11000 x 24 x 8 (1 mark) x 2 (1 mark) bits</i> <i>= 4224000 bits = 528000 bytes = 515.625 Kb</i> <i>= 515.6 Kb (1 mark)</i> <i>Note : all 3 marks to be awarded for correct answer with no explanation</i>	
	The WAV file format is used to store the spoken comments. WAV files are compressed.		
	(c)	(i) State the name of the compression method used.	1 KU
		<i>ADPCM (Adaptive Delta Pulse Code Modulation/Adaptive Differential Pulse Code Modulation) (1 mark)</i>	
		(ii) Describe how this method achieves compression.	2 KU
		<ul style="list-style-type: none"> Stores a sampled sound then change between sound samples (not the actual samples) Compression is because number of bits required to store change between samples is less than sample amplitude value. <i>(1 mark for each)</i> <i>Note: double jeopardy applies here</i>	

	(d) Describe how the file size of a spoken comment could be significantly reduced without changing the sampling depth.	1 PS
	<i>Storing recordings in mono would half storage required (1 mark)</i> <i>Edit out pauses et cetera to shorten the clip (1 mark)</i>	
	A short musical introduction is used at the start of the slide show. Figure 1 shows the waveform of the introduction. Figure 2 shows the waveform after an effect has been applied.	
	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Figure 1</p> </div> <div style="text-align: center;">  <p>Figure 2</p> </div> </div>	
	(e) State the effect applied to the sound.	1 PS
	<i>Fade in (1 mark)</i>	

	(f)	During testing of the slide show, it is noted that one audio file has been <i>clipped</i> .	
	(i)	Explain the term 'clipping'. You must include a diagram in your explanation.	2 KU
		 <p>Minimum acceptable diagrams</p>	
		<p><i>Graph must show flat (clipped) section(s) (1 mark)</i> <i>Clipping occurs when sound outwith the dynamic range is lost (1 mark)</i></p>	
	(ii)	Describe how <i>normalisation</i> would have avoided the problem of clipping.	2 PS
		<p><i>It calculates average volume/level (1 mark)</i> <i>Scales amplitudes/volumes to bring everything within dynamic range (1 mark)</i></p>	
	(iii)	Describe one disadvantage of normalisation.	2 PS
		<p><i>Every sound in the file is affected (1 mark)</i> <i>Therefore background noise will also be boosted (1 mark)</i></p>	

35	A designer has stored a graphic in each of <i>GIF</i> , <i>PNG</i> and <i>SVG</i> formats.			
	(a)	The designer notices that adding each circle to the graphic increases the file size of the <i>SVG</i> file but not the <i>GIF</i> or <i>PNG</i> files. Explain why the <i>SVG</i> file size increases.		2 PS
		<ul style="list-style-type: none"> • <i>Vector graphic formats store each object (and its attributes) separately</i> • <i>Adding another object requires more data to be stored (so file size increases)</i> <i>(1 mark for each point)</i>		
	(b)	The finished graphic will be displayed on a variety of screen sizes. Explain why <i>SVG</i> might be the best format to choose in this situation.		2 PS
		<ul style="list-style-type: none"> • <i>Vector graphic formats are displayed at hardware's resolution/resolution independent</i> • <i>So scaling will not affect image quality in vector</i> • <i>Bitmaps become pixelated if graphic is scaled up</i> <i>(1 mark for each of two valid points)</i>		
	(c)	Part of the code for the smallest circle is changed from rgb(0,78,0) to rgb(0,16,0) . Describe the effect of this change on the circle.		2 PS
		<i>It will be a lighter/paler (1 mark) shade of green (1 mark)</i> <i>Less detailed answers, such as "it will be less green", gain 1 mark</i>		
	(d)	Dithering can be used with the <i>GIF</i> file format but is unnecessary with <i>PNG</i> .		
	(i)	Explain the term <i>dithering</i> .		1 KU
		<ul style="list-style-type: none"> • <i>Dithering uses patterns of existing colours to create illusion of additional colours (not in palette/at bit depth)</i> • <i>Two (or more) adjacent coloured pixels create the illusion of another colour (not in the palette)</i> <i>(1 mark for any valid)</i>		
	(ii)	Explain why dithering is not required for the <i>PNG</i> file format.		2 PS
		<i>PNG allows 2²⁴ (16 million) colours (1 mark)</i> <i>More colours are not required/this is true colour (1 mark)</i>		

	(e)	The graphics software used by the designer includes <i>anti-aliasing</i> .	
	(i)	State the purpose of anti-aliasing.	1 KU
		<i>To smooth jagged edges of curves/diagonals (1 mark)</i>	
	(ii)	Describe a situation when anti-aliasing might have to be used.	1 PS
		<ul style="list-style-type: none"> • <i>Image scanned/drawn/displayed at low resolution</i> • <i>Improve the look of a (low resolution/pixelated) image</i> • <i>Description of other valid situation</i> <i>(1 mark for any one of the above)</i>	

[END OF MARKING INSTRUCTIONS]