



2009 Computing

Higher

Finalised Marking Instructions

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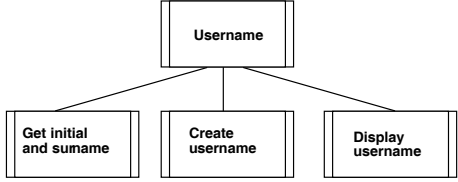
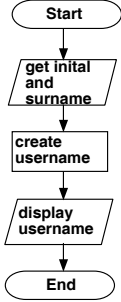
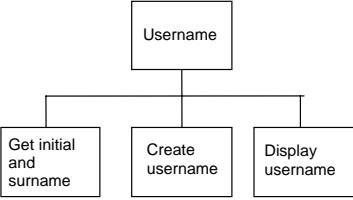
SECTION I

1	(a)	Write the binary number 1000100111 as a positive integer.	1 PS
		<i>551 (1 mark)</i>	
	(b)	Represent the decimal number – 73 using 8 bit two’s complement .	1 PS
		<i>10110111 (1 mark)</i> <i>Note: –10110111 gets zero</i>	
2		Most modern computers use <i>Unicode</i> rather than <i>ASCII</i> to represent text. State one advantage of Unicode when compared to ASCII.	1 KU
		<ul style="list-style-type: none"> • <i>Unicode can represent all character based alphabets <u>OR</u> ASCII has a very limited character set</i> • <i>Characters can be user/software defined <u>OR</u> ASCII does not allow user defined characters</i> <p><i>1 mark any valid point</i> <i>Note: not “all languages”</i></p>	
3		State the number of bits required to represent 16 777 216 colours.	1 KU
		<i>24 (1 mark)</i>	

4	System software consists of the operating system and utility programs.	
	(a) A <i>disk editor</i> is a common example of utility software. Describe one function of a disk editor.	1 KU
	<ul style="list-style-type: none"> • <i>Allows the user to directly edit contents of disk sectors/blocks</i> • <i>Allows user to get/remove file fragments</i> • <i>Allows recovery of damaged/deleted blocks/files</i> <p>1 mark for any valid point <i>Note: Answers <u>must</u> refer to low level actions</i></p>	
	(b) The <i>bootstrap loader</i> is part of the operating system. State the purpose of the bootstrap loader.	1 KU
	<i>To (locate and) load the rest of the OS (at startup) (1 mark)</i>	
5	A <i>trojan horse</i> is a malicious computer program. State one characteristic of a trojan horse.	1 KU
	<ul style="list-style-type: none"> • <i>Not spread by infecting other files or self replicating</i> • <i>Disguises itself or appears to be a harmless/ordinary/useful file</i> <p>1 mark for any of the above</p>	
6	Explain why increasing the number of <i>registers</i> could improve system performance.	1 PS
	<ul style="list-style-type: none"> • <i>Fewer fetches required from (slower) main memory/RAM/cache</i> • <i>Access to data in registers is faster than to RAM or cache</i> <p>1 mark for any valid point</p>	

7	A piece of software has been installed on a computer. A compatibility issue may prevent the new software from running properly on the computer.		
	(a)	State one possible software compatibility issue that might prevent the new software from running.	1 KU
		<ul style="list-style-type: none"> • <i>Unable to run on available OS</i> • <i>Clash with existing software</i> <p><i>1 mark for any valid point</i></p>	
	(b)	State one possible hardware compatibility issue.	1 KU
		<ul style="list-style-type: none"> • <i>Lack of available memory</i> • <i>Less powerful/unsuitable processor</i> • <i>Unsuitable graphics/sound card</i> <p><i>1 mark for any valid point (NOTE: Size of hard disk is not an issue as the software has already been installed)</i></p>	
8	A company is advised to change from a peer-to-peer network to a client-server network		
	(a)	Describe one difference between a peer-to-peer network compared to a client-server network.	2 KU
		<p><i>Server controls a function of entire client-server network (1 mark)</i> <i>In peer-to-peer, control is distributed not centralised (1 mark)</i></p> <p><i>Accept answers that use a valid example to describe centralisation of function, for example...</i> <i>Peer to peer holds data on individual computers (1 mark), client-server holds data on central file server (1 mark)</i></p> <p><i>Note: Simplistic answers “has server” etc too trivial, “equal peers/rights” without explanation is insufficient. The devices have the rights in peer to peer, not the users.</i></p>	
	(b)	Describe one possible technical reason for choosing a client-server network over a peer-to-peer network.	1 KU
		<ul style="list-style-type: none"> • <i>Easier to do backups with centralised file server</i> • <i>Better security of data (through multi-level access/password & usernames)</i> • <i>Software servers allow better control of licensing/upgrades/remote installation</i> <p><i>1 mark for any valid technical point</i></p>	

9	A graphic file is to be transferred as an e-mail attachment. Explain why a <i>JPEG</i> file might be preferred to a <i>TIFF</i> file for the graphic in this situation.	2 PS
	<p><i>JPEG achieves greater compression (1 mark), therefore less time to be transferred/reduction in net traffic (1 mark)</i> OR <i>JPEG (more) widely compatible (1 mark), as several versions of TIFF exist (1 mark)</i></p> <p><i>NOTE: Simplistic answers such as “smaller file size” are not related to this network scenario and get no credit. TIFF can use LPZ (lossless) compression, so “JPEG is compressed” is insufficient.</i></p>	
10	The software development process is described as an <i>iterative</i> process. Explain how the iterative nature of the software development process is used in the production of software.	2 KU
	<ul style="list-style-type: none"> • <i>Stages are revisited/repeated</i> • <i>As a result of new information/information gained later in the process</i> • <i>In order to improve the solution</i> <p><i>Note: Allow exemplification to make or clarify the above 1 mark each of two valid points (max 2 marks)</i></p>	
11	The <i>software specification</i> can act as part of the legal contract between the client and the software development company. State two other purposes of this document.	2 KU
	<ul style="list-style-type: none"> • <i>States boundaries & scope of problem</i> • <i>Fix timescale and total budget of project</i> • <i>States exactly what the software is required to do/functional specification</i> • <i>Used as a reference during the rest of the stages of the process</i> • <i>Informs testing by outlining test criteria</i> • <i>Any other valid</i> <p><i>1 mark for each of two valid points (max 2 marks)</i></p>	


12	<p>A program is being designed which generates a username using the following steps:</p> <ol style="list-style-type: none"> 1. get user initial and surname 2. create username 3. display the username 	
(a)	<p>Show how these steps could be represented using a <i>graphical design notation</i>.</p>	2 PS
	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div> <ul style="list-style-type: none"> • <i>valid structure/representation using boxes/shapes (do not penalise for shape of boxes etc)</i> • <i>labels/names/titles are in correct order (left to right or up to down)</i> <p>1 mark each of two valid points (max 2 marks) <i>Note: many possible answers.</i></p>	
(b)	<p>The username is created by joining the initial to the end of the surname, for example “CarrickE”. Name the <i>string operation</i> used to create the username.</p>	1 PS
	<p><i>Concatenation (1 mark)</i></p>	

13	Many applications contain scripting languages. Explain why there is a need for scripting languages within applications.	1 PS
	<ul style="list-style-type: none"> • <i>To make an application more flexible/more usable by a larger group of users</i> • <i>Allows experts to customise/extend the functionality of the application</i> • <i>Allows experts to automate the functionality of the application</i> • <i>Allows beginners to perform tasks beyond their level of expertise</i> • <i>Creating/editing a macro</i> <p><i>1 mark for any valid point</i></p>	
14	Name one type of personnel involved in the <i>documentation</i> stage.	1 KU
	<i>Client OR Programmer OR Document/Technical writer OR Project Manager (1 mark)</i>	
15	Software can be evaluated in terms of <i>robustness</i> and <i>reliability</i> .	
	(a) Explain what is meant by the term ‘robustness’.	1 KU
	<i>Program can cope with unexpected input/conditions without failing (1 mark)</i>	
	(b) Explain what is meant by the term ‘reliability’.	1 KU
	<ul style="list-style-type: none"> • <i>Software performs as predicted on duplicated test runs</i> • <i>Software will not stop due to design flaws</i> • <i>Output is correct for all specified inputs</i> <p><i>1 mark for any valid point</i></p>	

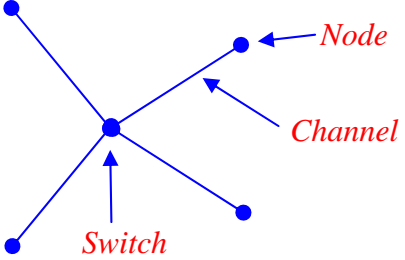
16	Software may require adaptive maintenance when a new operating system is installed. Describe one further example of when adaptive maintenance would be required.	1 PS
	<ul style="list-style-type: none"> • <i>A new item of hardware is installed which the program must interact with</i> • <i>Any other valid</i> <p><i>1 mark for any valid point</i> <i>Note: “In case they change computer” is too vague</i></p>	
17	A program is created during the implementation stage of the software development process.	
	(a) Programmers may make use of a <i>module library</i> . State what is meant by the term ‘module library’.	1 KU
	<i>A collection/group of pre-written/pre-tested sections of code (which can be used within programs) (1 mark)</i>	
	(b) The program may require a <i>user-defined function</i> . State what is meant by the term ‘user-defined function’.	2 KU
	<ul style="list-style-type: none"> • <i>created within this program by the programmer, not already present/presupplied</i> • <i>module has a value/which returns a single value to a program</i> <p><i>1 mark for each valid point</i> <i>Note: Do not accept created by the “user”</i></p>	

SECTION II

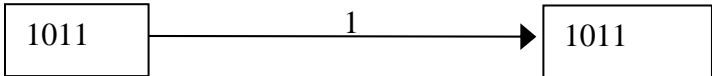
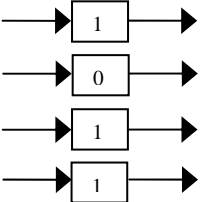
18	A palmtop computer has a processor with a 24 bit address bus, 32 bit data bus and 8 control lines. The palmtop computer accepts <i>flash cards</i> as additional storage.	
	(a) The processor receives a signal on an <i>interrupt</i> control line. Explain what happens when the processor receives this signal.	2 PS
	<ul style="list-style-type: none"> • Processor halts the current process/task • Processor stores current state/register values • Clears (internal) registers • Loads a new task/temporarily passes control to another routine. <p><i>1 mark for each of two valid points (max 2 marks)</i></p>	
	(b) Calculate the maximum amount of memory that the palmtop computer can address. Express your answer in appropriate units. Show all working.	3 PS
	<p> $Max\ memory = 2^{24} (1\ mark) \times 32\ bits (1\ mark)$ $= 2^4 \times 4\ Mb \quad OR\ 67,108,864\ bytes \quad OR\ 2^{24} \times 4\ bytes$ $= 16 \times 4\ Mb \quad OR\ 65,5336\ Kb \quad OR\ 2^{14} \times 4\ Kb = 2^4 \times 4\ Mb$ $= 64\ Mb (1\ mark\ for\ correct\ conversion)$ </p> <p><i>If 64Mb is given with no working then all 3 marks must be allocated, as working must be assumed as correct.</i></p>	
	(c) Data is to be transferred from the processor to main memory using a <i>write</i> operation. Describe how a processor would perform a write operation. Your answer should mention the <i>buses</i> or <i>control lines</i> used at each stage.	4 PS
	<ul style="list-style-type: none"> • Address bus is set up with the address to be written to • Data bus is set up with data to be written • Write (control) line is activated • Data on data bus is placed in memory location specified by address bus <p><i>1 mark for each valid point in order (max 4 marks)</i> <i>Note: At least one bus must be mentioned in 4th bullet. If all statements are present, but in wrong order, max 3</i></p>	

18	(d)	<p>A file created on the palmtop is to be stored on the flash card. The <i>file management</i> and <i>input/output management</i> functions of the palmtop's operating system are used during the transfer.</p> <p>Describe one task carried out by each of these functions.</p>	2 PS
		<p><i>File management :</i></p> <ul style="list-style-type: none"> • <i>update file allocation table</i> • <i>locate location of data blocks for storing/updating file</i> • <i>protect existing files from overwriting</i> <p>1 mark for any valid point</p> <p><i>I/O management</i></p> <ul style="list-style-type: none"> • <i>coordinate transfer of data (to flash card)</i> • <i>check readiness of flash card for data transfer</i> • <i>detect transmission errors</i> • <i>buffer data in transit.</i> <p>1 mark for any valid point</p> <p><i>Note: Accept answers not directly related to context</i></p>	
	(e)	<p>The price of <i>flash cards</i> has decreased in recent years as their capacity has increased. State one other recent trend in the development of flash cards.</p>	1 PS
		<ul style="list-style-type: none"> • <i>Security software included on flash card</i> • <i>Speed of access has improved</i> • <i>Reduction in physical size (ie mini-SD cards)</i> <p>1 mark for any valid point</p>	

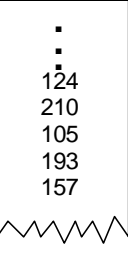
19	Pat has a <i>wireless enabled</i> laptop in his house. He uses this to illegally access his neighbour's wireless network.		
	(a)	Name the Act of Parliament that makes this network access illegal.	1 PS
		<i>Computer Misuse Act (1 mark)</i>	
	(b)	Pat's computer has anti-virus software installed. One technique used by anti-virus software to detect a virus is <i>virus signature recognition</i> .	
	(i)	Name one other virus detection technique	1 KU
		<i>Checksum OR Memory Resident Monitoring OR Heuristic Detection (1 mark)</i>	
	(ii)	Describe how your named technique detects a virus.	1 KU
		<p><i>Checksum – reports when calculations on a file produce varying results between initial storage and subsequent openings</i></p> <p><i>Memory Resident Monitoring – check for suspicious actions/activity in memory (copying/deleting files, program modification)</i></p> <p><i>Heuristic Detection – search for code that activates at a specific time/action</i></p> <ul style="list-style-type: none"> - <i>searches for exe files</i> - <i>writes to disk other than in normal OS procedures</i> - <i>rates files/actions according to level of threat</i> <p>1 mark for any of the above</p>	
	(iii)	Describe how a virus might use <i>camouflage</i> to avoid virus signature recognition.	1 KU
		<ul style="list-style-type: none"> • <i>Adding (dummy) instructions</i> • <i>Changing the order of instructions</i> <p>1 mark for any valid point</p>	

20	A network is configured as a <i>star</i> topology. It contains four computers and a <i>switch</i> .		
	(a)	Draw a labelled diagram of this star topology. You should clearly show the location of the switch .	2 KU
		 <p data-bbox="1061 331 1715 392"><i>1 mark for diagram of star with node & channel labels</i> <i>1 mark for switch location</i></p> <p data-bbox="1061 432 1715 528"><i>Note:</i> <i>Do not penalise correct diagrams with too many nodes.</i> <i>Precision of sketches may vary.</i></p>	
	(b)	Describe one advantage of using a <i>star</i> topology compared to a <i>bus</i> topology.	1 PS
		<ul data-bbox="344 746 936 810" style="list-style-type: none"> • <i>Channel failure in star will only affect 1 node</i> • <i>Channel failure in bus will affect all nodes</i> <p data-bbox="344 847 719 879"><i>1 mark for any one valid point</i></p>	
	(c)	Explain why using a <i>switch</i> rather than a <i>hub</i> may improve the performance of a network.	2 PS
		<p data-bbox="344 986 1323 1050"><i>Switch directs signal to appropriate node OR hub broadcasts to all nodes (1 mark)</i> <i>therefore less network traffic. (1 mark)</i></p> <p data-bbox="344 1054 389 1082"><i>OR</i></p> <p data-bbox="344 1086 1323 1150"><i>Switch can use full bandwidth to send signal OR hub bandwidth is shared (1 mark)</i> <i>reducing possible collisions (1 mark)</i></p> <p data-bbox="344 1190 763 1222"><i>1 mark for cause, 1 mark for effect</i></p>	

20	(d)	Explain why the addition of a print server to a large network contributes to an improvement in network performance.	1 PS
		<ul style="list-style-type: none"> • <i>Server queues/organises print jobs</i> • <i>freeing processors of other nodes for other tasks</i> • <i>central control of print queues maximises (efficiency of) hardware usage</i> <p><i>1 mark for any valid point</i></p>	
	(e)	Developments in <i>browser software</i> have contributed to the increase in the use of networks. Describe two of these developments.	2 PS
		<ul style="list-style-type: none"> • <i>use of tabs to hold several pages open at once</i> • <i>site adviser to rate relevance/reliability/security of sites</i> • <i>spell checking built in</i> • <i>search box built into browser window, removes need to go to search page</i> • <i>predictive text/drop down on search criteria</i> • <i>micro-browsers on palmtops etc</i> <p><i>1 mark for any valid point (max 2 marks)</i> <i>Note: trivial answers like 'more user friendly' are not acceptable</i></p>	
21		One function of an <i>interface</i> is to store data in transit between the computer and a peripheral.	
	(a)	State one other function of an interface.	1 KU
		<ul style="list-style-type: none"> • <i>Data conversion (serial/parallel, analogue/digital)</i> • <i>Handling status signals (ready/busy)</i> • <i>Voltage conversion (peripherals typically work at higher voltage, needs to be reduced to CPU voltage)</i> • <i>Protocol conversion (differences in data sizes/speeds require handling)</i> <p><i>1 mark for any valid point</i></p>	

21	(b)	(i)	Describe how data is transferred using a <i>serial interface</i> . You may include a diagram in your answer.	2 KU
			<p><i>Serial transfers signals down a single line (1 mark) bit by bit (1 mark)</i></p> <p><i>Serial transfer of 1011</i></p>  <p><i>Correct diagram only, 1 mark</i></p>	
		(ii)	Describe how data is transferred using a <i>parallel interface</i> . You may include a diagram in your answer.	2 KU
			<p><i>Parallel transfers groups of bits simultaneously (1 mark) down several lines (1 mark)</i></p>  <p><i>Note: Correct diagram only, 1 mark</i></p>	
	(c)	State one advantage of a serial interface over a parallel interface.		1 KU
		<ul style="list-style-type: none"> • <i>Fewer errors over longer distances (as a result of skewing)</i> • <i>Transmission possible over longer distances</i> • <i>Skewing does not occur</i> <p><i>1 mark</i></p>		

22	NoTow is a company running a city centre car park. The company require software to control the operation of the car park. The software will have modules for actions such as ‘recognising a car is at a barrier’, ‘printing an entry ticket’ and ‘calculating ticket charge’.		
	(a)	Name the most suitable type of programming language to implement this software. Explain your answer.	2 PS
		<p><i>Event-driven (1 mark) Program is waiting for an event/action from the customer to respond to (1 mark)</i> OR <i>Procedural (1 mark)</i></p> <ul style="list-style-type: none"> • a sequence of instructions with clear start and end point • program will be modular, making use of procedures/functions <p><i>1 mark for any valid point</i></p>	
	(b)	The software is written using modules. Describe two benefits to the programmer of writing modular code.	2 KU
		<ul style="list-style-type: none"> • Maintenance is helped by improved readability • Modules can be allocated to programmers to work on simultaneously • Testing can be carried out at module level first, reducing errors later • Errors are more easily traced in a modular structure • Use of parameters/local variables in modules avoids unexpected variable changes in other parts of code <p><i>1 mark for each of two valid points, max 2</i> Note: “easily read” is not the same as “improved readability” Answers should relate to the programmer writing code not merely using prewritten modules.</p>	
	(c)	After the software is written, testing is carried out.	
	(i)	<p>“Testing should be planned in advance with the creation of a test plan containing the test data to be used and the expected results.”</p> <p>State the aspect of testing being described here.</p>	1 KU
		<i>Systematic (1 mark)</i>	
	(ii)	<p>“Testing should be as thorough and complete as possible covering every part of the program with all kinds of test data and testers.”</p> <p>State the aspect of testing being described here.</p>	1 KU
		<i>Comprehensive (1 mark)</i>	

22	NoTow would like the software to calculate the number of cars on a particular day that spent more than three hours in the car park. The number of whole minutes each car is parked in the car park is stored in a list, as shown on the right.	<pre> . . 124 210 105 193 157 </pre> 		
	(d) Use <i>pseudocode</i> to design an algorithm to carry out this calculation.			4 PS
	<pre> Set over3 = 0 For each car that day If duration > 180 then Add one to over3 End if End loop </pre>	<p>1 mark for initialising 1 mark loop with termination 1 mark for if..endif with correct condition 1 mark for keeping running total</p> <p>Note: End of if/loop may be implicit in <u>clearly indented</u> algorithm The value is in minutes so the condition is > 180</p>		
	(e) The output from part (d) is turned into a percentage of the total number of cars using the car park in a day. This is stored in a variable called percent . Using a programming language with which you are familiar, show how to format the output to two decimal places.			2 PS
	<p>Visual Basic: <code>Println formatNumber(percent,2) OR picdisplay.print(format(percent, "#.00"))</code></p> <p>TrueBasic: <code>PRINT "The percentage is ";</code> <code>PRINT USING "#####.##" : percent</code></p> <p>Comal: <code>PRINT USING "#####.##" : "The percentage is "; percent</code></p> <p>Pascal: <code>writeln('The percentage is', percent:5:2)</code></p> <p>1 mark for use of function and variable, 1 mark for indication of 2 decimal places Note: Many languages/variations are possible. Syntax may not be exact.</p>			
	(f) Identify the type of <i>maintenance</i> used to add the module described in part (d). Justify your answer.			2 PS
	<i>Perfective maintenance (1 mark)</i> as they are adding a new function not in the original software (1 mark)			

23	<p>A cinema ticket system allows customers to select and pay for their own tickets. The top level algorithm is:</p> <ol style="list-style-type: none"> 1. Get ticket details 2. Calculate cost 3. Display cost and accept payment 										
<p>The module CalculateCost uses the number of tickets and the category of ticket to calculate the total payment due. It uses the <i>parameters</i> described below.</p> <table border="1" data-bbox="264 424 1099 564"> <thead> <tr> <th>Parameter</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Amount</td> <td>Number of tickets</td> </tr> <tr> <td>Category</td> <td>adult, child, student, OAP</td> </tr> <tr> <td>Cost</td> <td>Total cost of required tickets</td> </tr> </tbody> </table>			Parameter	Description	Amount	Number of tickets	Category	adult, child, student, OAP	Cost	Total cost of required tickets	
Parameter	Description										
Amount	Number of tickets										
Category	adult, child, student, OAP										
Cost	Total cost of required tickets										
	(a)	State the most suitable <i>data type</i> for the parameter called Cost .	1 PS								
<p><i>Real/float/single/currency (1 mark)</i> <i>Note: Integer is incorrect as it is a decimal value.</i></p>											
<p>(b) Parameters can either be passed by <i>value</i> or by <i>reference</i>.</p>			2 PS								
		(i) Identify one parameter that is passed by value to the module CalculateCost . Justify your answer.									
<p><i>Amount or category (1 mark)</i> <i>not to be changed by this module, so only current value passed in (1 mark)</i></p>											
		(ii) Identify one parameter that is passed by reference to the module CalculateCost . Justify your answer.	2 PS								
<p><i>Cost (1 mark)</i> <i>This is calculated by the module and updated, the amended variable being passed back out (1 mark)</i></p>											

23	(c)	A program may use <i>local</i> variables and <i>global</i> variables.		
		(i)	What is the <i>scope</i> of a global variable?	1 KU
			<i>Whole program (1 mark)</i> <i>Accept “throughout program” etc</i>	
		(ii)	State two advantages of using <i>parameter passing</i> rather than <i>global</i> variables when programming.	2 KU
			<ul style="list-style-type: none"> • <i>Increases modularity, reducing unexpected clashes between variable names</i> • <i>Increases portability, can re-use without changing variable names</i> • <i>Makes data flow clear, so improving readability</i> • <i>Makes data flow clear, so improving maintainability</i> <p><i>1 mark for any point, max of 2 marks</i></p>	
		(d)	State one reason why <i>portability</i> of software is an important factor for developers to consider.	1 KU
			<p><i>Greater range of hardware platforms means</i></p> <ul style="list-style-type: none"> • <i>the larger the potential sales market</i> • <i>a greater risk of potential hardware/software conflicts</i> • <i>more able to deal with future upgrades by/for customers</i> <p><i>1 mark for any valid point</i></p>	

23	(e)	To calculate the total cost the program must check the category of each ticket against the four possible categories. The programmer could use a series of IF statements or a nested IF as shown below.			
		<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> Series of IF statements: IF category = 'adult' THEN Price=5.50 IF category = 'child' THEN Price=3.50 IF category = 'student' THEN Price=4.50 IF category = 'OAP' THEN Price=4.00 </td> <td style="width: 50%; vertical-align: top;"> Nested IF: If category = 'adult' THEN Price=5.50 ELSE IF category = 'child' THEN Price=3.50 ELSE IF category = 'student' THEN Price=4.50 ELSE IF category = 'OAP' THEN Price=4.00 END IF </td> </tr> </table>	Series of IF statements: IF category = 'adult' THEN Price=5.50 IF category = 'child' THEN Price=3.50 IF category = 'student' THEN Price=4.50 IF category = 'OAP' THEN Price=4.00	Nested IF: If category = 'adult' THEN Price=5.50 ELSE IF category = 'child' THEN Price=3.50 ELSE IF category = 'student' THEN Price=4.50 ELSE IF category = 'OAP' THEN Price=4.00 END IF	
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	(i)	The programmer decides to use a nested If. Explain why this is a more efficient method.	2 PS		
		<i>Each discrete/separate IF in the series will be checked even after the match is found (1 mark)</i> <i>Nested if will only be executed until a condition is true (then it will exit the statement) (1 mark)</i>			
	(ii)	State one other <i>multiple outcome selection</i> statement that the programmer could have used.	1 PS		
		<i>CASE statement (1 mark)</i>			

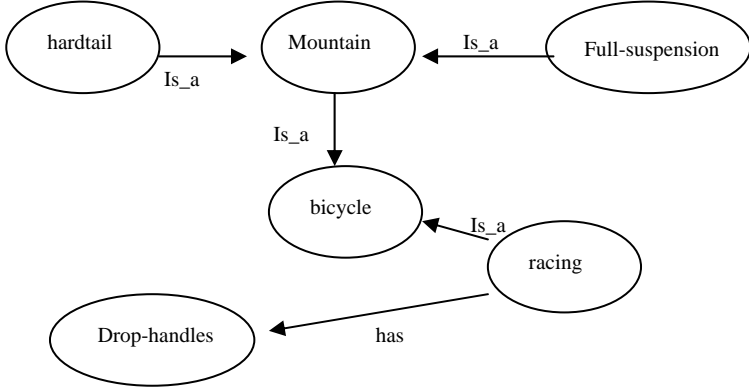
23	(f)	The program will make use of a 1-D array.	
	(i)	When creating, or declaring, a 1-D array for use in a program, a name must be given to the array. State two other items that should be set when the array is created.	2 KU
		<ul style="list-style-type: none"> • Data type • Number of elements/size of array • First index/start and end (both start and end would <u>imply</u> no. of elements) <p><i>1 mark for any point, max of 2 marks</i> <i>(The actual data itself would not normally be set at time of creation, although some languages allow this)</i></p>	
	(ii)	Explain why it is a more <i>efficient</i> use of system resources to pass an array by reference rather than by value .	2 PS
		<p><i>Does not take up memory (1 mark) storing a second copy of the array (1 mark)</i> OR <i>Does not waste processor time (1 mark) making a second copy of the array (1 mark)</i></p>	

SECTION III – Part A – Artificial Intelligence

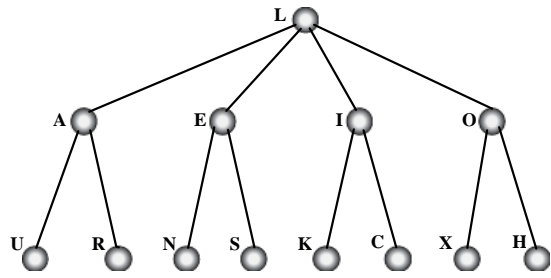
24	A human tester communicates with one human and one computer using remote terminals. The tester is to identify which terminal is connected to the human and which is connected to the computer.		
	(a)	State the name of this test.	1 KU
		<i>Turing test (1 mark)</i>	
	(b)	State one limitation of this test.	1 KU
		<ul style="list-style-type: none"> • <i>Only tests one aspect of artificial intelligence</i> • <i>Depends on the intelligence or personality of the user/interrogator</i> • <i>Test is text-based</i> <p><i>1 mark for any valid point</i></p>	
	(c)	(i) State one strategy that the human judge could use to differentiate between the human and the computer.	1 PS
		<ul style="list-style-type: none"> • <i>Use humour/jokes</i> • <i>Ask questions dependent on previous answers/repetition/contradiction</i> • <i>Bring in topical information</i> <p><i>1 mark for any valid point</i></p>	
		(ii) Explain why the strategy suggested in (c)(i) helps the tester to tell the difference between the human and the computer.	1 PS
		<ul style="list-style-type: none"> • <i>Humour is too sophisticated/high level for computers</i> • <i>Computer may not store all previous answers/be able to cross-reference between answers/no common sense</i> • <i>Computer may not have been updated with current events/knowledge base may be too narrow</i> <p><i>1 mark for any valid point relating to answer in (ii)</i></p>	

25	<i>Natural Language Processing (NLP)</i> involves creating software that uses language in a similar way to people.		
	(a)	State two common applications of NLP.	2 KU
		<ul style="list-style-type: none"> • <i>Auto-translation</i> • <i>Speech driven software/speech recognition</i> • <i>NL search engines</i> • <i>NL database interfaces</i> <p>1 mark for any valid point <i>Note: Accept examples of implementations eg chatterbots</i></p>	
	(b)	NLP has to deal with <i>ambiguity of meaning</i> in sentences.	
	(i)	Describe what is meant by “ambiguity of meaning” in a sentence.	1 KU
		<i>Sentence can be understood in a number of ways/different meanings/interpretations. (1 mark)</i>	
	(ii)	<p>The speech recognition stage of NLP correctly recognised the following sentences.</p> <p>Sentence 1: “The man threw a bottle at the window and broke it.”</p> <p>Sentence 2: “The restaurant was full of international food specialists.”</p> <p>State one example of ambiguity from each sentence.</p>	2 PS
		<ul style="list-style-type: none"> • <i>Unclear what the ‘it’ refers to – broken window or broken bottle</i> • <i>Was the food international or were they international specialists</i> <p>1 mark for any valid point for each sentence, max 2</p>	
	(c)	Name the stage of NLP that would attempt to resolve ambiguity in a sentence.	1 KU
		<p><i>Natural Language Understanding (1 mark)</i></p> <p><i>Note: Do not accept “NLU” alone, full term required</i></p>	

25	(d)	(i)	Name the stage that takes place after your answer to (c).	1 KU
			<i>Natural Language Generation (1 mark)</i> <i>Note: Award mark for correct stage following an incorrect answer to (c)</i> <i>Stages are: Speech (or Language) Recognition, NL Understanding, NL Generation, Speech (or Language) Synthesis</i>	
		(ii)	Explain why it is important to deal with ambiguity prior to this stage.	1 PS
			<i>Difficult to generate a correct response without coming to an understanding of the meaning of a sentence (1 mark)</i>	
	(e)		Regional accents or pronunciations, as well as ambiguity, can cause problems for NLP. State two other problems for NLP, using an example to illustrate each answer.	2 KU 2 PS
			<ul style="list-style-type: none"> • <i>Changing nature of language/new words or usage of words (1 mark) eg text, surf (1 mark)</i> • <i>Inconsistencies in grammar. (1 mark) eg There is a number of books in the box/There are a number of books in the box. (1 mark)</i> • <i>Similar sounding words (1 mark) eg through/threw (1 mark) OR similar spelling (1 mark) eg lead the pack/lead piping (1 mark)</i> <p>1 mark for each of two valid points, plus 1 mark for each point illustrated by a valid example, max 4 <i>Note: Mark the example to fit the point, avoiding double jeopardy. Slang is to be taken as an example of regional accent/dialect</i></p>	

26	A bicycle manufacturer is developing an <i>expert system</i> to advise customers on their bicycle purchase.	
(a)	State one reason why the bicycle manufacturer's <i>domain</i> is suitable.	1 PS
	<ul style="list-style-type: none"> • <i>Narrow area/field of knowledge/topic (bicycles/one manufacturer's bikes)</i> • <i>Clear boundaries/well-defined.</i> • <i>Advice would be clearly defined based on certain inputs (probability/uncertainty is limited)</i> <p>1 mark for any valid point</p>	
(b)	<p>The following paragraph contains some of the information for the proposed expert system.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p>Racing and mountain are two types of bicycle. Racing bicycles have drop handle bars. Hardtails and full-suspension are two types of mountain bicycle.</p> </div> <p>Draw a <i>semantic net</i> to represent this information.</p>	4 PS
	 <pre> graph TD hardtail((hardtail)) -- Is_a --> Mountain((Mountain)) FullSuspension((Full-suspension)) -- Is_a --> Mountain Mountain -- Is_a --> bicycle((bicycle)) racing((racing)) -- Is_a --> bicycle racing -- has --> DropHandles((Drop-handles)) </pre>	<p>1 mark for central node of bicycle.</p> <p>1 mark for both subclasses (racing & mountain)</p> <p>1 mark for all 4 “is_a” relationships with correct arrows.</p> <p>1 mark for correctly arrowed “has” relationship</p> <p><i>Note: Candidates may not use terms “has” or “is_a”, but latter must be consistently used</i></p>

26	(c)	An expert system can be created using an <i>expert system shell</i> .		
		(i)	Name and describe one component of an expert system shell.	2 KU
			<p><i>Inference engine (1 mark)</i> <i>selects appropriate facts or rules/uses pattern matching to search for a solution based on user input. (1 mark)</i> <i>OR</i> <i>User interface (1 mark) accepts user responses via suitable interface (such as radio buttons, list boxes) & outputs advice (1 mark)</i></p> <p><i>Note: Working memory is not an acceptable answer, as it is hardware used during execution of expert system</i></p>	
		(ii)	State the component that must be added to an expert system shell to create an expert system.	1 KU
			<i>Knowledge base (1 mark)</i>	
	(d)	Other than faster development time, state one advantage of creating an expert system using an expert system shell rather than a declarative language.		1 PS
		<ul style="list-style-type: none"> • <i>Support for the existing software ie expert system shell has been used before</i> • <i>More robust as components are pretested</i> • <i>Lower level of programming skill required</i> <p><i>1 mark for any valid point</i> <i>Note: Creation of user interface etc is a component of development time</i></p>		

27	<p>A search tree is shown on the right. Node L is the start, or initial, state. Node N is the goal state.</p>	 <pre> graph TD L((L)) --- A((A)) L --- E((E)) L --- I((I)) L --- O((O)) A --- U((U)) A --- R((R)) E --- N((N)) E --- S((S)) I --- K((K)) I --- C((C)) O --- X((X)) O --- H((H)) </pre>	
	(a)	State the order in which nodes would be visited using a <i>breadth-first</i> search, stopping when the goal state is reached.	1 PS
		LAEIOURN (1 mark)	
	(b)	(i) State the order in which nodes would be visited using a <i>depth-first</i> search, stopping when the goal state is reached.	1 PS
		<p>LAUREN (1 mark) Note: accept the path which repeats redundant states ie "LAUARALEN"</p>	
		(ii) List the nodes stored in <i>working memory</i> when the goal state is found using a depth-first search.	1 PS
		LEN (1 mark)	
		(iii) Explain your answer to (b)(ii) making reference to the search tree.	2 PS
		<ul style="list-style-type: none"> • Search only stores current path (LEN) • When the leftmost branch has been exhausted and it backtracks to L • Redundant nodes (AUR) are removed/previous path not saved <p>1 mark for each of two valid points, max 2</p>	

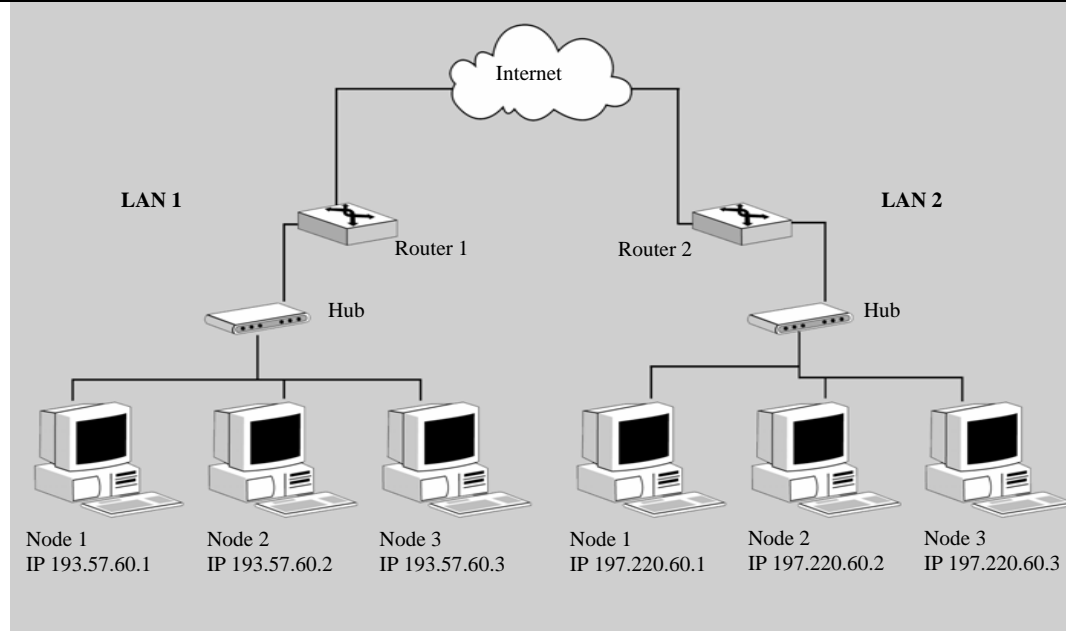
27	(c)	Search trees can result in <i>combinatorial explosion</i> .	
	(i)	Describe what is meant by a “combinatorial explosion”.	2 KU
		<i>Each node has a large number of descendants (1 mark) causing the number of nodes to become huge very quickly (1 mark)</i>	
	(ii)	The game of chess is one example of a problem that results in combinatorial explosion. State another example.	1 KU
		<i>Rubik cube, backgammon, Go, draughts (1 mark)</i> <i>Note: Accept any other game with many possible alternative moves rapidly expanding the number of board states</i>	
	(iii)	Describe how a heuristic search can be used to overcome the problems of combinatorial explosion.	2 PS
		<ul style="list-style-type: none"> • <i>A heuristic indicates which of the descendant nodes is more promising/where a solution is likely to be</i> • <i>through the use of an evaluation function/calculation</i> • <i>making the need to visit every node less likely/cutting down the search space</i> <p><i>1 mark for each of two valid points, max 2</i></p>	
	(iv)	Explain one way in which faster processors can improve the speed of a heuristic search.	1 PS
		<ul style="list-style-type: none"> • <i>Faster selection/comparison of descendant nodes</i> • <i>Faster calculation of evaluation functions which rate the node</i> <p><i>1 mark for any valid point</i> <i>Note: Generic answers “faster calculations/processing” no marks</i></p>	
	(d)	Explain why the use of <i>cache memory</i> could improve search times.	2 PS
		<i>Algorithm/fact/rule/code/state likely to be contained in cache (1 mark)</i> <i>reducing need to fetch <u>from slower main memory</u> OR causing faster execution of fetch-execute cycle (1 mark)</i>	

28	<p>The following knowledge base contains information about various animals.</p> <p>1 subclass (monotreme, mammal). <i>A monotreme is a subclass of mammal.</i></p> <p>2 subclass (platypus, monotreme).</p> <p>3 subclass (anteater, mammal).</p> <p>4 has (bird, egg_laying). <i>Birds lay eggs.</i></p> <p>5 has (mammal, live_young). <i>Mammals have live young.</i></p> <p>6 has (mammal, warm_blood).</p> <p>7 has (platypus, egg_laying).</p> <p>8 has (X,Y) IF subclass (X,Z) AND has (Z,Y). <i>X has the property Y IF X is a subclass of Z AND Z has the property Y</i></p>		
(a)	(i)	State the answers to the query: ?- has(X, egg_laying).	2 PS
		<p><i>X=bird (1 mark)</i></p> <p><i>X=platypus (1 mark)</i></p> <p><i>Note: Do not penalise wrong order of results. Must have correct form of "X=..."</i></p>	
	(ii)	State the query for the question "What are the subclasses of mammal?".	1 PS
		<p><i>subclass(X, mammal). (1 mark)</i></p> <p><i>Note: Variable may not be X, accept any valid, capitalised, variable</i></p>	

28	(b)	<p>Assuming that a depth-first search is used, trace the first two solutions to the query:</p> <p style="text-align: center;">?-has(platypus, Y).</p> <p>You must include the correct use of the term <i>sub-goal</i> in your trace. Use the line numbers to help your explanation.</p>	7 PS
		<ul style="list-style-type: none"> • Match at 7, Y is instantiated to <u>egg_laying</u>, <u>Y = egg_laying</u> (is output/solution) • Match at 8, X is instantiated to platypus, <u>subgoal subclass(platypus,Z)</u> • Match at 2, Z instantiated to monotreme, <u>subgoal has(monotreme,Y)</u> • Match at 8, X instantiated to monotreme, <u>subgoal subclass(monotreme,Z)</u> • Match at 1, Z = mammal, <u>subgoal has(mammal,Y)</u> • Match at 5, Y instantiated to liveyoung, <u>Y=liveyoung</u> (is output/solution) <p>1 mark for each point, max 6 plus 1 mark for a single correct use of term sub-goal/subgoal (question max 7) <i>Note: Many expressions of a valid trace are possible, but they should all contain the underlined points in some form</i></p>	
	(c)	<p>Explain the difficulty with the answers to part (b).</p>	1 PS
		<ul style="list-style-type: none"> • The two answers (“egg laying” and “live young”) are conflicting • Platypus do not bear live young <p>1 mark for any valid point</p>	
	(d)	<p>State the name of the type of rule used in line 8.</p>	1 KU
		<p><i>Recursion/Recursive (rule) OR Inheritance (rule) (1 mark)</i></p>	

SECTION III – Part B – Computer Networking

29 The diagram below shows the configuration of two *intranets*. Each LAN is connected to the Internet via a *router*.



(a) (i) State the *class* of network for LAN 1. Justify your answer.

2 PS

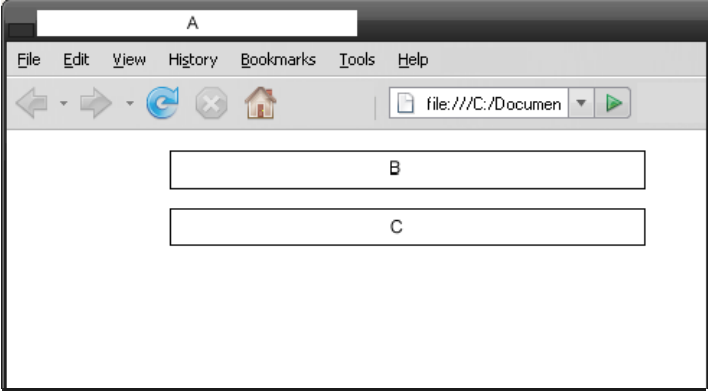
Class C (1 mark)

- *the first 3 octets are fixed*
- *the first octet is between 192-223*
- *the first octet is 193, which is in the range for class C*

1 mark for any valid point

29	(a)	(ii)	State how many additional nodes can be connected to LAN 1. Justify your answer	2 PS
			<p>249 (1 mark)</p> <p><i>Class C can have 254 nodes/there are 5 used (1 mark) leaving 249</i></p> <p><i>Note: Avoid double jeopardy where 5 devices are subtracted from a number other than 254</i></p>	
	(b)		Node 1 on each of the LANs has the same hardware specification and operating system.	
		(i)	State one possible reason why node 1 on LAN 2 may have better performance.	1 PS
			<p><i>Any valid answer relating to the reduced performance of Node 1 on LAN 1 eg</i></p> <ul style="list-style-type: none"> • <i>The hard drive on LAN 1 may be fragmented</i> • <i>Node 1 on LAN 1 may have other devices connected ...printer/scanner</i> • <i>Node 1 LAN may have more software installed</i> <p><i>OR</i></p> <p><i>Network related responses</i></p> <ul style="list-style-type: none"> • <i>The stations on LAN 2 may be configured with a higher bandwidth</i> • <i>The network software/hardware on LAN 2 may be more efficient/newer version than LAN 1</i> • <i>There may be less traffic on LAN 2 than LAN 1</i> <p>1 mark for above or other valid answer</p>	
		(ii)	Justify your answer to part (i).	1 PS
			<ul style="list-style-type: none"> • <i>Fragmented drive- takes longer to retrieve/store data from the drive slowing performance</i> • <i>More devices requires more system resources reducing performance</i> • <i>More software installed requires additional system resources reducing performance</i> • <i>Higher bandwidth means data will be sent/received in less time</i> • <i>More efficient network software may reduce time taken for data to be sent/received</i> • <i>Reduced traffic will allow more bandwidth to stations transmitting</i> <p>1 mark for valid justification which matches answer to part (i)</p>	

29	(c)	State why it is possible for the three stations on LAN 1 to communicate if they have different operating systems.	1 PS
		<i>They all use a common/standard network protocol/OSI (1 mark)</i>	
		A mail message is sent from node 1 on LAN 1 to node 3 on LAN 2 using <i>TCP/IP</i> .	
	(d)	State a suitable <i>application layer</i> protocol for the message.	1 KU
		<i>SMTP [1 mark]</i>	
	(e)	Describe in detail the role of TCP when sending and receiving the message.	3 KU
		<ul style="list-style-type: none"> • <i>The message is broken into packets</i> • <i>Each packet is given a sequence number/(sequence) header</i> • <i>The message is reassembled at the destination</i> <p><i>1 mark for each point, max 3</i></p>	
	(f)	A <i>Cyclic Redundancy Check (CRC)</i> is used to check the data packets for errors. Describe the operation of CRC.	3 KU
		<ul style="list-style-type: none"> • <i>Sender performs a calculation and sends result/CRC with the data</i> • <i>Receiver recalculates the result/CRC and compares it to the result/CRC sent</i> • <i>prompt to resend if no match/if results match accept packet/error if no match</i> <p><i>1 mark for each point, max 3</i></p>	
	(g)	Describe how a router ensures that the data packets reach the correct destination.	2 KU
		<ul style="list-style-type: none"> • <i>The router takes the destination IP/logical address from the packet</i> • <i>and matches this with the MAC/physical address of the node</i> <p><i>1 mark for each point</i></p>	

30	Hamish is creating a website for the Highland Chess League. Part of the <i>HTML</i> for the home page is shown below.	
	<pre> <head> <title>Highland Chess League</title> <meta name="description" content="The Highland Chess League"/> <meta name="keywords" content="chess,league,games,Highland,hobbies"/> </head> <body> <div align="center"> <p>Welcome to the Highland Chess League Home Page </p> <p>Play the board <u>not </u> the man</p> </div> </body> </pre>	
(a)	<p>The window below is seen when a browser is used to view the home page. Use the HTML code above to identify the contents displayed in A, B and C.</p> 	3 PS
	<p><i>A – Highland Chess League (1 mark)</i> <i>B – Welcome to the Highland Chess League Home Page (1 mark)</i> <i>C – Play the board <u>not</u> the man (1 mark) (note: the word “not” must be underlined to get the mark)</i></p> <p><i>Note: Ignore <u>minor</u> errors involving spelling or some missing capitals if answer is otherwise correct</i></p>	

30	(b)	Hamish uses <i>FTP</i> once he has developed the website. State what <i>FTP</i> is used for in this situation.	1 PS
		<i>To upload his website/pages/files (1 mark)</i>	
	(c)	(i) State the purpose of the following line of the HTML code. <pre><meta name="keywords" content="chess,league,games,Highland,hobbies"/></pre>	2 PS
		<ul style="list-style-type: none"> • <i>To describe the contents/purpose of the site</i> • <i>To enable a search engine to select websites according to these keywords</i> <p><i>1 mark for the idea of providing information and 1 mark for the purpose of the information</i></p>	
		(ii) Describe how a <i>spider</i> would use this line of code.	2 PS
		<i>A spider collects data/keywords (from meta tags) (1 mark) and it is stored in a database/index (1 mark)</i>	
		(iii) Explain why one search engine may provide more relevant and comprehensive results than another.	2 PS
		<p><i>Answers include:</i></p> <ul style="list-style-type: none"> • <i>Results of search depends on how accurately gathered data (1 mark) represents content of site (1 mark)</i> • <i>A meta search engine (1 mark) may gather the results of searches from other search engines (1 mark)</i> • <i>Sites may be rated/ordered (1 mark) to indicate popularity/relevance(1 mark)</i> • <i>Sponsored links may be included in results (1 mark) pushing more relevant sites down the list (1 mark)</i> • <i>Other valid</i> 	

30	(d)	Morag knows that Hamish is working on the website. She enters http://www.highlandchess.com into her browser and receives the following message.	
		<div style="border: 1px solid black; padding: 10px; width: fit-content; margin: 0 auto;"> <p>The requested URL could not be retrieved While trying to retrieve the URL: http://www.highlandchess.com The following error was encountered: DNS Server unable to resolve</p> </div>	
	(i)	Describe the events that led to this message being displayed.	3 PS
		<ul style="list-style-type: none"> • <i>the Domain Name Server (DNS) tried to match the given URL</i> • <i>to find the corresponding IP address</i> • <i>the IP could not be found/the DNS has no record of the URL</i> <p><i>1 mark for each point (Note: No mark for simply stating that the website does not exist)</i></p>	
	(ii)	State what Hamish must do to make the website accessible to the public.	1 PS
		<i>Register the domain name (1 mark)</i>	

31	The owner of a local coffee shop has decided to provide Internet access for his customers. A computing company sends one of their personnel to examine the coffee shop and interview both the owner and his staff.		
	(a)	State the job title of the person sent from the computing company.	1 PS
		<i>Systems analyst (1 mark)</i>	

31	(b)	The coffee shop can either be wired with network access points in the wall or a wireless access point can be installed.	
	(i)	State two reasons why the wireless access point solution was chosen.	2 PS
		<ul style="list-style-type: none"> • <i>No need to change the infrastructure of the building.</i> • <i>Not limited by the number of users logging on</i> • <i>More economical than the cabled solution</i> • <i>Less additional hardware required</i> • <i>Customers able to sit where they like/wireless laptops give more portable network access</i> <p><i>Any two valid points 1 mark each, max 2</i></p>	
	(ii)	State a suitable type of Internet connection for the coffee shop	1 PS
		<p><i>ISDN, ADSL or cable modem (1 mark)</i></p> <p><i>Note: Do not accept “broadband” alone.</i></p>	
	(c)	The wireless network is correctly installed, but customers complain that at certain times the Internet access is very slow. State one reason for this drop in performance.	1 PS
		<ul style="list-style-type: none"> • <i>Many people logged on in the coffee shop sharing the same Internet connection</i> • <i>Internet is very busy at these times so less external bandwidth</i> <p><i>1 mark for any valid point</i></p>	



32	A college intranet is used by lecturers, technicians and students. The technicians need to be able to install software and configure computers on the network.		
	(a)	Explain how it is possible to allow only the technicians to install software.	1 PS
		<ul style="list-style-type: none"> • They have software and hardware permissions/rights which are denied the other users • They belong to a group with advanced/higher/different permission rights <p>1 mark for any valid point Note: not enough to say they have r/w permissions</p>	
	(b)	A hacker intercepts student records which are being sent between two lecturers.	
	(i)	What term is used to describe this type of attack?	1 PS
		<i>Passive attack (1 mark)</i>	
	(ii)	Describe one software technique to defend against this type of attack.	1 PS
		<u>Description of Encryption</u> : data is coded before being sent making it unreadable if it is intercepted (1 mark)	
	(c)	Explain the difference between a <i>backup strategy</i> and <i>disaster avoidance techniques</i> .	2 KU
		<p><i>Backup happens after the disaster (1 mark) and disaster avoidance attempts to prevent it happening (1 mark)</i></p> <ul style="list-style-type: none"> • A backup strategy will not prevent a disaster/The backup strategy is a recovery technique • Description of scenario such as restoring files after hard disk failure • Disaster avoidance is put in place to prevent failure or data loss • Description of scenario such as using fault tolerant components or UPS to prevent misfortune <p>1 mark for any valid point describing each strategy</p>	

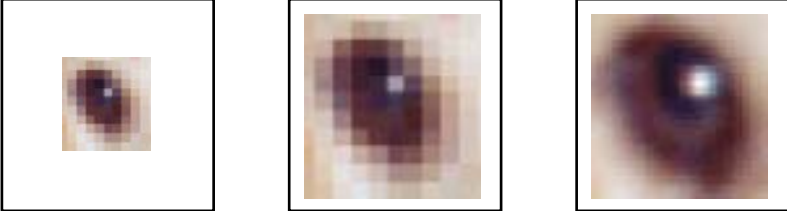
32	(d)	A differential backup contains all files that have changed since the last full backup.	
	(i)	State one advantage of using this type of backup compared to a full backup of data.	1 PS
		<ul style="list-style-type: none"> • <i>The differential backup process will take less time than a full backup</i> • <i>The backing storage requirements are lower than that of a full backup</i> • <i>The performance of the network will be affected for a reduced duration</i> <p><i>1 mark for any valid point</i></p>	
	(ii)	Describe a situation where a differential backup would not provide any advantage over a full backup.	1 PS
		<ul style="list-style-type: none"> • <i>Restore of a differential backup takes more time than a full restore due to the number of files changed</i> • <i>If differential backup is done too many times the number of layers make it slower/larger than a full backup</i> • <i>Accept any reasonable scenario which shows the above to be true</i> <p><i>1 mark for any valid point</i> <i>Note: There can be no differential backup without a prior full backup as there needs to be a base level to start from</i></p>	
	(e)	The intranet is connected to the Internet. This may cause both access and security issues.	
	(i)	Describe the technique known as <i>Internet filtering</i> .	1 KU
		<i>Internet filtering is where access to a web page is denied/filtered due to properties of page eg content, file type, URL, key rating (1 mark)</i>	
	(ii)	Describe the technique known as a <i>walled garden</i> .	1 KU
		<i>A walled garden allows access to only those websites that have been specifically chosen (1 mark)</i>	

32	(f)	State two reasons why Internet filtering would more appropriate for the college.	2 PS
		<ul style="list-style-type: none"> • <i>The students need access to the whole Internet and not simply a restricted part of it</i> • <i>The walled garden may not have the most recent research sites whereas filtering allows this</i> • <i>Any answer relating to restriction of walled garden to all but permitted list</i> • <i>Filtering method is more versatile than the walled garden (in blocking vulgar/illegal sites to different groups)</i> <p><i>1 mark for any valid point relating to the features/benefits of filtering compared to walled garden</i></p>	
	(g)	Application filtering is a technique used by a firewall. Name and describe one other technique.	2 KU
		<p><i>Packet filtering (1 mark) – data packets are filtered depending on IP or TCP content (1 mark)</i></p> <p><i>Circuit (level) filtering (1 mark) – a secure connection is set up between the source and network (1 mark) denying access to packets outwith the secure connection</i></p> <p><i>(1 mark) for the name and (1 mark) for the description</i></p>	
	(h)	Describe the meaning of the terms:	
	(i)	Data integrity.	1 KU
		<i>Data integrity is ensuring that the data is correct/up to date (1 mark)</i>	
	(ii)	Data security.	1 KU
		<i>Data security is making sure that only authorised users have access to the data (1 mark)</i>	


SECTION III – Part C – Multimedia Technology

33	The company VideoStream specialises in video recording devices.		
	(a)	Ten years ago, VideoStream’s best selling product was their VS32 video capture card. Due to advances in video camera technology, the VS32 video capture card is no longer for sale.	
	(i)	One of the main components of the video capture card is the DSP. Describe the role of the DSP.	1 KU
		<ul style="list-style-type: none"> • <i>DSP allows the hardware encoding of data stream</i> • <i>DSP allows high speed manipulation of video data eg compressing the video as MPEG</i> <p><i>Any one of above, 1 mark</i></p>	
	(ii)	Describe the technological advance in video cameras that has resulted in the drop in sales of all video capture cards.	1 PS
		<i>Digital video cameras have replaced analogue video cameras therefore there is no need for video capture card as the video can be transferred directly to the computer.</i>	
	(b)	Derek has bought VideoStream’s latest video camera that comes with free video editing software.	
	(i)	Derek records a two minute video using 24-bit colour and a 1000 by 800 pixel frame size at 10 frames per second. Calculate the file size of the uncompressed video. Show all working and express your answer in appropriate units. Show all working.	3 PS
		<p><i>$2 \times 60 \times 10$ (1 mark for no of frames) $\times 1000 \times 800 \times 24$ (1 mark for bits per frame)</i></p> <p><i>Note: numbers may be in a different order</i></p> <p><i>$= 23040000000$ bits</i></p> <p><i>$23040000000 / 8 = 2880000000$ bytes</i></p> <p><i>$2880000000 / 1024 = 2812500$ Kb</i></p> <p><i>$2812500 / 1024 = 2746.6$ Mb</i></p> <p><i>$2746.6 / 1024 = 2.68$ Gb (1 mark)</i></p> <p><i>2.68 Gb (units essential) with no working – 3 marks</i></p>	
	(ii)	The settings in part (i) produced a poor quality video. Explain why the video is poor quality.	1 PS
		<p><i>The frame rate is too low at 10 fps (and should be increased to 25 fps)</i></p> <p><i>1 mark</i></p>	


33	<p>Derek records several video clips and tries out the free video editing software. He loads the video clips and then uses two features of the video editing software to edit the video as shown below.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Before Editing</p>  </div> <div style="text-align: center;"> <p>After Editing</p>  </div> </div>		
(b)	(iii)	<p>Name two features of the video editing software that Derek has used to edit the video.</p>	2 PS
		<ul style="list-style-type: none"> • <i>Sequencing</i> • <i>Transition</i> <p>1 mark each <i>Note: Naming Fade and Wipe – 0 marks</i></p>	
(c)	<p>The default format for saving video clips from all VideoStream’s products is AVI. AVI is an example of a <i>container file</i>. Explain why AVI is a “container file”.</p>		1 PS
	<p><i>It contains more than one media type within the one file (audio and video) 1 mark</i> <i>Note: Repeating “Audio Video Interleave” with no explanation does not sufficiently demonstrate understanding</i></p>		
(d)	<p>MPEG is a compressed video file type. Describe how MPEG achieves compression.</p>		3 KU
	<ul style="list-style-type: none"> • <i>Use of key frames (I-frames)</i> • <i>(Between key frames) only changes to the frames recorded</i> • <i>Each frame compressed (as JPEG)</i> <p>1 mark each, max 3 marks</p>		

34	Harpreet is an experienced website creator. She uses a WYSIWYG editor rather than a text editor to create a website.		
	(a)	Compare the use of a WYSIWYG editor and a text editor in producing the website, in terms of their demand on system resources.	2 PS
		<ul style="list-style-type: none"> • WYSIWYG – would require faster processing speed (1 mark) as it has to process higher resolution graphics and a more complex interface (1 mark) • WYSIWYG – would require a larger RAM (1 mark) as the software would need to display and manipulate higher resolution graphics (1 mark) • WYSIWYG – would require a higher resolution monitor (1 mark) to display the high resolution graphics (1 mark) <p>1 mark for the hardware, 1 mark for the reason. Max 2 marks</p>	
	(b)	As part of a graphic for the website, Harpreet scanned the image of an eye using 24-bit colour. Describe how a scanner captures an image. Your answer must contain an appropriate level of technical detail.	3 KU
		<ul style="list-style-type: none"> • Reflected light is detected by the (linear) CCD/light sensitive elements/light sensors • It is converted to an analogue electrical signal • The ADC converts this to a digital signal <p>1 mark for each valid point, max 3</p>	
	(c)	<p>After scanning, Harpreet scaled the eye and used <i>image manipulation software</i> to adjust the image.</p> <div style="text-align: center;">  <p>Original scan After scaling After adjustment</p> </div>	
	(i)	Name the feature of image manipulation software that Harpreet used to carry out the adjustment.	1 PS
		<i>Re-sampling/increasing resolution (1 mark)</i>	

34	(c)	(ii)	Explain how this feature is able to improve the image of the eye.	1 PS
			<p>1 mark for any one of the following explanations:</p> <ul style="list-style-type: none"> Increases number of pixels, looks at surrounding pixels and gives best guess at what the output pixel colour should be Bilinear interpolation/Output pixel values calculated from weighted average of pixels in the nearest 2-by-2 group Bicubic interpolation/Output pixels are an average of the surrounding pixels by weighting the value of the pixel in the average based on its distance from the origin pixel. Pixels farther away have less effect on the resulting pixels value than its nearest neighbours. 	
		(iii)	Name and describe a <i>compression technique</i> that would allow Harpreet to reduce the file size of the 24-bit colour eye without losing any image quality when it is decompressed.	2 PS
			<p>Run Length Encoding (RLE) (1 mark) Note: LZW is not suitable as it is 8 bit</p> <p>Repeated pixels of the same colour can be stored using the colour of a pixel followed by the number of times it occurs eg seven black pixels could be stored as the number pair 1 7 (1 mark)</p>	
	(d)		Harpreet would like music to be playing in the background while each web page is being viewed. The music can either be stored as a MIDI file or a compressed MP3 file.	
		(i)	Describe one way that the file size is reduced when saving a sound file as a compressed MP3 file.	1 KU
			<ul style="list-style-type: none"> Sounds that can't be heard by the human ear are not encoded Sounds that are drowned out by other sounds are not encoded Compressed using Huffman algorithm/encoding Low frequency sounds are sampled at a lower resolution <p>Any 1 of the above, 1 mark</p>	
		(ii)	State two advantages of storing the music for Harpreet's web page using MIDI rather than MP3.	2 PS
			<ul style="list-style-type: none"> Has a smaller file size than MP3 so <u>can be downloaded faster/uses less memory/backing storage</u> Individual instrument data stored so <u>a single instrument can be edited at a later date</u> Flexible/universal format so <u>no need for additional CODECs</u> MIDI is universal format so <u>can be embedded directly into the web page</u> Other valid advantage <p>1 mark each, max 2 marks Note: responses must be advantages not just facts</p>	

35	<p>The logo for a transport system was created as an SVG graphic and is shown on the right.</p> 										
	(a)	<p>SVG is an example of a <i>vector graphic</i> file type. Name one other vector graphic file type.</p>	1 KU								
		<ul style="list-style-type: none"> • VRML • WRL <p>Any of the above 1 mark</p> <p>Others might include SWF (Shockwave Flash), AI (Adobe Illustrator), CDR (CorelDRAW), CMX (Corel Exchange), CGM (Computer Graphics Metafile), DXF AutoCAD, WMF (Windows Metafile)</p>									
	(b)	<p>Explain why the above logo can be stored more efficiently as an SVG graphic than in the equivalent bit-map graphic.</p>	1 KU								
		<p>SVG stores the attributes of the graphic (rather than the actual picture itself) (1 mark)</p>									
	(c)	<p>Choose one of the objects in the metro logo above and show how it would be represented in SVG code. Your answer should include the name of the object and at least two attributes.</p>	2 PS								
		<p>1 mark for naming the object and 1 mark for two attributes.</p> <table border="1" data-bbox="353 884 1319 1027"> <thead> <tr> <th>Object</th> <th>Suitable Attributes include:</th> </tr> </thead> <tbody> <tr> <td>circle</td> <td><i>cx, cy, r, stroke, stroke-width, fill</i></td> </tr> <tr> <td>rect</td> <td><i>x, y, width, height, fill, stroke, stroke-width</i></td> </tr> <tr> <td>text</td> <td><i>x, y, font-family, font-size, font-weight, fill, stroke</i></td> </tr> </tbody> </table> <p>For example: circle with <i>cx</i> and <i>cy</i> would get 2 marks, whilst rectangle with <i>x</i> and <i>y</i> would get 1 mark as it should be <i>rect</i></p> <p>The actual code used was:</p> <pre><circle cx="300" cy="300" r="75" stroke="black" stroke-width="1" fill="white"/></pre> <pre><rect x="175" y="275" width="250" height="50" style="fill:rgb(255,255,255);stroke-width:1;stroke:rgb(0,0,0)"/></pre> <pre><text x="215" y="316" style="font-family:Adventurer Black SF;font-size:36pt" > METRO </text></pre>	Object	Suitable Attributes include:	circle	<i>cx, cy, r, stroke, stroke-width, fill</i>	rect	<i>x, y, width, height, fill, stroke, stroke-width</i>	text	<i>x, y, font-family, font-size, font-weight, fill, stroke</i>	
Object	Suitable Attributes include:										
circle	<i>cx, cy, r, stroke, stroke-width, fill</i>										
rect	<i>x, y, width, height, fill, stroke, stroke-width</i>										
text	<i>x, y, font-family, font-size, font-weight, fill, stroke</i>										

35	(d)	A small part of the SVG code for the logo is shown below: rgb(0,0,255)	
	(i)	State which colour is represented by this code.	1 PS
		<i>It is blue, (1 mark)</i>	
	(ii)	The largest number that can be entered into the rgb instruction shown above is 255. Calculate the bit depth of that object. Show all working.	2 PS
		<ul style="list-style-type: none"> • 8-bits used to store colour intensity of each of RGB (in range 0 to 255) • Triad of RGB stored in $3 \times 8 = 24$ bit colour <p><i>1 mark for each bullet</i></p>	
	(e)	The logo was converted to 3D and a <i>texture</i> applied to it. Explain the term “texture” in relation to 3D graphics.	1 KU
		<ul style="list-style-type: none"> • A 2D image mapped onto the surface of a 3D object • A graphic ‘pasted’ onto the surface of a 3D object <p><i>(1 mark)</i></p>	
	(f)	The logo was converted to a bit-map so it could be animated . Name a bit-map format that would be suitable for storing the animated logo.	1 PS
		<ul style="list-style-type: none"> • GIF • MNG (animated version of PNG) <p><i>Any 1 of above, 1 mark</i></p>	

36	FoneSmart is releasing the latest version of their highly successful smart phone.		<div style="border: 1px solid black; padding: 5px;"> 512 Mb Data Storage MP3 Player Voice Recording function Bluetooth & Firewire enabled </div> 	
	(a)	A multimedia presentation has to be designed and created for the launch of the latest version of the phone.		
		(i)	State two elements that should be included in the design of a multimedia presentation.	2 KU
			<ul style="list-style-type: none"> • <i>Storyboard/Timeline</i> • <i>A diagrammatical representation of each slide</i> • <i>Details of each of the multimedia objects and their attributes</i> • <i>Details of navigation structure</i> <p><i>1 mark for each of two valid points, max 2 marks</i></p>	
		(ii)	Describe two reasons why FoneSmart may wish to create the presentation in <i>multimedia authoring</i> software rather than <i>presentation</i> software.	2 PS
			<ul style="list-style-type: none"> • <i>Greater control over the timing of events</i> • <i>Use of variables</i> • <i>Flexibility over user interface</i> • <i>May contain scripting language</i> • <i>Ability to control external devices</i> <p><i>1 mark each, max 2 marks</i></p>	
	(b)	The phone has a voice recording function. This allows the phone to record the user's voice using 8-bit mono sound at 22 kilohertz. The recording is then stored on a flash memory card.		
		(i)	Calculate the file size of a 30 second voice recording. Express your answer in appropriate units. Show all working.	3 PS
			<ul style="list-style-type: none"> • 30×22000 (1 mark) $\times 8 = 5280000$ bits (1 mark) • $5280000 / 8 = 660000$ bytes • $660000 / 1024 = 644.53125 = 644.5$ kilobytes (1 mark) 	

36	(b)	(ii)	Calculate how many of these 30 second voice recordings can be stored on a 512 Mb flash card? Show all working.	1 PS
			$(512 \times 1024) / 644.53125 = 813$ (or correct answer using figure from part (i)) (1 mark)	
		(iii)	One of the advantages of using a flash card in the phone, rather than optical or magnetic storage, is its portability. Describe one other advantage of using a flash memory card in the phone compared to optical or magnetic storage.	1 PS
			<ul style="list-style-type: none"> • Uses less power so can work from batteries • More robust as it has no moving parts <p>Any 1 of the above, 1 mark Note: Ease of transfer of data via card is an expression of portability</p>	
	(c)		Voice recordings may be stored using either <i>PCM</i> or <i>ADPCM</i> .	
		(i)	State one advantage of storing the recording using <i>ADPCM</i> compared to <i>PCM</i> .	1 KU
			<i>ADPCM has a smaller file size than PCM (1 mark)</i>	
		(ii)	Describe how <i>ADPCM</i> stores sound data.	1 KU
			<ul style="list-style-type: none"> • <i>ADPCM stores the differences between the samples (rather than the actual samples themselves)</i> • <i>Uses 4 bits to store the changes between samples rather than the 16 bits for each sample</i> <p>Any 1 of the above, 1 mark</p>	
	(d)		<p>FoneSmart have received complaints that some voice recordings are unclear. The waveform of one of these voice recordings is shown opposite.</p> <p>Explain why this voice recording is unclear.</p>	1 PS
			Voice recording has been clipped/highest & lowest frequencies removed (1 mark) (By recording at too loud a volume)	



36	(e)	Music files can be transferred to the phone by connecting the phone directly to a computer using either <i>Bluetooth</i> or <i>Firewire</i> .	
		(i) State one advantage of using ‘Bluetooth’ rather than ‘Firewire’ for transferring music files to the phone.	1 PS
		<i>No need to connect the phone with cables</i> <i>Other valid (1 mark)</i>	
		(ii) State one disadvantage of using ‘Bluetooth’ rather than ‘Firewire’ for transferring music files to the phone.	1 PS
		<ul style="list-style-type: none"> • <i>Slower data transfer rate</i> • <i>Less secure</i> • <i>Other valid</i> <p><i>(1 mark)</i></p>	
	(f)	Explain how this smart phone demonstrates <i>convergence of technology</i> .	1 PS
		<ul style="list-style-type: none"> • <i>Where there used to be separate devices for making phone calls and playing MP3 files, the smart phone combines both of these functions in the one device</i> • <i>Where there used to be separate devices for making phone calls and voice recordings, the smart phone combines both of these functions in the one device</i> <p><i>Answer <u>must</u> relate to the features described in the smart phone</i> <i>Any 1 of the above, 1 mark</i></p>	
	(g)	FoneSmart are designing a new smart phone that will use <i>holographic storage</i> . This phone will have a larger storage capacity and a faster data transfer rate than previous phones.	
		(i) Explain how holographic storage achieves a very high storage capacity .	1 KU
		<i>Information can be stored in layers (throughout the full depth of the medium) (1 mark)</i>	

36	(g)	(ii)	Explain how holographic storage achieves a very high data transfer rate .	1 KU
			<i>Information can be read a layer at a time (in Parallel) rather than as a sequence of bits (1 mark)</i>	
				(17)
				(50)
			<i>[END OF SECTION III – PART C]</i>	

[END OF MARKING INSTRUCTIONS]