

2006 Computing

Higher

Finalised Marking Instructions

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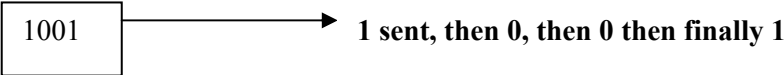
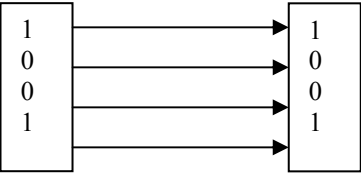
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SECTION I, Software Development and Computer Systems, 15 marks each. Total 30 marks.

1	The software development process aims to produce code that is <i>reliable</i> and <i>robust</i> . Describe what is meant by each of the terms “reliable” and “robust”.	2KU
	Reliable the ability to produce correct results from specified input OR not stopping due to design faults. Robust the ability to cope with unexpected data without crashing. 1 mark each	
2	<i>Pseudocode</i> is a text-based notation used at the design stage. Name and describe one <i>graphical design notation</i> . You may use a diagram as part of your answer.	2KU
	Flowchart OR Structure/Block diagram OR Semantic net OR JSP 1 mark for name and 1 mark for description (this description may include a diagram)	
3	During the <i>maintenance</i> stage of the software development process programmers will have to alter code.	
	(a) Which type of maintenance does not have to be paid for by the client? Explain your answer.	2PS
	Corrective (1 mark) Code is faulty because of errors introduced by the software development company (1 mark)	
	(b) Describe one characteristic of code that would make a program more maintainable.	1KU
	One answer from below. 1 mark : <ul style="list-style-type: none"> • descriptive variable/procedure names • effective use of whitespace (indentation and/or blank lines) • internal commentary • use of functions/subroutines/modules • any other valid 	

6	A <i>scripting language</i> is a type of high level language. Describe two characteristics of a scripting language not commonly found in a <i>procedural</i> language.	2KU
	Two answers from below. 1 mark each: <ul style="list-style-type: none"> • embedded within a GPP • allows customisation of the features or user interface of GPP • increase productivity of experienced user by automating series of operations • operations on data at a lower level are available to the programmer • allow a clear description of uses of scripts. 	
7	When storing a 32-bit <i>floating point</i> number, 24 bits are allocated to the mantissa and 8 to the exponent. What is the effect on the precision and the range of the numbers available if the allocation is changed to a 16-bit exponent and a 16-bit mantissa ?	2KU
	Decreasing the allocation to mantissa leads to decreased precision (it drops from 32 to 16 sig figures!). (1 mark) Increasing the allocation to the exponent leads to a greater range (doubling exponent squares the range). (1 mark)	
8	Write the number – 37 as an 8-bit binary number using two’s complement.	1PS
	11011011 (1 mark)	
9	State one way in which <i>cache memory</i> within the processor improves system performance.	1KU
	One of the following for 1 mark : <ul style="list-style-type: none"> • more data/instructions can be stored within the processor • less fetches from main memory are required • faster access than main memory. 	

10	Sophina buys a new laser printer. When printing a 200 page document, the computer makes use of <i>spooling</i> .		
	(a)	What does the term spooling mean?	2KU
		<ul style="list-style-type: none"> • The temporary storage of data (to be printed) on a backing storage • before being sent to a (slower) device • allow processor to get on with other tasks. 1 mark for each point	
	(b)	The printer has a <i>parallel interface</i> . Describe the difference in operation between a parallel and serial interface. You may use a diagram to illustrate your answer.	4KU
		<p>Serial – the bits are sent one after the other (1 mark) down a single wire (1 mark)</p> <div style="text-align: center;">  </div> <p>Parallel- a group of bits are sent along several parallel wires (1 mark) simultaneously (1 mark)</p> <div style="text-align: center;">  </div> <p>Note: A mark can be awarded for each clear diagram in lieu of a more detailed description.</p>	

11	A local council sets up an intranet within their headquarters. Internet access is made available through a Web server on the intranet. Apart from allowing shared Internet access, state two functions that the Web server is likely to provide the local council.	2KU
	Two answers from below. 1 mark each: <ul style="list-style-type: none"> • filtering out of unacceptable Web content • virus detection • blocking attempted access to intranet from Internet/Firewall • caching Web pages/storing intranet page. 	
12	A computer has a 24-bit data bus, 32-bit address bus and a 16 line control bus. Calculate the maximum amount of memory that can be addressed by this computer. Show all of your working and express your answer in appropriate units.	3KU
	<p>1 mark per bullet point</p> <ul style="list-style-type: none"> • Will have 2^{32} locations, • each of 24 bits (or 3 bytes) • Hence, has $2^{32} * 3 = 12$ Gigabytes <p>If bullet point 1 or 2 is wrong, but final answer is correct for numbers used, only penalise once ie 2 marks. If both bullet point 1 and 2 are wrong, but show multiplication and conversion, 1 mark.</p>	

SECTION II, Software Development and Computer Systems, 30 marks each. Total 60 marks.

13	<p>A program can analyse a document in order to calculate the reading level of the text. Part of this calculation involves counting the frequency of common words such as “the”, “a”, “is” etc. The subroutine CountStringOccurrences performs this task and it has four parameters described below.</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>word</td> <td>The string to be counted eg “the” or “a”</td> </tr> <tr> <td>document</td> <td>The string containing text to be searched</td> </tr> <tr> <td>found</td> <td>Set to true if word is present in document and false if it is not present</td> </tr> <tr> <td>occurrences</td> <td>The number of occurrences of word in document</td> </tr> </tbody> </table>		Parameter	Description	word	The string to be counted eg “the” or “a”	document	The string containing text to be searched	found	Set to true if word is present in document and false if it is not present	occurrences	The number of occurrences of word in document	
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	(a)	Which data type would be used for the parameter found ?	1PS										
		Boolean (1)											
	(b)	The parameters can either be passed by <i>value</i> or by <i>reference</i> .	4PS										
	(i)	Identify a parameter that is passed by value giving a reason for your choice.											
	(ii)	Identify a parameter that is passed by reference giving a reason for your choice.											
	(i)	“word” OR “document” – passed into subroutine but will not be changed and so do not need to be passed back out.											
	(ii)	“found” OR “occurrences” – these are passed into the subroutine and any changes must be passed back out.											

	(c)	A programmer suggests that the parameter found is not necessary in the subroutine.	
	(i)	Explain why the programmer is correct.	2PS
	(ii)	Explain why the programmer's suggestion would make the program more time efficient.	2PS
	(i)	If occurrences contained 0 (1) then the word would not have been present in string. (1)	
	(ii)	Processor does not need to spend time setting the value of a variable. Fetch/execute – the processor does not need to spend time fetching and executing an instruction. Any two valid points, 1 mark each.	
	(d)	The software team maintains a <i>module library</i> . Describe two advantages of using a module library over the creation of new code for each project.	2PS
		Faster development due to less design time, implementation time, testing time.	

14	<p>A university awards their students a grade of 1 to 4 for their performance in an examination. Two thousand students sit the examination. A program is to be written that will calculate the number of occurrences of each grade and will display this in a frequency table as shown below.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Grade</th> <th>Frequency</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>301</td> </tr> <tr> <td>2</td> <td>689</td> </tr> <tr> <td>3</td> <td>585</td> </tr> <tr> <td>4</td> <td>425</td> </tr> </tbody> </table> <p>The data items are: grades () : an array of 2000 integers occurrences () : an array of 4 integers</p> <p>The top level algorithm is:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">1. get grades</td> <td style="width: 50%;">out : grades ()</td> </tr> <tr> <td>2. count occurrences of each grade</td> <td>in : grades () in/out: occurrences ()</td> </tr> <tr> <td>3. display frequency table</td> <td>in : occurrences ()</td> </tr> </table>	Grade	Frequency	1	301	2	689	3	585	4	425	1. get grades	out : grades ()	2. count occurrences of each grade	in : grades () in/out: occurrences ()	3. display frequency table	in : occurrences ()	
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	(a) <i>Top-down</i> design methodology is being used. Describe how top-down design would be used during the design stage to solve the problem.	2KU
	The steps are broken down into smaller steps. (1 mark) Those steps are further refined until a complete description is achieved. (1 mark)	
	(b) Use <i>pseudocode</i> to design step 2 which counts the number of occurrences of each of the four grades.	5PS
	<pre> loop 2000 times case grade() of 1: increment occurrences(1) 2: increment occurrences(2) etc end case end loop loop 2000 times increment occurrences(grade(current)) end loop Candidates may provide us with many alternative whole and part solutions Use professional judgement as appropriate. for value = 1 to 4 for counter = 1 to 2000 if grade(counter) = value then increment occurrences (value) end if end loop end loop end loop </pre>	<p>1 mark for loop with end 1 mark for correct CASE clause with end 1 mark for subclauses of case correct 1 mark for use of array 1 mark for increment</p> <p>1 mark for loop with end 1 mark for increment 1 mark for correct use of each array 1 mark for use of grade() as index</p> <p>1 mark for checking of each of the 4 grades 1 mark for loop with end 1 mark for comparison with value 1 mark for increment</p> <p>1 mark for use of array</p>

	(c)	An <i>independent test group</i> is employed to test the program.	
	(i)	Describe what is meant by an “independent test group”.	1KU
	(ii)	Explain why the testing stage is documented.	2KU
	(i)	A testing group separate from the designers and programmers of the program. (1 mark)	
	(ii)	1 mark for each of any two of the following points: <ul style="list-style-type: none"> • having a complete description of the cases already tested informs the maintenance phase • helps to identify errors by analysing already tested components • identifies additional testing required by the addition of new code/integrative testing • helps provide proof of error correction • other valid. 	

15	A credit card company plans to introduce a new service for its customers. The customers will be able to manage their account using e-mail. Every transaction that takes place will be confirmed by an e-mail. Customers will be able to e-mail for common requests such as the balance of the account or to change their spending limit.		
	(a)	A <i>software specification</i> is produced and approved before the software development continues.	
	(i)	State two groups involved in producing the “software specification”.	2KU
	(ii)	Describe two purposes of the software specification.	2KU
	(i)	Any two of : development team, systems analyst, project leader and client. (1 mark each)	
	(ii)	A legal contract between client and developer. (1 mark) Validation of latter stages such as design, finished software. (1 mark) Detailed description of problem to be solved. (1 mark)	
	(b)	After completion of the design, the implementation stage will begin. The design is analysed to identify the <i>objects</i> and <i>operations</i> that are required.	
	(i)	One object that is identified is an e-mail attachment. State one operation that might be performed on it.	1PS
	(ii)	Describe one reason that the objects and operations are identified before implementation takes place.	2PS
	(i)	Open, delete, print, save, virus check, copy etc.	
	(ii)	The objects and operations will inform the choice of programming language (1) since different languages employ different data types (objects) and operations (control structures/functions/procedures). (1)	
	(c)	During the testing stage the software specification will be involved again. Explain how this document would be used at the testing stage.	
		Used to verify that the software is meeting the software specification. (1 mark) Any other appropriate answer.	

16	Ian purchases a new scanner. He scans photographs saving them as a <i>bitmapped</i> image.		
	(a)	Ian is aware that the quality of a <i>bitmapped</i> image depends upon its <i>bit depth</i> and <i>resolution</i> . What is meant by the terms:	2KU
		(i) bit depth;	
		(ii) resolution?	
		(i)	The number of bits used to store (the value of) each pixel. (1 mark)
		(ii)	The number of pixels in a given area OR The number of dots per inch. (1 mark) NOTE: must mention the idea of “area” or DPI for the mark.
	(b)	Ian scans a photograph. The image is 800 by 600 pixels and uses 65,536 colours. Calculate the file size of the scanned image. Show all working and express your answer in appropriate units.	4PS
		<ul style="list-style-type: none"> • No of pixels = $800 \times 600 = 480000$ (1 mark) • 65536 colours requires 16 bits per pixel (1 mark) • Storage = 480000×2 bytes (1 mark) (Accept 480000×16 bits = 7680000 bits) • 960000 bytes = 937.5 kilobytes (1 mark) 	
	(c)	The scanner connects to a computer via a USB interface. Two functions that an interface provides are <i>protocol conversion</i> and the handling of <i>status signals</i> . Describe both these functions.	2KU
		Protocol conversion – ensuring that protocols used by the peripheral can be understood by the computer it is attached to and vice versa. (1 mark)	
		Handling of status signals – ensuring that the peripheral and the computer are ready to communicate. (1 mark)	

17	A group of friends get together and set up a network of their computers in order to play some multi-player games.		
	(a)	They are unsure of which <i>topology</i> to use for the network. Give one benefit of using each of the following:	2PS
	(i)	a star topology;	
	(ii)	a bus topology.	
	(i)	<ul style="list-style-type: none"> • Server can control access / set the access rights of each user • Ease of expansion • Little effect on whole network if one “non-central” computer is taken away • High speed of data transmission • Centralised control of access to network 1 mark for any valid answer.	
	(ii)	<ul style="list-style-type: none"> • Simple cabling • No need for server (check validity of response) • Simple expansion • Inexpensive due to minimal cabling 1 mark for any valid answer.	
	(b)	The friends create a <i>client-server</i> network. State one advantage and one disadvantage of a <i>client-server</i> network compared to a <i>peer-to-peer</i> network.	2PS
		<p>Advantage (1 mark)</p> <ul style="list-style-type: none"> • Server can manage network – access rights can be set • Offers a more secure network • Administration carried out in one central location • Centralised back-up <p>Disadvantage (1 mark)</p> <ul style="list-style-type: none"> • Server has to be able to cope with the network requests (must be “powerful enough”) • Expense of central server • If server goes down then access to software/files/hardware available through the server become unavailable 	

	(c)	One of the friends begins to copy the game from the server to his own hard drive.	
	(i)	<i>What piece of legislation covers this activity?</i>	1KU
	(ii)	<i>Describe a situation where the copying of a piece of software from one computer to another would be legal.</i>	1PS
	(i)	Copyright, Designs and Patents Act (1 mark)	
	(ii)	<ul style="list-style-type: none"> • software was freeware • software was being purchased via the Web eg QuickTime Pro • software was previously purchased, was lost/damaged and was being replaced under licence • owner of the other computer owned the copyright to/wrote the software • licence allows multiple copies (more than currently installed) • any valid (1 mark) 	
	(d)	Two of the friends own computers with 3GHz processors. Name and describe one measure of computer performance the friends may use to determine whose computer offers better performance.	2KU
		<ul style="list-style-type: none"> • MIPS – millions of instructions carried out per second • FLOPS – floating point operations carried out per second • Application based tests (accept benchmarking) – carry out identical tasks and compare execution times 1 mark for name and 1 mark for description	
	(e)	State one way in which the friends can enhance their computers in order to further increase the gaming performance of the computer.	1PS
		<ul style="list-style-type: none"> • Install additional hardware such as a more powerful processor/graphics card/motherboard • Install more/faster RAM • Other answers relating to computer performance may be possible <p>Answers such as “adding a joystick/game controller” are not acceptable. Do not accept “increase cache”</p>	

18	Debbie buys a new computer. She intends to use the computer for Internet access. However, she is unhappy with the Web browser that came with the computer and would like to download a new one from the Internet.	
	(a) State two compatibility issues that Debbie will need to consider before installing a new browser.	2PS
	<p>1 mark for each of two of the following:</p> <ul style="list-style-type: none"> • computer/processor type • operating system • minimum RAM • minimum processor speed • minimum hard disk space • peripherals required. 	
	(b) Debbie downloads a new browser. Accompanying the software are two forms of electronic documentation. Name and describe the purpose of one of these pieces of documentation.	2PS
	<p>User guide – describes the main features of the package OR contains tutorials on how to use the package describes how to install the software</p> <p>Technical guide – describes how to install the software OR outlines the system requirements of the software outlines the version history/details corrective maintenance</p> <p>Licence document/Readme file/Installation Guide/Tutorial Guide – with acceptable explanation.</p> <p>1 mark for name and 1 mark for purpose</p>	

	(c)	Several days after installing the browser, Debbie is asked if she wishes to download an updated version of the browser.	
	(i)	The updated version contains new features. What type of maintenance was carried out to provide these new features?	1PS
	(ii)	When upgrading the browser software, what benefit would a modular approach to programming provide the software development team?	1PS
	(i)	Perfective. (1 mark)	
	(ii)	<p>1 mark for any of the following:</p> <ul style="list-style-type: none"> no need to redesign the entire program, only the additional/amended modules no need to write an entirely new program, only need to modify selected modules of the code other valid. 	
	(d)	Debbie installs the latest anti-virus software to help prevent the computer from becoming infected. Name and describe one anti-virus software detection technique.	2KU
		<p>Checksum – a checksum of system’s key files is recorded. When file is run, checksum is re-calculated. Any anomaly between checksums is reported</p> <p>Signature – checks for known signature (bit patterns) of viruses</p> <p>Heuristic – use knowledge of characteristics of previous viruses to detect future viruses</p> <p>Memory resident monitoring – software is always resident in memory, checking for possible infection.</p> <p>1 mark for name and 1 mark for description</p>	
	(e)	Whilst using the Internet the computer becomes infected with a virus. Describe two ways in which this virus may have escaped detection by Debbie’s anti-virus software.	2PS
		<p>1 mark for each of two of the following:</p> <ul style="list-style-type: none"> by taking on the characteristics that the software has been programmed to ignore by generating dummy code and inserting it in between actual sections of virus code (camouflage) by changing the order of lines of code in the virus file to confuse the signature check virus is very new and is not recognised by software – software is not up to date any other valid. 	

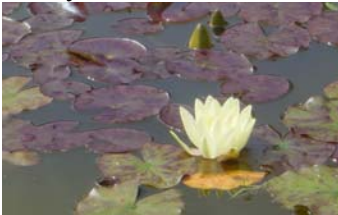
19	Hamish would like to purchase a new portable MP3 player so he can listen to music whilst jogging. He knows that some MP3 players make use of solid state storage, whilst others use a hard disk to store music.	
	(a) Hamish decides to purchase an MP3 player that makes use of solid-state storage. Apart from size and cost, give two advantages to Hamish in choosing this type of portable MP3 player rather than a player than uses a hard disk.	2PS
	Any two of the following for 1 mark each: <ul style="list-style-type: none"> • will not skip whilst he is jogging • use less power/increased playback time • faster access time • any other valid (not “lighter” as size is excluded in the stem). 	
	(b) Hamish transfers songs from his computer to the portable MP3 player. Two functions of the operating system that are involved when transferring the files are: <ul style="list-style-type: none"> • file management and • input/output functions. Describe a task that each of these functions would perform in this situation.	2PS
	File management – used to navigate to the files to transfer OR to organise files on storage device. I/O – taking in instructions from input device/sending files to storage device. 1 mark for a valid description of each task	

SECTION III – Part A – Artificial Intelligence

20	An annual competition, based on the Turing Test, is held to find the best example of current <i>artificial intelligence</i> .		
	(a)	Define what is meant by “artificial intelligence”.	1KU
		<ul style="list-style-type: none"> • need ‘computer carrying out task’ with link to human intelligence – requires intelligence if carried out by a human • ability to carry out task normally carried out by a human • any other valid. <p>Also accept reference to at least 2 characteristics of AI eg ability to learn/adapt to new situations/communicate etc.</p>	
	(b)	Modern versions of Eliza are occasionally entered for the competition.	
	(i)	Explain why a program such as Eliza might not pass the Turing Test.	2PS
	(ii)	State one reason why the Turing Test is not a good test for many modern artificial intelligence applications.	1PS
	(i)	<p>1 mark for 1 feature of Eliza and 1 mark for why Eliza fails the test eg:</p> <ul style="list-style-type: none"> • simple logic of Eliza • can be easily over-ridden by (knowledgeable) tester • no recall of the build-up in the history of the consultation • repetition • identifies key words • may not be in context/has generic response • any other valid feature with reason for failing. <p>Note: it is not enough to just describe the features of Eliza or say how it works for 2 marks; it must relate to the Turing Test</p>	
	(ii)	<p>1 mark for one of:</p> <ul style="list-style-type: none"> • many areas of AI but Turing Test is really aimed at Natural Language Processing/text based systems • depends on the interrogator’s intelligence • any other valid point. 	

	(c)	Some people believe that we might never achieve Artificial Intelligence. Do you agree with this point of view? Justify your answer.	1PS
		<p>Yes: Any supposed AI has to come from a program written by a human and so there is no originality in response.</p> <p>No: Computers can already exhibit many aspects of intelligence eg vision systems, expert systems. These systems will advance in the future and AI will be achieved.</p> <p>(1 mark for justification, no marks for YES/NO)</p>	

21	The progress of applications in artificial intelligence is partly dependent on the development of faster processors.		
	(a)	Explain how improvements in the following technology have supported artificial intelligence:	
	(i)	processor speed;	2
	(ii)	memory capacity.	2
	(i)	AI problems involve vast amounts of data processing (1 mark) which can now be completed in ' reasonable ' time. (1 mark)	
	(ii)	Processing large data sets (1 mark) need large amounts of RAM to hold the data and to provide a store for the working calculations. (1 mark) (No marks for answers referring to backing storage)	
	(b)	Many of these AI applications will be written in a <i>declarative language</i> and run on computers with <i>parallel processors</i> .	
	(i)	State one feature of a "declarative language" that is not found in procedural languages.	1
	(ii)	Explain why declarative languages are ideally suited to be run on a parallel processing system.	2
	(i)	Any one from: <ul style="list-style-type: none"> • declarative : describes the problem by facts and rules • allows pattern matching (accept goal driven) • knowledge and search method are separated • any other valid. 	
	(ii)	Clauses tested independently, (1 mark) evaluate more than one search path at once. (1 mark)	

22	<p>An Artificial Intelligence system is trying to identify plants from pictures of flowers presented to it. This is one of the images it is given to test the system.</p> 	
	<p>(a) Two stages in computer vision are <i>object recognition</i> and <i>image understanding</i>. Describe these stages, using the above image to illustrate your answer.</p>	<p>2KU 2PS</p>
	<p>Object recognition :</p> <ul style="list-style-type: none"> • using pattern matching to compare identified objects with known objects (1 KU mark) • identifying component parts (leaves OR the flower petals OR areas of water). (1 PS mark) <p>Image understanding :</p> <ul style="list-style-type: none"> • relating identified objects to each other (1 KU mark) • eg several leaves and flower floating on (water) surface. (1 PS mark) 	
	<p>(b) Give two reasons, other than colour of the flower, why the artificial intelligence system might have difficulty recognising a flower.</p>	<p>2PS</p>
	<ul style="list-style-type: none"> • angle of photograph may give flower a different representation • flower may be damaged • not all parts of the flower are visible • shadow on image makes comparison difficult • flower may be in a different stage of opening • flower may not be in the knowledge base <p>1 mark for each of 2 reasons DO NOT accept 'poor quality of image'.</p>	

	<p>(c) The plant identification software uses an artificial neural system.</p> <p>Links, weights and layers are components of an artificial neural system.</p> <p>Describe the parts played by each of these components in the learning process of the neural net.</p>	3KU
	<ul style="list-style-type: none"> • links: connect artificial neurons (1 mark) • weights: applied to each link and adjusted to produce a correct output for a given input (1 mark) • layers: several interconnected perceptrons (simple neural network)/output of one layer adjusted until correct and then fed into another layer to solve more complex problems. (1 mark) 	

	(c)	Line 8 demonstrates a <i>recursive</i> rule.	
	(i)	Describe what recursive means in this context	1KU 1PS
	(ii)	<p>By considering the query ? blowhole(toothed_whale, 1). explain why the following order of statements after the original lines 1 to 5 would not work</p> <p>6 blowhole(X, Y) if blowhole(Z, Y) and is_a (X, Z) 7 blowhole(toothed_whale, 1). 8 blowhole(baleen_whale, 2).</p> <p>1 mark for each of the following bullet points:</p> <ul style="list-style-type: none"> • explanation that the order of rules causes a problem award (termination/stopping clause has to come first) (1 mark) • the recursive call of blowhole() will cause a non-terminating loop (1 mark) 	2PS
	(i)	<ul style="list-style-type: none"> • the definition of the rule involves the rule itself (1 mark) • to evaluate whether X has Y blowholes, the rule needs to evaluate whether Z has Y blowholes, having established that X is a type of Z (1 mark) 	
	(ii)	<ul style="list-style-type: none"> • If the candidate answers that the order would work and gives some justification (rule order does not prevent match in this case) then award 1 mark for the YES and 1 mark for the justification • If the candidate reads the question as it was originally intended and explains that the order of rules causes a problem award 1 mark for a statement about the termination/stopping clause having to come first. The second mark is for the idea that the recursive call of blowhole() will cause a non-terminating loop. <p>No marks are to be awarded where the candidate has made no attempt to answer.</p>	

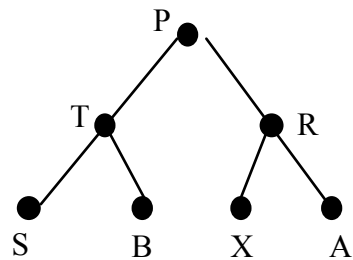
	<p>(d) Explain how the query: not (is_a (beaked_whale, baleen_whale)). would be evaluated.</p>	2PS
	<p>is_a (beaked_whale, baleen_whale) evaluated and found to be FALSE (no matches) (1 mark) not(is_a(beaked_whale, baleen_whale)) evaluated as not (FALSE) so answer TRUE (yes) is returned (1mark)</p>	

24	Dr Connolly, a dietician, is involved with the development of an expert system to give advice on healthy eating.		
	(a)	State two limitations of an expert system.	2KU
		Any two from below for 1 mark each: <ul style="list-style-type: none"> • ES readily becomes out of date • ES cannot make a common sense decision (in exceptional circumstances) • data is only good as long as it is accurate/complete • errors can be made by domain experts • different experts can disagree • misunderstandings can arise between domain expert and knowledge engineer • narrow or limited domain. 	
	(b)	The <i>knowledge base</i> and the <i>inference engine</i> are two parts of an expert system. State the purpose of each of these components.	2KU
		knowledge base : contains the specialised knowledge/facts and rules to be used by the system. (1 mark) inference engine : determines which questions to put to the user and in which order OR matches users answers with the knowledge in the knowledge base. (1 mark)	
	(c)	The user interface of Dr Connolly’s expert system will have <i>justification facilities</i> .	
	(i)	Explain what “justification facilities” are.	2KU
	(ii)	Identify two benefits that the inclusion of justification facilities will bring to the expert system.	2PS
	(i)	System is able to explain the reasoning behind : why it is asking a particular question (1 mark) how it arrived at its conclusion. (1 mark)	
	(ii)	<ul style="list-style-type: none"> • allows user to follow reasoning and so can judge whether to take advice/answer question (1 mark) • allows checking of logic leading to advice given for test data (1 mark) 	

	(d)	Give two reasons why the development team have chosen to use an expert system shell for their expert system, rather than using a high level language.	2PS
		<ul style="list-style-type: none"> • will cut down development time since no need to plan/code/test inference engine and user interface (1 mark) • since the shell is independent of knowledge base it is versatile/can be used for different domains (1 mark) • accept any other valid 	

	(e)	When searching a knowledge base, <i>depth-first</i> or <i>breadth-first</i> searches may be used.	
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	(i)	By using the diagram below	
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give the order of nodes visited in:

		A	a depth-first search;	1KU
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		B	a breadth-first search.	1KU
--	--	---	-------------------------	------------

	(ii)	Explain the difference between the memory requirements for these two types of searches.	3PS
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	(i)	A	PTSBRXA (accept the path with repeated nodes, PTSTBTPRXRA)	
--	------------	---	--	--

		B	PTRSBXA	
--	--	---	---------	--

		<p>(ii) depth first : stores current path only, once a path is redundant, it is removed from memory (1 mark) {for the above tree the maximum memory required is to store three nodes} breadth first : has to store all paths up to current depth (1 mark) {for the above tree, the maximum memory required to store the tree is for seven nodes} breadth first needs more memory than depth first. {This is particularly true as the tree get larger due to the depth or the degree of branching.} (1 mark)</p>	
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SECTION III – Part B – Computer Networking

25	A firm of accountants has recently installed a local area network in each regional office. A project manager appointed a systems analyst at the initial stage of the project.		
	(a)	Describe one other role of the project manager in this project.	1KU
		Project manager will (for 1 mark): <ul style="list-style-type: none"> • keep the project running to the agreed timescale • check the progress of the individual sections and oversee the project • report to the clients on the progress/major events in the project • other valid. 	
	(b)	The company decides to use wireless technology in each LAN. State one piece of hardware required to connect a computer to a wireless network.	1KU
		wireless network interface card/WNIC/Wireless NIC OR wireless hub (1 mark) (Do not accept Bluetooth Card, wireless network card)	
	(c)	(i) The network can operate using either <i>circuit switching</i> or <i>packet switching</i> . Describe “circuit switching”.	2KU
		(ii) Describe “packet switching”.	3KU
		(iii) <i>Packet switching</i> has been recommended for each network. Explain why this recommendation has been made.	1PS
		(i) Circuit switching (1 mark per bullet) <ul style="list-style-type: none"> • direct connection between two networks (for duration of transmission). • all data follows the same physical path. 	
		(ii) Packet switching (1 mark per bullet) <ul style="list-style-type: none"> • data broken into individually addressed packets. • each packet takes a different route around the network (using the destination address). • reassembled into whole message at destination (using packet sequence number). 	
		(iii) Packet switching allows network hardware to decide on most efficient/fastest/cheapest route.	

	(d)	The network software makes use of TCP/IP protocols to transmit each file across the network.	
	(i)	Describe the function of the <i>TCP</i> component of this protocol.	2PS
	(ii)	Describe the function of the <i>IP</i> component of this protocol.	1PS
	(i)	TCP splits data into packets (and adds header to each one) – 1 mark ensures packets are delivered/reordered in same order as they were sent. – 1 mark	
	(ii)	IP adds its own header to allow the packet to be routed around the network – 1 mark	
	(e)	Disaster avoidance strategies have been built in to the system. State two network disaster avoidance strategies.	2PS
		Any two of the following for 1 mark each: <ul style="list-style-type: none"> • use of anti-virus software • use of uninterrupted power supply • use of fault tolerant components eg RAIDS/Mirror Disks • regular maintenance • disk monitoring. (do not accept back-up as this is a disaster recovery strategy)	
	(f)	A 4 megabyte file is transferred across the network in 2 seconds. What is the transfer rate? Give your answer in megabits per second.	2PS
		Rate = Size/time Size = 4 x 8 = 32 Megabits (1 mark) Rate = 32/2 = 16 Mbps (1 mark) No credit is to be given for dividing 4 by 2 and getting 2 Mb/s	

	(g)	One possible method of data transfer is <i>asynchronous</i> data transfer.								
	(i)	Describe “asynchronous” data transfer.	2KU							
	(ii)	One problem with “asynchronous” data transfer is that it doesn’t include error checking. Describe one other problem.	1PS							
	(iii)	How would this problem be overcome using <i>synchronous</i> data transfer?	1PS							
	(i)	Each data block is sent individually (1 mark) with accompanying start and stop bits (1 mark) OR sender transmits addressed blocks as each is ready (1 mark) receiver will reorder blocks to reform data. (1 mark)								
	(ii)	Proportion of actual data in message is lower (due to start/stop bits, addressing info, etc). (1 mark)								
	(iii)	Only need start and stop frame at beginning and end of whole message rather than for each block. (1 mark)								
	(h)	<p>An incomplete diagram of the OSI model is shown below: –</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td><i>Application layer</i></td></tr> <tr><td><i>Presentation layer</i></td></tr> <tr><td><i>? layer</i></td></tr> <tr><td><i>Transport layer</i></td></tr> <tr><td><i>Network layer</i></td></tr> <tr><td><i>? layer</i></td></tr> <tr><td><i>Physical layer</i></td></tr> </table> <p>Name the two missing layers of this model.</p>	<i>Application layer</i>	<i>Presentation layer</i>	<i>? layer</i>	<i>Transport layer</i>	<i>Network layer</i>	<i>? layer</i>	<i>Physical layer</i>	2KU
<i>Application layer</i>										
<i>Presentation layer</i>										
<i>? layer</i>										
<i>Transport layer</i>										
<i>Network layer</i>										
<i>? layer</i>										
<i>Physical layer</i>										
		Session layer AND Data layer. (1 mark each)								

26	The Brady family make use of three networked computers to access the Internet.		
	(a)	Mr and Mrs Brady are concerned about their son Patrick's Internet usage. Describe two concerns they may have.	2PS
		Any two of the following for 1 mark each: <ul style="list-style-type: none"> • Patrick may access unsuitable material/pornography/extremist material or opinions • cost of Internet access – phone bill • excessive use of chat rooms/instant messaging (not MSN) • grooming/exposure to paedophiles • withdrawing from society • playing games rather than working • any other suitable. 	
	(b)	(i) Suggest a suitable transmission medium they could use to connect the computers in their network.	1KU
		(ii) Give one reason why you have recommended this medium.	1PS
		(i) 1 mark for twisted pair or wireless (or any other suitable eg Cat5, co-axial, fibre optic)	
		(ii) 1 mark for a valid reason for medium suggested in (i) <ul style="list-style-type: none"> • twisted pair/Cat5/UTP because it is cheap and relatively fast. • wireless because it is easy to install etc, no physical cable • co-axial already present in house • fibre optic no interference, secure 	
	(c)	(i) Mr Brady sets up an e-mail account. Name a protocol used by the e-mail server.	1PS
		(ii) At what layer of the <i>OSI</i> model does this protocol operate?	1PS
		(i) SMTP, POP-3 or POP	
		(ii) Both of these operate at the application layer If candidate answers (incorrectly) FTP/HTTP for part (i) then accept the correct layer for part (ii) – also application layer.	

27	Susan is building a Web site about her local football team and she wants to include photographs of the players.		
	(a)	Susan uploads the photographs to her Web page. Name and describe a suitable data format for representing the photographs.	2PS
		JPEG (1 mark), lossy compressed bitmapped format that uses true (24 bit) colour. (1 mark) PNG (1 mark) is a lossless compressed format that uses 8 bit colour (1 mark) Do not accept a <i>general</i> answer about GIF as the question specifies photographs. Credit may be given if GIF is suggested as a means of cutting download times or storing thumbnails.	
	(b)	Susan is keen to learn HTML and reads about the importance of <i>tags</i> such as the <i>header tag</i> and <i>title tag</i> .	
	(i)	Describe the purpose of <i>tags</i> in HTML code.	1KU
	(ii)	Name two other <i>tags</i> used in HTML.	2KU
	(i)	Allows browser to interpret how author wants text to appear OR tells browser how to deal with the text. (1 mark)	
	(ii)	Meta tag, body, font size, alignment, (1 mark for each of two)	
	(c)	She types the following piece of HTML code: <title>Susan <h1>Welcome to My Website</h1>	
	(i)	Describe one error with the above piece of code	1PS
	(ii)	Alter the second line of the code shown above so that the text “Welcome to My Website” will appear in bold.	1PS
	(i)	Title tag hasn’t been closed – 1 mark OR HTML tag is missing – 1 mark Do not accept “Screen appears blank” as this is a consequence of the error, not the error itself	
	(ii)	<H1>Welcome to My Website</H1> (do not accept <bold>, </bold> – does not work) OR <H1>Welcome to My Website</H1> (1 mark for the correct inclusion of open and close tags for bold)	

	(d)	Susan uses a search engine to find information on former players. The search engine uses <i>spiders</i> . Describe how a search engine uses a spider .	2KU
		Spider will collect data from Web pages (1 mark) and add to an index which can be accessed by the search engine (1 mark)	
	(e)	Susan uploads her completed Web page to her Internet Service Provider. The URL is shown below: – www.my-team.com .	
	(i)	Name the protocol that will upload her files to her ISP.	1KU
	(ii)	Susan’s friend types www.my-team.com into the address bar and presses return to load the Web site. Describe how the <i>domain name server</i> deals with this request.	2PS
	(i)	FTP	
	(ii)	The domain name server will translate/map (the url – www.myteam.com) (1 mark) into an IP address (1 mark)	

28	An on-line travel agent’s server has been subjected to a <i>denial of service</i> attack.		
	(a)	Name and describe one possible “denial of service” attack.	2PS
		Resource starvation (1 mark) Attack takes over bandwidth and so deny users access. (1 mark) DNS attack (1 mark) DNS queries contain a false IP address of target server. (1 mark) Exploit software flaws (1 mark) Take advantage of bugs in software thus causing it to crash. (1 mark) Exploit network management flaws (1 mark) Reach default usernames and passwords and bring server down. (1 mark)	

	(b)	What are two financial implications for the travel agent as a result of this attack?	2PS
		<ul style="list-style-type: none"> • system will be down therefore no bookings (1 mark) • cost of identifying and fixing the attack (1 mark) • any other valid. 	
	(c)	All the computers in the travel agent's head office are fitted with an Ethernet card. Each card has its own <i>MAC address</i> . State the function of the MAC address.	1KU
		Uniquely identify the device/NIC (1 mark)	
	(d)	Some customers are concerned about submitting their credit card details on-line to pay for a holiday. Describe one method the company can use to overcome on-line fraud.	2PS
		Encryption (1 mark), details are converted into code and encryption key is needed to read details. (1 mark) Use a secure payment method/ protocol/Web site (1 mark), such as HTTPS/SSL secure socket layer. (1 mark) Do not accept 'paypal' on its own.	
	(e)	Two office employees, Roma and Sanjana, are testing new video conferencing software. The IP address of Roma's computer is 168.212.226.204	
	(i)	Is the IP address of Roma's computer Class A, Class B, Class C or Class D? Justify your answer.	2PS
	(ii)	Roma enters 169.212.256.204.0 as the IP address for Sanjana's computer. State two reasons why this IP address is invalid.	2PS
	(i)	Class B (1 mark) as the decimal number of first octet is between 128 and 191 (1 mark)	
	(ii)	Any 2 of the following required for 1 mark each: <ul style="list-style-type: none"> • identifying 169 is a different network • identifying the address has 5 not 4 octets • identifying third octet is greater than 255 • zero not a valid number. 	

SECTION III – Part C – Multimedia Technology

29	A multimedia application has been developed for use in Scottish schools.		
	(a)	The application was created using authoring software. Describe the purpose of authoring software.	2KU
		Used to create interactive applications (1 mark) which incorporate multimedia elements (1 mark) eg a game, website, training, museum information etc.	
	(b)	During the design stage of the application state two items that were designed other than the page layouts.	2PS
		<ul style="list-style-type: none"> • linking/structure of pages • hardware, software, media elements used • background picture/colour • HCI. (1 mark per item, any two)	
	(c)	It is discovered that the USA flag has been used instead of the Scottish flag in the application. A teacher navigates to the folder, but is unable to replace the image of the flag. Suggest a reason for this.	2PS
		<ul style="list-style-type: none"> • data is embedded in the file (1 mark), therefore there is not a discrete file to delete/change (1 mark) • no access privileges (1 mark), preventing the user from editing individual images (1 mark) • do not have authoring software (1 mark), therefore cannot edit the application (1 mark) (any of the above)	
	(d)	Explain the purpose of a <i>codec</i> in a multimedia data file.	2KU
		<ul style="list-style-type: none"> • part of a file which contains the method needed to decode that specific data file for an application (1 mark) • reduce the size of a file by compressing and decompressing the data. (1 mark) NOTE – code and decode the data (max of 1 mark , answer incorrect in this context)	

30	(a)	Winnie creates a Web site for her gardening business. The multimedia application she uses provides both a WYSIWYG editor and a simple text editor.	
	(i)	Describe one advantage of a WYSIWYG editor over a simple text editor.	1KU
	(ii)	Describe one advantage of a text editor over a WYSIWYG editor.	1KU
	(i)	<ul style="list-style-type: none"> • allows easier editing of formatting or multimedia elements (1 mark) • can see results on screen as it is created/amended. (1 mark) 	
	(ii)	<ul style="list-style-type: none"> • Software is simple so does not require powerful hardware to run. (1 mark) 	
	(b)	Winnie uses a digital camera to take a photograph of a flower in her garden. Describe in technical detail how the digital camera captures the still graphic data. Your answer need not take colour into account.	3KU
		<ul style="list-style-type: none"> • 2D / rectangular array of CCD sensors to capture the image (1 mark) • sensors each capturing the data for a single pixel (roughly) (1 mark) • the more CCDs the higher the resolution of the image (1 mark) • an ADC is used to convert the signal to digital(1 mark) • store digital value of each CCD. (1 mark) <p>Max of 3 marks for any 3 of above points Sensors on own – no marks</p>	

	(c)	Winnie draws the leaf shown and stores it as a bitmapped image.	
	(i)	Name a compression method you would recommend as suitable for this image. (<i>clip art of maple leaf on exam paper</i>)	1PS
	(ii)	Describe how this compression method works.	2KU
	(i)	RLE (Run Length Encoding) OR LZW (1 mark) NOTE: PNG, JPEG are not methods, but file types	
	(ii)	RLE (Run Length Encoding): <ul style="list-style-type: none"> • this compression method works by using 2 numbers for each block of colour (1 mark) • number of pixels in the block and the colour that is repeated. (1 mark) LZW: <ul style="list-style-type: none"> • commonly repeating patterns are stored as a block (1 mark) • uses a dictionary/table to store a code for a colour rather than the actual colour data. (1 mark) 	
	(d)	Winnie uses still images to create an animation. The animation is slow to run. She is advised that a special piece of hardware would solve this problem.	
	(i)	Name this piece of hardware.	1PS
	(ii)	Explain how this piece of hardware would improve the performance of the computer	2PS
	(i)	graphics card (1 mark) or video card	
	(ii)	<ul style="list-style-type: none"> • video card has a GPU (graphics processing unit) (1 mark) • which can generate images faster and of better quality than the processor (1 mark) • GPU would free up the processor from some of the load. (1 mark) <p>Any 2 points above for 1 mark each</p>	

	(e)	On one of the Web pages Winnie is going to include a photograph of her own garden. The image has a resolution of 640 x 800 pixels. The size of the file is 500 kilobytes.	
	(i)	The file is stored in GIF format. How many colours does GIF allow?	1KU
	(ii)	If the resolution of the image is doubled, what effect will this have on the file size? Explain your answer.	2PS
	(i)	256 colours (1 mark)	
	(ii)	File size x 4. Accept the actual file size – 2000Kb or 1.95 Mb (1 mark) Resolution is a linear measure. Four times the pixels in given area. (1 mark)	
31	(a)	(i) <i>A recent development in communications technology is Bluetooth. Explain the term “Bluetooth”.</i>	1KU
		(ii) <i>WiFi is another transmission method. Describe two advantages of WiFi over Bluetooth.</i>	2PS
	(i)	<ul style="list-style-type: none"> • wireless technology enabling computers and other devices to communicate (1 mark) • use of radio waves to allow communication between computers and devices. (1 mark) 	
	(ii)	<ul style="list-style-type: none"> • higher bandwidth of data transmission (1 mark) • greater range. (1 mark) 	

	(b)	A mobile phone is an example of the <i>convergence</i> of multimedia technologies	
	(i)	Explain what is meant by the “convergence” of multimedia technologies.	1KU
	(ii)	Choose an example of the convergence of multimedia technology, other than a mobile phone and describe it.	2PS
	(i)	Several functions from a single unit. (1 mark)	
	(ii)	<p>Do not accept multimedia equipment eg monitor, camera etc Do not accept devices designed for multifunction eg laptop, computer</p> <ul style="list-style-type: none"> • games console – gaming, browsing, watching movies (2 marks) • PDA • digital TV – TV, Internet access, e-mail (2 marks) • fridge, TV etc must make explicit alternative function eg e-mail etc • MPS – play/view media files and alternative function eg storage device – pictures/files, games/browse. (2 marks) <p>Award 1 for an answer where functions are similar eg reading different file types (play music, play movies)</p>	
	(c)	<i>Surround sound</i> has recently become popular in cinema and home entertainment systems. State two advantages of “surround sound” over stereo sound.	2PS
		<ul style="list-style-type: none"> • make the film more immersive/life-like (1 mark) • allow for the audio positioning of more objects within a movie. (1 mark) <p>1 mark for either point</p>	

32	Brian wishes to transfer analogue data from a video tape onto computer. His computer has a video capture card.		
	(a)	State the role of the ADC and DSP on a video capture card.	2KU
		ADC: converts the analogue signal to a digital signal. (1 mark) DSP: processes the signal to remove noise/distortion/allows the addition of effects. (1 mark) Not just “processes the digital signal”. Also surround sound is not an effect.	
	(b)	The video is captured at 12 frames per second with 2 million pixels in 24-bit colour and lasts for 5 minutes. Calculate the storage capacity required to store the video. Give your answer in appropriate units (Ignore sound and compression in your calculation.)	3PS
		=24 bits x 12 fps x 2000000 pixels (1 mark) x 300 secs (1 mark) / 8 / 1024 / 1024 / 1024 = 20.11 Gb (1 mark)	
	(c)	(i) The finished video is saved as an MPEG file. Explain why.	1PS
		(ii) Describe how MPEG compresses data.	2KU
		(i) Large file size, needs to be compressed (1 mark)	
		(ii) <ul style="list-style-type: none"> • not all frames are stored • a few key frames, I-frames • frames are stored as JPEGS • data is stored only what has changed between I-frames. <p>any 2 points for 2 marks</p>	

33	(a)	Dicken has to create an advertising image for a new radio show called “Big Sister”. The creator likes the idea of an ear as the logo. The logo can be created using vector or bit-mapped graphics.	
	(i)	State two reasons for using vector graphics to create this logo.	2PS
	(ii)	State one reason for using bitmapped graphics to create this logo.	1PS
	(i)	<ul style="list-style-type: none"> • draw the image of an ear and have small file size • can be scaled for different types of advert without losing original quality • can edit individual objects without affecting rest of image. 1 mark for each point, up to 2 marks	
	(ii)	<ul style="list-style-type: none"> • can edit individual pixels • apply special effects eg blur. 1 mark for each point, up to 2 marks	
	(b)	A commercial has been recorded to promote the show. After the voice-over was recorded it was edited to make the sound louder. When played back, the sound was louder but had become distorted. Give two reasons why this may have happened.	2PS
		<ul style="list-style-type: none"> • clipping has occurred OR volume has increased beyond the dynamic range of the file • white noise (background). 1 mark for each point, up to 2 marks	
	(c)	The commercial is an uncompressed, 30 second stereo file, sampled at 40KHz and in 16-bit sound. Calculate the file size for the commercial. Give your answer in appropriate units.	3PS
		= 2 (1 mark) x 40000 x 30 x 16 bits (1 mark) = 38400000 / 8 = 4800000 bytes = 4.58 Mb (1 mark)	

	(d)	The advertising jingle for Big Sister is stored as a MIDI file. A MIDI file contains the attributes required to reproduce a sound. Attributes may include the instrument type and volume.	
	(i)	Name two other attributes that may be stored.	2KU
	(ii)	A frequent criticism of MIDI music is that it is not as realistic as digitised sounds. State two reasons why MIDI music is used despite this criticism.	2PS
	(i)	<ul style="list-style-type: none"> • pitch/frequency/tone of note • channel • tempo • duration/sustain (not length) • other valid. <p>1 mark for each point, up to 2 marks</p> <p>Do not accept: start of note, end of a note, control messages, effects on note eg reverb and distortion, expression and portamento</p>	
	(ii)	<ul style="list-style-type: none"> • small file size • no background noise • all individual notes/instruments can be edited/have affects applied. <p>1 mark for each point, up to 2 marks</p>	

[END OF MARKING INSTRUCTIONS]