

**2003 Computing**

**Higher**

**Finalised Marking Instructions**

Section I

<b>1.</b>	Describe <b>three</b> different types of software maintenance.		3
	<p><b>Corrective</b> - to correct errors which were not detected during testing.  <b>Perfective</b> - to add new features (functions) to the software.  <b>Adaptive</b> - to update the software to enable it to work in a new environment e.g. new OS.</p> <p><u>No marks for names only</u></p>	<b>3x1 Marks</b>	<b>3 Marks</b>

<b>2.</b>	<p>During the implementation stage in any software development project the target is to deliver code which is <u>correct</u> and <u>reliable</u>.</p> <p>Explain <b>both</b> of the underlined terms.</p> <p><b>correct</b> - meets the requirement's specification (or fit for purpose)</p> <p><b>reliable</b> - how well the software operates without stopping due to design and coding faults  or expected results at all times</p>		2
		<b>2x1 Marks</b>	<b>2 Marks</b>

3.	When producing software it is very important to have good design and clear documentation.		3
	<p>(a) (i) Name <b>two</b> methods of representing program design.  (ii) Give <b>one</b> advantage of <b>each</b> method.</p> <p>(i) <b>structure chart, pseudocode, flowchart or any other known method</b>  - <b>1 mark for two methods (No half marks)</b></p> <p>(ii) <b>All are language independent, allow translation to different languages. Pseudocode useful for showing logic of single module</b>  <b>structure diagram uses linked boxes showing hierarchy or shaped boxes to show constructs of program so is useful for showing overall structure and data flow</b>  <b>flowchart uses shaped boxes to show constructs in the program and links to show sequence</b>  <b>Pseudocode has line to line mapping with HLL – easy to convert to code</b></p> <p>- <b>2 marks for two advantages, one for each method</b></p>	<p><b>1 Mark</b></p> <p><b>2x1 Marks</b></p> <p><b>3 Marks</b></p>	
	<p>(b) Describe <b>two</b> items of documentation that would accompany the finished software.</p> <p><b>Technical and user guides :</b></p> <p><b>Technical -    how to install software</b>  <b>                  installation requirements</b></p> <p><b>User -        how to operate the software – (how to use software)</b>  <b>                  any commands that are needed</b>  <b>                  tutorial</b></p> <p>- <b>1 mark for one name and stating one function of that document</b>  - <b>2 marks for both names and one function of each</b></p> <p><b>No marks for names only</b></p>	<p><b>2x1 Marks</b></p> <p><b>2 Marks</b></p>	2

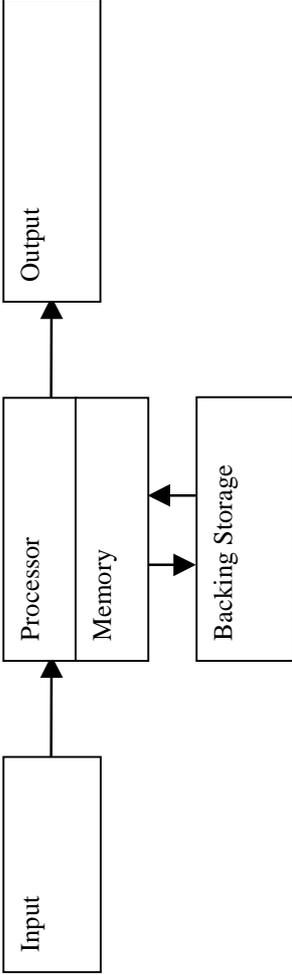
4.	<p><i>Fixed loops and conditional loops</i> are types of <i>iterative</i> control structures</p> <p>(a) Describe a conditional loop. You may use an example from a programming language with which you are familiar</p>		1
	<p><b>Description of REPEAT or WHILE eg repeats a block of code until a condition is met.</b>  <b>- 1 mark description must include both repetition AND condition</b></p>	1 Mark	1 Mark
	<p>(b) What is the difference between a fixed loop and a conditional loop?</p>	1 Mark	1
	<p><b>Fixed loop is used when the number of iterations is known - 1 mark</b>  <b>Or will repeat a block of code for a fixed no. of iterations</b></p>		1 Mark
	<p>(c) Explain the meaning of “iterative” in relation to control structures</p>		1
	<p><b>repeating a section of code over again, - 1 mark</b></p>	1 Mark	1 Mark
5.	<p>A <i>readable</i> program is easier to maintain.</p> <p>(a) Explain why a readable program is easier to maintain.</p>		1
	<p><b>readable code is more easily understood by other programmers - 1 mark</b>  <b>or same programmer may be maintaining at a later date</b></p>	1 Mark	1 Mark
	<p>(b) State two techniques that programmers could use to make their programs more readable.</p>		1
	<p><b>internal documentation/commentary</b>  <b>meaningful variable names</b>  <b>structured listings / indentation/white space</b>  <b>modularity - any two for 1 mark – no ½ marks</b></p>	1 Mark	1 Mark

6.	(a) What feature of computer architecture determines <i>word size</i> ? <b>Data bus width. (allow data bus)</b>		1
	(b) Explain how word size affects system performance. <b>An increase in word size increases system performance because more data can be processed in one cycle</b>	<b>1 Mark</b>	<b>1 Mark</b>
			<b>1 Mark</b>
7.	The processor and memory are linked by the <i>address, data and control buses</i> . Give <b>two</b> examples of the use of the “control bus”.		1
	<b>signal a read signal write reset processor registers interrupt current process carry clock signal – <u>Any two for 1 mark no ½ marks, no marks for names of lines only</u></b>	<b>1 Mark</b>	<b>1 Mark</b>
8.	A company logo has been created in both <i>vector</i> and <i>bit-mapped</i> graphics packages. Describe <b>two</b> actions which could be carried out on the “vector graphic” but not on the “bit-mapped graphic”.		2
	<b>Order of objects could be changed Individual objects can be resized, Individual objects can be moved/edited Objects can be resized with no loss of quality Two points for two marks <u>1 mark each</u></b>	<b>2x1 Marks</b>	<b>2 Marks</b>

9.	<p>'Signed-bit' and 'two's complement' are two ways of storing binary integers. Give <b>two</b> advantages of using two's complement rather than signed-bit.</p> <p><b>rules of arithmetic are supported (progression of numbers)</b></p> <p><b>two values for 0 do not exist (+0 = -0)</b></p> <p><b>Two points for two marks <u>1 mark each</u></b></p>	2x1 Marks	2
			2 Marks
10.	<p>(a) (i) State <b>one</b> network topology that could be used for a local area network (ii) Draw a labeled diagram of this topology.</p> <p>(i) <b>bus, star, ring etc (not mesh)</b></p> <p>(ii) <b>diagram must have two labels eg communication link/channel/connecting wire and node/workstation/networked computer and must match the name given in (i). Need both name and diagram (<u>1 mark</u>)</b></p>	1 Mark	1
	<p>(b) What would be the result of channel failure in your chosen topology?</p> <p><b>Answer depends on topology.</b>  <b>Bus - no communication can take place.</b>  <b>Ring - no communication can take place</b>  <b>Star - only one node is isolated.</b>  <b>Any topology with correct result is acceptable</b></p>	1 Mark	1
11.	<p>State <b>one</b> similarity and <b>one</b> difference between <i>scripting</i> and <i>procedural</i> programming languages.</p> <p><b>similarity : both are high level languages, both use modularity, both use data structures both use control structures (<u>1 mark</u> for any valid point)</b></p> <p><b>difference : scripting languages are embedded within an application or OS, procedural languages stand alone (<u>1 mark</u>)</b></p>	2x1 Marks	2

<b>12.</b>	<i>Resolution and capacity</i> are important features of digital cameras.		1
	(a) Explain the terms "resolution" and "capacity" in relation to digital cameras. <b>Resolution : number of dots per inch or number of pixels used to store image</b> <b>Capacity : amount of memory in the camera / number of pictures which can be stored.</b> <b>(½ mark each)</b>	<b>2 x ½ Marks</b>	<b>1 Mark</b>
	(b) Describe how the resolution of a digital camera affects its capacity.		1
	<b>Higher the resolution the more memory required to store one picture so fewer pictures can be stored.</b> <b>Or capacity will need to be increased</b>	<b>1 Mark</b>	<b>1 Mark</b>
<b>13.</b>	Standard file formats are often used to transfer data between applications of the same type.		2
	Choose <b>two</b> different types of application package and state <b>one</b> standard file format for each. <b>Word processing : RTF, text, ASCII</b> <b>Database : DBF, CSV, TAB separated</b> <b>Spreadsheet : SYLK, CSV, TAB separated</b> <b>Graphics : TIFF, JPEG, BMP, GIF</b> <b>Audio: MPS, WAV</b> <b>Web design: html</b> <b>Video editing: MPEG</b> <b>(2 x 1 mark for application with standard file format - format must match application)</b>	<b>2x1 Marks</b>	<b>2 Marks</b>

Section II

<p><b>14.</b></p>	<p>Most computers are still based on the system proposed by John von Neumann:</p>  <pre> graph LR     Input[Input] --&gt; Processor     subgraph Processor_Memory         Processor         Memory     end     Processor --&gt; Output[Output]     Processor &lt;--&gt; Memory     Memory &lt;--&gt; BackingStorage[Backing Storage]     </pre>		2
<p>(a)</p>	<p>(i) Explain how memory is organized so that data can be stored and retrieved by the processor.                  (ii) Explain the importance of the <i>memory management</i> function of the operating system.</p>		2
<p>(i)</p>	<p><b>Each memory location has a unique address. (1 mark)</b></p>	1 Mark	2 Marks
<p>(ii)</p>	<p><b>It stores the layout of memory indicating which addresses store the OS, programs and data and keeps each process separate so that overwriting does not occur. (1 mark for 1 valid point)</b></p>	1 Mark	2 Marks
<p>(b)</p>	<p><i>Registers</i> are one component of the processor.                  (i) Explain how the number of registers can affect system performance.                  (ii) Name <b>one</b> other component of the processor and describe its function.</p>		2
<p>(i)</p>	<p><b>If data is stored in registers within the processor then <u>less fetches to memory are required for a process.</u></b>  <b>(1 mark)</b></p>	1 Mark	2 Marks
<p>(ii)</p>	<p><b>ALU – Adds/subtracts binary numbers. Performs logical AND, OR NOT etc. Comparisons. Control Unit – manages fetching, decoding and executing of instructions</b>  <b>1 mark for either, no marks for name only. Descriptions must be complete.</b></p>	1 Mark	2 Marks

	<p>(c) Different types of memory can be used within a computer system such as <i>ROM, RAM, SRAM</i> and <i>DRAM</i>.</p> <p>(i) Explain why <i>maintainability</i> of ROM based software could pose problems.</p> <p>(ii) Describe <b>one</b> solution to this problem not involving the use of RAM..</p> <p>(iii) Describe <b>one</b> advantage and <b>one</b> disadvantage of using DRAM instead of SRAM other than cost</p>		4
	<p>(f) <b>Contents of ROM cannot be changed. (1 mark)</b></p>	1 Mark	
	<p>(ii) <b>EPROMs or EEPROMs could be used which would allow data to be erased and rewritten OR Upgraded program can be stored on new ROM chip to be inserted into machine (1 mark)</b></p>	1 Mark	
	<p>(iii) <b>Adv – Needs less power and circuitry is simpler (1 mark)</b>  <b>Disadv - Needs continuous signal to refresh contents of chip (1 mark)</b>  <b>Slower than SRAM</b></p>	2x1 Marks	4 Marks
	<p>(d) A computer system with a microprocessor which has a 24-bit data bus and a 32-bit address bus is sold with 1Gb of addressable memory. What is the maximum amount of <b>additional</b> memory which could be added to this system.  Express your answer in appropriate units.</p>		2
	<p><b><math>2^{32} \times 24 \text{ bits}</math> (2 x 1/2 marks)</b></p> <p><b><math>8 \div 1024 \div 1024 \div 1024 = 12\text{Gb}, 12\text{Gb} - 1\text{Gb} = 11\text{Gb}</math> (2 x 1/2 marks)</b></p>	4x1/2 Marks	2 marks

<b>15.</b>	A software company has been asked to create a piece of software to help an employment agency match various jobs with prospective employees. The software company carries out an analysis on how the agency currently performs this task.		
	(a) Describe <b>one</b> method that the software company might have used to analyse the agency's current system.		1
	<b>Interview employees of agency, examine current paperwork, observe work place, questionnaires</b> .. many more answers possible  <b>(1 mark)</b>	<b>1 Mark</b>	<b>1 Mark</b>
	The software will store the responses of applicants to a number of standard questions. The applicants' responses are whole numbers in the range 1 to 5.		
(b) The set of responses given by the applicant must be held during processing. These are held in an <i>array of integers</i> . Give <b>two</b> reasons why an array has been chosen to hold the responses. <b>Two of the following for 1 mark each:</b>		2	
<ul style="list-style-type: none"> <li>• easier to pass as a single parameter between code blocks (' formal parameter lists are shorter than when individual variables are used)</li> <li>• easier to read/understand code than if large number of variables used</li> <li>• easier to carry out list operations (search, sort etc)</li> <li>• any other valid</li> </ul>	<b>2x1 Marks</b>	<b>2 Marks</b>	

	<p>(c) When the array is searched, the module responsible returns the location of where the item is found. The search item can be passed as a parameter either <i>by reference</i> or <i>by value</i>.</p> <p>(i) Explain the terms “pass by reference” and “pass by value”  (ii) Which is more appropriate for the passing of the search item? Justify your choice.</p> <p><b>(i) Pass by reference is where the location/address of the variable is passed to the code block. This enables changes to the variable contents to be made and passed back out. (1 mark)</b></p> <p>Pass by value is where the current value of the variable is passed into the code block, subsequent changes to that value do not affect the original variable. <b>(1 mark)</b></p> <p><b>(ii) (Pass by value) as the search item should not be able to be changed. (1 mark for reason)</b></p>	<p>2x1 Marks</p> <p>1 Mark</p> <p>3 Marks</p>	<p>3</p> <p>2</p>
	<p>(d) The software development team could have chosen to implement the program in a <b>declarative</b> language. Explain why they might have considered this approach.</p> <p><b>All the job characteristics could be stored (as facts and rules) (1 mark).</b></p> <p><b>Then the applicant’s attributes could be pattern matched against the facts stored to search for the best match ie querying facility is “built in” (1 mark)</b></p>	<p>2 x 1 Marks</p>	<p>2</p>
	<p>(e) Good documentation should be developed both at the <i>implementation</i> stage and at the <i>testing</i> stage of the software development process.  Describe how documentation from each of these stages can benefit <i>maintainability</i>.</p> <p><b>Implementation: When software is being upgraded, future programmers will have full description of how the code evolved. The function of the component parts will be clear (1 mark for any valid point)</b></p> <p><b>Testing: Corrective maintenance is the resolution of errors not discovered at the testing stage. Documentation (e.g. test data which was used) may help to identify areas where testing was inadequate. (1 mark)</b></p>	<p>2x1 Marks</p>	<p>2</p> <p>2 Marks</p>

**Attempt either Question 16 or Question 17**

<b>16.</b>	A publishing business uses a range of computer systems, software and peripherals to produce its newspapers and magazines.		
	(a) Name a type of software application it could choose for creating a newspaper and give <b>one</b> reason for your choice.	1	
	<b>DTP, Word processor with graphics capability, Integrated package</b> <b>Package must allow inclusion and manipulation of text and graphics (1 mark for type <u>AND</u> reason)</b> <b>Commercial names are acceptable eg MS Word, Pagemaker etc</b>	1 Mark	1 Mark
	(b) A high resolution scanner is used to capture photographs onto a computer. (i) Describe <b>two</b> hardware features of a scanner other than resolution. (ii) Calculate how much storage would be required for a 6 x 4 inch photograph scanned at 600 dpi using 256 colours. Express your answer in appropriate units.	4	
(i) <b>Bit depth - the number of bits used to represent the colour of a pixel, which defines the number of colours available</b> <b>Type of interface - USB, parallel etc</b> <b>Size of scanner surface (A3, A4, handheld etc) Scanning speed 2 features – 1 mark each</b>	2x1 Marks		
(ii) <b>6 x 4 x 600 x 600 x 8 bits (1 mark) (69 120 000 bits or 8 640 000 bytes)</b> <b>÷8÷1024÷1024 = 8.24 Mb (1 mark)</b>	2x1 Marks		4 Marks

	<p>(c) (i) The business want to equip its journalists with either laptop or palmtop computers. Which computer system would you recommend? Give <b>one hardware</b> and <b>one software</b> reason for your choice.  (ii) Describe how the <i>user interface</i> of our recommended system could benefit the journalist.</p>		2
<p>(i) <u>Laptop</u> - Larger RAM (128Mb) or faster processor (<u>1 mark</u>) which means more powerful applications (eg fully featured WP) can be used (<u>1 mark</u>)  OR larger backing storage(20Gb) (<u>1 mark</u>) so larger files/more powerful applications can be saved. (<u>1 mark</u>)  OR modem available (<u>1 mark</u>) so stories can be e-mailed to newspaper (<u>1 mark</u>)</p> <p><u>Palmtop</u> – handwriting recognition software (pen-based device) used for fast input(<u>1 mark</u>) software, PCMCIA slots for attaching eg modem or memory cards(<u>1 mark</u> hardware) OR physical size allows easy portability(<u>1 mark</u> hardware)</p> <p>(<u>1 mark for hardware 1 mark for software , no mark for choice only</u>)</p>	2x1 Marks	3 Marks	
<p>(ii) <u>Laptop</u> – GUI (WIMP) system. Trackpad or trackerball can be used so easy to point and click. Standard keyboard Useful when (large) stories have to be entered quickly. (1 mark)</p> <p><u>Palmtop</u> - .Handwriting recognition. Easy to write notes quickly (interviews, comments etc) (1 mark)</p>	1 Mark		
<p>(d) The business decides to invest in a piece of software which will allow readers to search for past news stories using keywords. Give <b>one</b> advantage and <b>one</b> disadvantage to the software house of using a general-purpose database package to create this software rather than creating a specialised software package.</p> <p><b>Advantage: No need to create interface or searching engine, just create files, less coding required =&gt; speed of development. (1 mark)</b></p> <p><b>Disadvantage: Lack of control over "look and feel". lack of control over searching algorithm. (1 mark)</b></p>	2x1 Marks	2	

17.	<p>Panes 2001 is a stand alone operating system. It boasts many features such as:</p> <ul style="list-style-type: none"> <li>• Plug and play</li> <li>• Graphical user interface</li> <li>• Utility software</li> <li>• Multimedia features</li> </ul>		
(a) Why does a computer require an operating system?			1
<b>The operating system manages and maintains the computer system. O.S. provides link between applications and hardware. (1 mark)</b>		1 Mark	1 Mark
(b) What is <i>utility software</i> ? Describe one utility which may be provided with Panes 2001.			2
<b>Utilities are programs that aid in the maintenance of (or enhance the use of) computer systems. Other answers possible here. (1 mark)</b>			
<b>Disk formatter – formats media for use with OS</b> <b>Defragmentation software – moves data around disk until it is stored in consecutive sectors</b> <b>Virus checker – checks software for relevant viruses and feeds back to user</b> <b>(1 mark for one relevant response, no marks for name only)</b>		2x1 Marks	2 Marks
(c) In order to use multimedia elements (such as text, graphics, video and sound), <i>standard file formats</i> have to be used by the software. Why are standard file formats necessary?			1
<b>So that different data elements can be used by different computers and software (1 mark)</b>		1 Mark	1 Mark
(d) One of the system requirements for Panes 2001 is that it requires 256 Mb of RAM. Describe <b>two</b> other hardware requirements which may be necessary for a computer to run an operating system such as Panes 2001?.			2
<b>Large backing storage (Hard disc)/10GB + to ensure storage of OS</b> <b>High processing power 500MHz, + to ensure computer runs fast enough when carrying out other tasks.</b> <b>(1 mark for each relevant response, no marks for name only)</b>		2x1 Marks	2 Marks

	<p>(e) An upgrade to Panes 2001 is to include many extra features including video manipulation and voice recognition.</p> <p>(i) Explain how the use of modular programming in Panes 2001 could benefit the coding of these new features.</p> <p>(ii) Describe <b>two</b> methods that programmers could use at the testing stage to ensure that their OS upgrade is free from errors.</p>		4
	<p>(i) <b>The program is split into appropriate units (1 mark) therefore it is easier for the programmer to find relevant parts of the OS which are linked to the new features</b></p> <p><b>OR</b> <b>the new code could be tried and tested on its own (1 mark).</b></p> <p><b>Different programmers can work on different modules</b></p> <p>(ii) <b>Test data which 'exercises' all program paths and special cases. All 3 types of test data must be mentioned. (1 mark)</b></p> <p><b>Program is tested by typical users for real world exposure (beta testing) (1 mark)</b></p>	<p><b>2x1 Marks</b></p> <p><b>2x1 Marks</b></p>	<p><b>4 Marks</b></p>

Attempt either Question 18 or Question 19

<p><b>18.</b></p>	<p>The Scottish Tree Foundation has commissioned a piece of software to be written to gather information for a national survey of the trees of Scotland. The prototypes of two styles of user interface are shown below.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 10px; width: 45%;"> <p style="text-align: center;"><b>Interface A</b></p> <p>Please enter tree name . . . . . ? </p> </div> <div style="border: 1px solid black; padding: 10px; width: 45%;"> <p style="text-align: center;"><b>Interface B</b></p> <div style="border: 1px solid black; padding: 5px;"> <p>Please choose the tree name from the list and press OK</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p>Oak, Black</p> <p>Oak, Holm</p> <p>Oak, Sessile</p> <p>Pear, Common</p> <p>Pear, Willow-leaved</p> </div> <p style="text-align: right; border: 1px solid black; padding: 2px 10px;">OK</p> </div> </div> </div>	
	<p>Using this program, the data is gathered and output to a text file for processing later.</p> <p>(a) Describe <b>each</b> of the interfaces in terms of <i>robustness</i>, <i>ease of data entry</i> and <i>efficiency of computer resources</i>.</p>	3
	<p><b><u>Robustness:</u></b> A is more error prone as user may mistype the name, B – invalid entries not possible</p> <p><b><u>Ease of data entry:</u></b> A requires keyboard skills, B is able to be used by people with poor computer skills because no keyboard skills would be needed</p> <p><b><u>Efficiency of Resources:</u></b> A is not memory or processor intensive, B uses more memory/processor power to draw the menus etc</p> <p>(No credit for “Entry is faster – so computer is not overused”! Must be comparison.)</p> <p style="text-align: right;"><b>(6 x 1/2 marks)</b></p>	6x1/2 Marks  3 Marks

	(b) Describe two features of an <i>event driven</i> language which would make it easier to implement Interface B compared with a procedural language.		2
	<b>1 mark for each of two points from the following:</b> <ul style="list-style-type: none"> <li>• standard routines for the creation of buttons</li> <li>• linking of buttons to segments of code</li> <li>• any other valid</li> </ul>	2x1 Marks	2 Marks
	(c) The software must be run on a number of different computer systems. Describe two ways in which the software company could make the program <i>portable</i> . <b>Credit given for the mention of points linked to the context.</b> More general points on portability can gain half marks. <ul style="list-style-type: none"> <li>• use of subroutines to allow easier conversion</li> <li>• sparse or no use of processor specific code</li> <li>• use of different compilers to create different versions of object code</li> <li>• meaningful variable names to allow conversion</li> </ul>		2
	(d) It is suggested that the time required to develop the program might be reduced by the use of a module library. How might the use of a <i>module library</i> accelerate the development process?	2x1 Marks	2 Marks
	(e) A module library is a set of pre-written routines which can be re-used (0.5 mark) Module components have already been pre-tested and therefore may be more reliable ... (0.5 mark)		1
	(e) One module of the program will take a tree name from the user and will count all occurrences of that name in the current list of trees. The module will return the number of times the name appears in the list or zero if the name is not found. Using pseudocode or otherwise, write a detailed algorithm for this process. set occurrences = 0 FOR position = 1 to maxarray IF tree\$(position) = target\$ THEN increment occurrences NEXT position Display occurrences (REPEAT could be used instead of FOR)	2 x 0.5 Marks	1 Mark
			2
		4x0.5 Marks	2 Marks

19.	A large suite of software consisting of separate modules is being developed by several programming teams. A number of stages are gone through to ensure that these modules will fit together properly.		
(a) Individual programmers can take steps during the writing of these modules that will make the modules fit together more easily. A program can be made more <i>robust</i> by using local variables instead of global variables where possible.	(i) Explain the difference between <i>global variables</i> and <i>local variables</i> . (ii) How would the use of local variables contribute to the "robustness" of the software.		3
(i) <b>Global: variables which can be used by any part of the program. (1 mark)</b> <b>Local: scope of the variable is limited to the procedure in which it is used (1 mark)</b>		<b>2x1 Marks</b>	
(ii) <b>Local variables cannot be accidentally changed by other parts of the software. Their use makes the behaviour of the code more predictable. (1 mark)</b>		<b>1 Mark</b>	<b>3 Marks</b>
(b) The type of programming language used for the software implementation must be decided at an early stage in the design process. Describe <b>three</b> factors, other than the expertise of the programmer which will affect the final choice of language for the implementation. <b>Three of the following for 1 mark each:</b>	<ul style="list-style-type: none"> <li>• <b>intended platform for software</b></li> <li>• <b>suitability of type ie Prolog in AI application, assembler etc</b></li> <li>• <b>data types available in language</b></li> <li>• <b>features/constructs within language</b></li> <li>• <b>support tools available ie CASE</b></li> <li>• <b>any other valid</b></li> </ul>		3
		<b>3x1 Marks</b>	<b>3 Marks</b>

	<p>The software is able to have several windows open at once. The program holds a list of the names of all open windows in an appropriate data structure.</p> <p>(c) What type of data structure is being used to hold the names ? Your answer should state the <b>full</b> data type of the data structure.</p>		1
	<p><b>array of strings (1 mark)</b>  <b>Or string array or (2D) array of char (1 mark). NOT array on its own</b></p> <p>When a window is selected, a software module finds the position of that window in the list. For example, when the user clicks on a window, the module checks the list and returns its position on the list.</p> <p>(d) Use pseudocode, or another design notation of your choice, to fully describe the process of identifying the position of the name in the list.</p> <p><b>1 mark for use of loop to step through array. 1 mark for identifying and recording position of name.</b></p> <p>e.g.</p> <pre> set position to 0 set current position to 1 loop until end of list OR position &gt;0 (0.5) if name at current position = window name (0.5)     set position to current position (0.5) end if add 1 to current position (0.5) end loop </pre>	<p><b>1 Mark</b></p> <p><b>1 Mark</b></p> <p><b>4x0.5 Marks</b></p> <p><b>2 Marks</b></p>	2
	<p>(e) When the software is handling the window selection process described above, it communicates with part of the operating system. Which part of the operating system is involved? Justify your answer.</p> <p><b>Give 1 mark for the naming of a valid OS component and the reason. No marks for names only.</b></p> <p><b>e.g. Input/Output subsystem will take mouse clicks and pass data to a relevant part of the program (1)</b></p> <p><b>Other answers are possible.</b></p>	<p><b>1 Mark</b></p>	1

Section III Part A – Artificial Intelligence

<p><b>20.</b></p>	<p>(a) MYCIN is an expert system which is used for medical diagnosis. It has been in use for over three decades and during this time has been continually improved.</p> <p>(i) Describe <b>two</b> advances in <b>hardware</b> which have contributed to its improvement over this time.</p> <p>(ii) Describe <b>one</b> legal implication of using such expert systems and suggest how a good explanatory interface within an expert system could help to prevent such problems.</p> <p>(iii) Suggest <b>two</b> reasons why expert systems such as MYCIN are useful even though there may be several human experts in various medical centres around the world.</p>	<p>6</p>	
<p>(i) <b>Parallel processing allows several clauses or rules to be processed simultaneously so improving overall processing time</b></p> <p><b>Improvements to backing storage have meant that more information could be included in the knowledge base</b></p> <p><b>Improvements to internal memory have meant that larger knowledge bases can be manipulated</b></p> <p><b>Faster clock speeds have improved processing time so more could be expected from MYCIN</b> (<u>1 mark</u> for each of <u>two points</u>)</p> <p>(ii) Any actions taken as a result of using the expert systems are at the users risk. (1 mark)</p> <p>A good explanatory interface will give justification of how a result is obtained and will help the user to evaluate the worth of the advice. (<u>1 mark</u>)</p> <p>(iii) Many copies of the expert system can be made and distributed, rather than just the few human experts</p> <p>Expert not always at the point of need</p> <p>Advice is always consistent whereas human experts may be inconsistent</p> <p>Combines knowledge of many experts</p> <p>Can be used in training to confirm learner's knowledge</p> <p>MYCIN does not forget things</p> <p>(<u>1 mark</u> for each of <u>two valid points</u>)</p>	<p>2x1 Marks</p> <p>2x1 Marks</p> <p>2x1 Marks</p>	<p>6 Marks</p>	

	<p>(b) Knowledge acquisition is an important stage in the development of an expert system. Explain why knowledge acquisition is an <i>iterative</i> process.</p> <p><b>Concept of knowledge engineer going back (1 mark) to domain expert for clarification / detail / more information / checking etc after first consultation (1 mark) in order to proceed with the development of the system</b>  <b>OR Different domain experts may give conflicting advice (1 mark) so need to go back to confirm advice (1 mark)</b>  <b>(1 mark for each of two points)</b></p> <p>(c) Expert systems is one area of current artificial intelligence (AI) research. Others include <i>natural language processing</i> and <i>computer vision</i>. Suggest <b>two</b> reasons why there is such a large number of areas for research within the field of AI.</p> <p><b>Many definitions of AI (or many types of intelligent behaviour) (1 mark) and each gives rise to a particular field of research. (1 mark)</b></p> <p><b>Also idea that easier to focus on making a machine (or application) which can perform a specific (AI) task than it is to create a "thinking machine"</b></p>		2
		2x1 Marks	2 Marks
			2
		2x1 Marks	2 Marks

<p><b>21.</b></p>	<p>The following knowledge base summarises the management structure of a small company.</p> <p>1 is_manager_of(friedland,bennett)  2 is_manager_of(friedland,brown)  3 is_manager_of(friedland,everson)  4 is_manager_of(grainger,friedland)  5 is_manager_of(grainger,hill).  6 is_manager_of(hill,backley)  7 is_manager_of(hill,foster)  8 male(everson)  9 male(foster)  10 male(grainger)  11 male(hill)  12 female(X) if not male(X)  13 boss(X,Y) if is_manager_of(X,Y)  14 boss(X,Y) if is_manager_of(X,Z) and boss(Z,Y)</p> <p>Friedland is Bennett's manager</p> <p>Everson is male</p> <p>X is female if X is not male</p> <p>X is Y's boss if X is Y's manager</p> <p>X is Y's boss if X is the manager of Z and Z is Y's boss</p>		
<p>(a) (i) What would be the result of the following query?  ?male (macdonald).  (ii) In terms of this knowledge base, what problem is there with this result?</p>			2
<p>(i) <b>No or false (1 mark)</b>  (ii) <b>There is no information about Macdonald so to take the result that Macdonald is male is misleading. (1 mark)</b></p>		2x1 Marks	2 Marks

	<p>(b) Trace the solution to the query: ?female(friedland)</p>		2
	<p><b>Establish a match for female(friedland) at line 12, - (1/2 mark)</b>  <b>try to establish sub-goal male(friedland) – (1/2 mark)</b>  <b>subgoal fails – 1/2 mark</b>  <b>so not(male(friedland)) succeeds – (1/2 mark)</b></p>	4x1/2 Marks	2 Marks
	<p>(c) Write a complex query to find out which female employees have Grainger as their boss.</p>		2
	<p><b>boss(grainger, W), AND female(W) (1 mark for both clauses, 1 mark for correct order)</b></p>	2x1 Marks	2 Marks
	<p>(d) Two people are in the same department if they have the same immediate manager. Design a rule to show this.</p>		2
	<p><b>same_department(X,Y) if is_manager_of(Z,X) (1 mark) and is_manager_of(Z,Y) (1 mark)</b></p>	2x1 Marks	2 Marks
	<p>(e) (i) Explain why the rules in lines 13 and 14 are both required.  (ii) Why must they appear in the order shown?</p>		2
	<p>(i) <b>Recursion in line 14 needs a terminating condition which is provided by line 13.(1 mark)</b>  (ii) <b>If lines 13 and 14 are the other way round the terminator would not be encountered by the search so the recursion would be unterminated.(1 mark)</b></p>	1 Mark 1 Mark	2 Marks 2 Marks

Attempt either Question 22 or Question 23

<p><b>22.</b></p>	<p>(a) Give <b>two</b> reasons why simple game playing was an important part of early artificial intelligence research.</p> <p><b>a limited number of simple rules which were straight forward to code limited computer technology meant anything more complicated would give processing/memory problems game playing requires intelligence by people so was a good beginning for computer emulation (mixture of reasoning and creativity)</b></p> <p><b>(1 mark each for any of two valid reasons)</b></p> <p>(b) A computer has been programmed to play noughts and crosses against a human opponent. The human opponent does not know whether he is playing against a computer or another human. He has been asked to work out which it is. Why would it be difficult for a human player to decide whether he was playing against a computer or another human?</p> <p><b>Computer may be programmed to follow strategies like a human player (use of heuristics). Computer may be programmed to learn from mistakes like a human player Human player may not be very good at the game and so may play randomly like a poorly programmed computer.</b></p> <p><b>(Two reasons, 1 mark each)</b></p>	<p><b>2x1 Marks</b></p>	<p><b>2 Marks</b></p>
		<p><b>2x1 Mark</b></p>	<p><b>2 Marks</b></p>

	<p>(c) A robot is being programmed to solve a jigsaw puzzle using computer vision techniques.          (i) Describe <b>two</b> difficulties when using computer vision in this context.          (ii) Suggest how the use of a simple heuristic may be applied to the computer vision algorithm to solve a jigsaw puzzle</p> <p>(i) <b>Pieces need to be turned right way up</b>  <b>Detail must not be 'lost' in cutting of the jig-saw</b>  <b>'Picture' for comparison needs to be a full size identical copy</b>  <b>Position of camera</b>  <b>Camera angle</b>  <b><u>1 mark</u> for each of <u>two valid difficulties</u></b></p> <p>(ii) <b>Identification of corners first and then edges... (1 mark)</b>  <b>to give a smaller number of pieces to search to build up framework of jig-saw (1 mark)</b>  <b>OR group like coloured pieces (1 mark) join groups together (1 mark)</b>  <b>(1 mark for the heuristic and 1 mark for how it helps)</b></p>	<p><b>2x1 Marks</b></p> <p><b>2x1 Marks</b></p> <p><b>4 Marks</b></p>	<p>4</p>
	<p>(d) State clearly how research into <i>pattern matching</i> and <i>parallel processing</i> may assist in the development of intelligent robots.</p> <p><b>Computer vision (linked to pattern matching) needed for reduction of wastage, adaptability in jobs, freedom of mobility</b>  <b>Pattern matching to improve complexity of jobs and efficiency of carrying out tasks</b>  <b>Parallel processing to improve speed of processing of instructions</b>  <b><u>1 mark</u> for each of <u>two valid points</u></b></p>	<p><b>2x1 Marks</b></p> <p><b>2 Marks</b></p>	<p>2</p>

23.	(a) Databases and knowledge bases are both used to store information. Describe <b>two</b> ways in which they differ.		2
	<p>Databases have rigid structure (records), facts and rules in knowledge bases are less well defined. (1 mark)  Databases produce results to simple/complex searches whilst the logic applied to a knowledge base allows for deductions to be made. (1 mark)  Justification features contained in knowledge base. (1 mark)  (Look for 1 mark for storage, 1 mark for usage)  (1 mark each for <u>two valid points</u>)</p>	2x1 Marks	2 Marks
	(b) Give <b>one</b> reason why the knowledge base and inference engine are separated in the traditional architecture for an expert system shell.		1
	<p>Logic processes are independent of subject content of knowledge base (1 mark)  OR single inference engine can be used with different knowledge bases</p>	1 Mark	1 Mark
	(c) A <i>domain expert</i> provides the knowledge which is stored in an expert system. Name <b>one</b> other person who is involved in creating an expert system and <b>describe</b> the role of this person.		1
	<p>Knowledge engineer who organises the knowledge of the expert into a form suitable for computer processing . (1 mark) Need both name and role.</p>	1 Mark	1 Mark
	(d) In many situations human experts cannot be precise about the advice that they give. They may only be able to say that their advice is very likely to be correct in a certain situation. (i) Describe a feature of an expert system that could help to model this type of advice. (ii) Describe how the feature might be used in a particular situation.		2
	(i) A <b>certainty factor</b> is a number which is attached to an advice rule to reflect degree of belief that advice, based on information provided, is correct (1 mark) Note : applying CF to answers given by user as possible in Intermodeller, is not appropriate here	1 Mark	
	(ii) More than one alternative piece of advice, each with a certainty factor can be offered (1 mark) (candidates may give a description of a particular situation involving several advice rules with certainty factors)	1 Mark	2 Marks

	<p>(e) Advice from an expert system can be arrived at by using either <i>forward chaining</i> or <i>backward chaining</i>.</p> <p>(i) Using a syntax with which you are familiar, give an example of a forward chaining rule and a backward chaining rule.</p> <p>(ii) For what type of problem is forward chaining best suited?</p> <p>(ii) To what type of problem is backward chaining best suited?</p> <p>(i) <b>Examples :</b>  <b>Forward chaining :</b>  <b>IF</b> hair <b>IS</b> brown <b>AND</b>  Face shape <b>IS</b> oval <b>AND</b>  Eye colour <b>IS</b> blue  <b>THEN</b> name <b>IS</b> Jenny (<u>1 mark</u>)  <b>Backward chaining :</b>  <b>ADVISE</b> name <b>IS</b> Jenny <b>IF</b>  Hair <b>IS</b> brown <b>AND</b>  Face shape <b>IS</b> oval <b>AND</b>  Eye colour <b>IS</b> blue (<u>1 mark</u>)  <b>Syntax not important, order of condition is.</b>  <b>Forward chaining : prognosis, monitoring or control systems (<u>1 mark</u>)</b>  planning + classification</p> <p>(ii) <b>Backward chaining : diagnostic problems (<u>1 mark</u>)</b>  giving advice</p>	<p>2x1 Marks 1 Mark 1 Mark</p>	<p>4 4 Marks</p>
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Section III Part B – Computer Networking

<p><b>24.</b></p>	<p>A large insurance company makes extensive use of the Internet and e-mail. The company also has computer-based networked information systems and their own intranet. Some of the company's staff have access to the entire network from home using a dial-up connection.</p> <p>(a) The company has used the <i>client-server</i> networking model rather than the <i>peer-to-peer</i> model when designing their network.</p> <p>(i) Explain the terms "peer-to-peer" and "client-server".</p> <p>(ii) Give <b>two</b> reasons why they have chosen the client-server model.</p> <p>(i) <b>peer-to-peer: each station on the network has the same status and can share files. (1 mark)</b>  <b>client-server: only certain computers on the network can make resources available to other stations. (1 mark)</b></p> <p>(ii) <b>All shared files stored on a central server means data more likely to be up to date and correct – everyone using the same data. (1 mark)</b>  <b>The security (access rights) of a central server can be controlled centrally so files are more secure (1 mark)</b>  <b>OR Dedicated server may be faster. Easier to backup centrally stored files</b></p> <p>(b) Suggest <b>two</b> reasons why access to the company's network might be slower from home than it is from the office.</p> <p><b>Telephone link uses modem which is slower (lower band width) than internal ethernet/communication channels (1 mark).</b>  <b>Home computer less powerful than company computers.(1 mark)</b></p>	<p>4</p> <p>2x1 Marks</p> <p>2x1 Marks</p> <p>2</p> <p>2x1 Marks</p> <p>2 Marks</p>	<p>4</p> <p>4 Marks</p> <p>2</p> <p>2 Marks</p>
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	<p>(c) The IT Manager is worried that the company's network might be broken into by unauthorised people. Describe <b>two</b> ways a <i>firewall</i> could prevent unauthorised access.</p> <p><b>firewall computer is a security device to prevent unauthorised access (hacking) into a network e.g.</b>  * a <b>firewall computer will only transfer packets for particular ports (1 mark)</b>  * a <b>firewall computer may accept / reject packets from certain IP addresses (1 mark)</b></p> <p>(d) The dial-up server offers a "callback" facility. When an employee dials from home, the dial-up server checks their user name and password, terminates the connection and then re-establishes the link to the employee's home number.  Give <b>two</b> reasons why this feature is used in addition to a firewall.</p> <p><b>A hacker who discovers a user's password cannot dial in from another telephone number. Links can only be made to specific numbers. (1 mark)</b>  <b>Data is safer as it is guaranteed to be delivered to a private address</b>  <b>User does not pay for telephone call. (1 mark)</b></p>	<p>2</p> <p>2x1 Marks</p> <p>2</p> <p>2x1 Marks</p>	<p>2</p> <p>2 Marks</p> <p>2</p> <p>2 Marks</p>
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<p><b>25.</b></p>	<p>A business has several large offices, one in each of the main capital cities of Europe. Each office has a local area network (LAN) of desktop computers. The company now wishes to connect all of the offices to one another, so that any computer in one office can access data which is stored on the server of another office. The TCP/IP stack is used on all of the computers.</p> <p>(a) (i) What <b>device</b> is necessary to connect the LANs?  (ii) Give <b>one</b> reason for your choice.</p> <p>(i) <b>Router (1 mark)</b>  (ii) <b>determines most efficient path for sending message to ultimate destination bridges can't connect geographically distant networks, routers work with phone line or ISDN or all of the LAN's are using TCP/IP (any one valid point for 1 mark)</b></p> <p>(b) Describe the steps involved in the transfer of files between computers using the TCP/IP protocol.</p> <p><b>TCP breaks down the data into packets (0.5 mark) and adds header(s) (0.5 mark)</b>  <b>IP delivers to receiver (0.5 mark)</b>  <b>TCP re-assembles packets in correct order (0.5 mark)</b></p> <p>(c) One of the company's LANs provides multimedia for CD-ROM sharing. State, with reasons, <b>two</b> requirements of the LAN for this to operate satisfactorily.</p> <p><b>Large bandwidth (1 mark), large buffering capacity to cope with size of sound and video files (1 mark)</b>  <b>Don't accept multimedia server</b></p>		<p>2</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p>
		<p>2x1 Marks</p> <p>2x1 Marks</p> <p>4x0.5 Marks</p> <p>2x1 Marks</p>	<p>2 Marks</p> <p>2 Marks</p> <p>2 Marks</p> <p>2 Marks</p>

	<p>(d) The business makes heavy use of printed output. Describe <b>two</b> functions provided by a <i>print server</i> to control printing.</p> <p><b>Can queue jobs and deal with them by priority (1 mark)</b>  <b>Can direct print jobs to particular printers (1 mark)</b>  <b>Can store print jobs until they are printed (1 mark)</b></p>	2x1 marks	2
	<p>(e) Explain how the use of TCP/IP has led to the development and growth of <i>intranets</i>.</p> <p><b>Standard protocol which enables communication between different platforms works with whatever network cabling is already installed in the building isn't tied to one particular hardware or software vendor can be used on LAN to create private internet ie use of e-mail, browsers on LAN (1 mark each for any of two valid reasons)</b></p>	2x1 Marks	2 Marks

**Answer either Question 26 or Question 27**

<p><b>26.</b></p> <p>(a) It is claimed that: "computer networks create information rich and information poor individuals or societies". Explain what is meant by this statement.</p>		2
<p><b>Computer networks give access to large amounts of shared information (1 mark)</b>  <b>Individuals or societies who do not have access to computer networks will not have the same access to information and so will be information poor.(1 mark)</b></p>	2x1 Marks	2 Marks
<p>(b) When downloading or using information from another country, a user may accidentally break the law. Why might this cause difficulties for legal authorities across the world?</p>		2
<p><b>Different laws in different countries makes it hard for authorities to work together (1 mark)</b>  <b>Which country's law should be used—the one where the user is or the one where the host computer is (1 mark)</b></p>	2x1 Marks	2 Marks
<p>(c) A method called the Domain Name System is used to construct Internet addresses. A URL is of the form:          protocol://host_address/resource name          For each part of the URL:          (i) describe its purpose, and          (ii) give an example of an actual URL.</p>		3
<p>(i) <b>protocol - method used to transfer resource e.g. ftp, http, mail (0.5 mark)</b>  <b>host_address - address of computer which holds the resource (0.5 mark)</b>  <b>resource name - file name or pathname of resource on the host computer (0.5 mark)</b></p> <p>(ii) e.g. <b>http://www.anyhost.com/news/index.html</b>  <b>protocol - http(0.5 mark), host_address - www.anyhost.com(0.5 mark), resource name - /news/index.html – need extension of filename (0.5 mark)</b></p>	3x0.5Marks	3 Marks

	<p>(d) A major step forward in the development of the Internet was the development of packet switching as a data transmission method.</p> <p>(i) State <b>one</b> other data transmission method.</p> <p>(ii) Describe <b>two</b> advantages of packet switching when compared to your answer to (i).</p>		3
	<p>(i) <b>circuit switching (1 mark)</b></p> <p>(ii) <b>packets broken down into the same size enables efficient storage management, allows the small packet to be sent by whatever route is convenient at the time, so that transmission appears to be quicker, other messages can be inserted when there are any gaps in transmission of small packets (any two reasons for 1 mark each )</b></p>	<p><b>1 Mark</b></p> <p><b>2x1 Marks</b></p> <p><b>3 Marks</b></p>	

<p><b>27.</b></p>	<p>A team of fashion designers work in an office with computers which are connected to a local area network. They also have access to the World Wide Web. Each member of the team has a laptop and a digital camera which they use when working away from their main office.</p> <p>(a) (i) Name <b>one</b> item of hardware and <b>one</b> item of software which would be needed to allow communication between the laptops and the office server.  (ii) Describe <b>two</b> tasks that the item of <b>software</b> would carry out.</p> <p>(i) <b>modem and communications software (1 mark) no half marks</b>  (ii) <b>software - controls modem, encodes data, manages data flow (two tasks 1 mark each.)</b></p> <p>(b) The team also use video conferencing to share ideas and information when meetings in the office are not possible.  (i) Describe <b>two</b> facilities which video conferencing makes available  (ii) Security is an important consideration for this company. How can the company ensure that a video conference is secure?</p> <p>(i) <b>Real time audio and visual communication of several people in different places (1 mark) anywhere with network connection, whiteboard utility allows greater interactivity (1 mark)</b>  <b>OR</b>  <b>sharing applications</b>  (ii) <b>By encrypting the signal on the network. (1 mark)</b></p>	<p>3</p> <p><b>1 Mark</b> <b>2x1 Marks</b> <b>3 marks</b></p> <p><b>3</b></p> <p><b>2x1 Marks</b> <b>1 Mark</b> <b>3 Marks</b></p>	<p>3</p> <p><b>3 Marks</b></p>
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	<p>(c) (i) Name a file format which is suitable for transmitting photographs over a typical Internet link.  (ii) Describe <b>two</b> features of this file format which make it suitable for this purpose.</p>		2
	<p>(i) <b>JPEG (1 mark) or any other acceptable eg TIFF, GIF, PNG</b></p> <p>(ii) <b>JPEG compressed file format (0.5 mark)</b>  able to represent large range of colours and resolutions. <b>(0.5 mark)</b>  <b>GIF – lossless compression comprehend format</b>  <b>(OR can control loss of detail during compression)</b></p>	<p><b>1 Mark</b></p> <p><b>2x0.5 Marks</b></p> <p><b>2 Marks</b></p>	
	<p>(d) The fashion house transmits its designs over a wide-area-network (WAN) which conforms to the Open Systems Interconnection (OSI) model.  Name and describe <b>two</b> layers of the OSI model.</p>		2
	<p><b>Physical layer : addresses physical characteristics of the network eg cabling, connectors etc</b>  <b>Data link layer : addresses size of packet, means of addressing packet, preventing two nodes transmitting at same time</b>  <b>Network layer : routes packets from one network to another</b>  <b>Transport layer : gives each node unique address, manages connections between nodes</b>  <b>Session layer : makes sure sessions are established and maintained</b>  <b>Presentation layer : converts data sent over network from one type of representation to another eg apply and remove compression</b>  <b>Application layer : techniques that application programs use to communicate with the network, network OS works within this layer</b>  <b>(any two layers for 1 mark each ; naming two layers with no descriptions 1 mark)</b></p>	<p><b>2x1 Marks</b></p> <p><b>2 Marks</b></p>	

Section III Part C – Computer Programming

<p><b>28.</b></p>	<p>When a computer receives an <i>interrupt</i> signal from a peripheral requiring attention, it saves the address of the instruction that it is currently processing by <i>pushing</i> it onto a <i>stack</i>. When it has dealt with the peripheral, it <i>pops</i> the saved address for the previous task from the stack and carries on from where it stopped.</p> <p>(a) What type of data structure will be used to implement the stack. Your answer should state the <b>full</b> data type of the data structure.</p> <p><b>Array of integers (1 mark) Half mark for “array” only. Accept linked list</b></p> <p>(b) What two items of data must the program hold if it is to be able to use the stack?</p> <p><b>current top of stack/stack pointer (1 mark) the maximum size of the array (1 mark)</b></p> <p>(c) Describe the process of <i>pushing</i> an item onto a stack. You may use a diagram to illustrate your answer.</p> <p><b>Diagram or explanation to show:</b></p> <ul style="list-style-type: none"> <li>• the array as a group of contiguous storage locations</li> <li>• pointer to the last item of the list (top) (<u>1 mark</u>)</li> <li>• space for adding the new item beyond</li> <li>• incrementing the pointer to the new end item (top=top+1) (<u>1 mark</u>)</li> <li>• the new item placed at the end (array(top)=new item) (<u>1 mark</u>)</li> </ul>	<p>1</p> <p><b>1 Mark</b></p> <p>2</p> <p><b>2x1 Marks</b></p> <p>3</p> <p><b>3x1 Marks</b></p>	<p>1</p> <p><b>1 Mark</b></p> <p>2</p> <p><b>2 Marks</b></p> <p>3</p> <p><b>3 Marks</b></p>
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	<p>(d) Another part of the software deals with the holding of jobs in a print queue. Jobs in this queue are carried out in order of priority. This is determined by the two digit job number allocated to the document to be printed. Jobs are held in a sorted list. Any new jobs are added to the list and the list is then reordered.</p> <p><b>Example:</b>  Old list : 13, 27, 39, 42  Job number 13 is sent to the printer and the queue manager receives a new job from a user (31).  Unsorted list: 27, 39, 42, 31  New list: 27, 31, 39, 42</p> <p>(i) Describe, using pseudocode or otherwise, <b>one</b> method of sorting the list <b>27, 39, 42, 31</b>.  (ii) Describe the efficiency of your sorting algorithm in terms of the number of comparisons and memory use.</p>		4
	<p>(i) <b>FOR</b> current = 1 to (arraymax-1)  <b>FOR</b> count = (current+1) to arraymax  <b>IF</b> array(current) &gt; array(count) <b>THEN</b>      let dummy = array(current)      let array(current) = array(count)      let array(count) = dummy  <b>END IF</b>  <b>NEXT</b>  <b>NEXT</b> (Many other algorithms are possible. 2 marks for correct description -0.5 each mistake) (diagrams are acceptable)</p> <p>(ii) Selection sort  uses a second array of same size therefore <u>doubles memory requirement (2n locations)</u>  repeatedly finds the smallest item in the list and copies it into the current position  (<u>n squared</u>)</p> <p><b>Exchange sort</b>  memory efficient (uses n + 1 locations)  compares current element with rest of list, swapping smaller items into current. Then applies same to rest of list (<u>n squared – n</u>)  <u>1 mark for mention of each of two criteria</u></p>	2 Marks	4 Marks
		2x1 Marks	4 Marks

<p><b>29.</b></p>	<p>A wages program is to read an alphabetical list of names and the number of hours worked from a text file. Each person's data is to be held as a pair on a single line in the file. Before the weekly wage is calculated, the data is to be read into two parallel one-dimensional arrays. The hourly rate will be held in a variable called <b>rate</b>. The calculated wages are stored in a third array before being output to the printer.</p> <p>(a) The developers are worried about generating a <i>run-time error</i> whilst reading the data from the file.  (i) Describe a "run-time error" that could occur at this stage.  (ii) Describe a programming method, or language structure, that could be used to detect this error and so prevent the program from crashing.</p> <p>(i) <b>Array subscript error (accept reading past end of file) (1 mark)</b>  (ii) <b>Use a conditional loop (1 mark) which detects the end of the file and/or array (1 mark)</b></p> <p>(b) Using pseudocode or another suitable form, show how the data is read into the arrays from the text file.</p> <pre> set count = 1 WHILE NOT end of data AND count &lt;= arraymax   READ name\$(count),hours(count)   count = count + 1 LOOP </pre> <p><b>Note: no credit for loop as credited in part (a)(ii)</b></p>	<p>3</p> <p>1 Mark 2x1 Marks</p> <p>3</p> <p>6 x 0.5 Marks</p>	<p>3</p> <p>3 Marks</p> <p>3</p> <p>3 Marks</p>
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	<p>(c) The wages program will be implemented in a high level language. High level language programs need to be translated using either an interpreter or a compiler.</p> <p>Use a loop construct from a language with which you are familiar to compare the efficiency of translation and execution using a compiler and an interpreter.</p> <p><b>Using the following code example for illustrative purposes:</b></p> <pre>FOR count = 1 TO 1000   PRINT count; "squared is";count*count NEXT count</pre> <p><u>Compiler</u> All three lines are decoded once then the resultant object code is executed ie the print line is decoded once and executed 1000 times</p> <p><u>Interpreter</u> All three lines are decoded then executed in turn ie the print line is decoded and executed 1000 times. This is 999 more translations of the print line.</p> <p>2 marks for a full description of the above point with a relevant illustrative example. 1 mark if the explanation is vague but essentially correct ie the fact that there are multiple translations of a single line is clearly stated</p>		2
			2 Marks

	<p>(d) When an employee leaves the company, the employee's data is removed from the wages list. Describe, using an algorithm or other method, how a data pair at a given position in the arrays could be removed so that when the arrays are output back to the file there will be no blank lines.</p> <p>It may be assumed that the item has been found and is held in an appropriate variable.</p> <p><b>! This section shuffles up the remaining elements in both arrays and blanks the last item in the lists</b></p> <p><b>FOR</b> count = position to maxarray-1      <b>(0.5 marks for traversal of remainder of arrays)</b>            name\$(count) = name\$(count+1)      <b>(0.5 marks)</b>            hours(count) = hours(count+1)      <b>(0.5 marks)(remember to check subscripts)</b>  <b>NEXT</b> count      <b>(0.5 mark for decrementing maxarray)</b>  maxarray = maxarray - 1</p> <p>name\$(maxarray) = ""  hours(maxarray) = 0</p>	<p>4 x 0.5 Mark</p>	<p>2</p>
		<p>2 Marks</p>	

**Answer either Question 30 or Question 31**

<p><b>30.</b></p>	<p>Below is an extract from the datafile used by the Cree Valley Cookery Club to hold details of their 128 members. It holds the Membership Number, Member Name, Membership Class and Favourite Recipe of each member.</p> <table border="1" data-bbox="405 568 738 1928"> <thead> <tr> <th>Membership Number</th> <th>Member Name</th> <th>Membership Class</th> <th>Favourite Recipe</th> </tr> </thead> <tbody> <tr> <td>112</td> <td>Seawright, D</td> <td>Full</td> <td>Game Pie</td> </tr> <tr> <td>113</td> <td>Ramsay, R</td> <td>Student</td> <td>Pork Casserole</td> </tr> <tr> <td>114</td> <td>Edeling, M</td> <td>Full</td> <td>Chocolate Cake</td> </tr> <tr> <td>115</td> <td>Lloyd, C</td> <td>Full</td> <td>Mushroom Pastry</td> </tr> <tr> <td>116</td> <td>Carrick, E</td> <td>Full</td> <td>Grilled Swordfish</td> </tr> </tbody> </table>	Membership Number	Member Name	Membership Class	Favourite Recipe	112	Seawright, D	Full	Game Pie	113	Ramsay, R	Student	Pork Casserole	114	Edeling, M	Full	Chocolate Cake	115	Lloyd, C	Full	Mushroom Pastry	116	Carrick, E	Full	Grilled Swordfish		
Membership Number	Member Name	Membership Class	Favourite Recipe																								
112	Seawright, D	Full	Game Pie																								
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114	Edeling, M	Full	Chocolate Cake																								
115	Lloyd, C	Full	Mushroom Pastry																								
116	Carrick, E	Full	Grilled Swordfish																								
	<p>(a) The software will report how many members of a given Membership Class are in the file. Name the standard algorithm that is used in this part of the software.</p>		1																								
	<p><b>Counting Occurrences (accept Conditional Loop and Count) (1 mark)</b></p>	1 Mark	1 Mark																								
	<p>During the implementation phase, programming teams refer to a detailed algorithm of the software produced by the design team. After the code is written, a <i>dry run</i> is carried out followed by <i>component testing</i> and testing of the finished product.</p>																										
	<p>(b) What is the purpose of a "dry run" and how is it carried out?</p>		1																								
	<p><b>Dry run is the <u>manual execution of code using pen, paper and structured test data (0.5 mark)</u></b>  <b>Carried out to check the logic of code block (0.5 mark)</b></p>	2 x 0.5 Marks	1 mark																								

	<p>(c) Give <b>two</b> reasons for carrying out "component testing".</p> <p>This allows the modules to be incorporated into the program as "black boxes", much in the same way as modules in a library (1 mark) Testing can be carried out by more than one programmer (1 mark)</p> <p>(d) Explain how <i>trace tables</i> and <i>break points</i> are used in the testing process.</p> <p>The mark is for an explanation of the <u>use</u> of each technique. A simple description of each technique is worth 0.5 marks each.</p> <p>Trace tables: Table of variables with current values. These allow the programmer to monitor the behaviour of individual variables and help prevent errors and unexpected side-effects. (1 mark)</p> <p>Break points: (Points in the program where execution will pause. This helps the programmer to identify the position of errors. (1 mark))</p> <p>The software searches the file on any of the fields and displays the first record it finds that matches the search item.</p> <p>(e) A member's details are found with a simple <i>linear search</i> on the Membership Name.</p> <p>(i) The time taken to access an individual record in the file is 0.05 seconds. How long would it take to find that the name "Cobbold, T" is <b>not</b> in the file? (ii) If a <i>binary search</i> was used on a file of this size, how long would it take to reach the same result for "Cobbold, T"? Show all your working. (iii) Explain why a <i>binary search</i> would <b>not work</b> on the list of records shown above.</p> <p>(i) <math>128 * 0.05 = 6.4</math> seconds (1 mark) (ii) <math>128 = 2^7</math>, 8 comparisons. (1 mark) <math>8 * 0.05 = 0.4</math> seconds (1 mark) (2 marks for correct answer with working, 1 mark if 0.35 given with working) (iii) A binary search requires the file to be sorted. (1 mark)</p>	<p>2</p> <p>2x1 Marks</p> <p>2</p> <p>2x1 Marks 0.5 for description only</p> <p>2 Marks</p> <p>4</p> <p>1 Mark 2x1 Marks 1 Mark</p> <p>4 Marks</p>	<p>2</p> <p>2 marks</p> <p>2</p> <p>2 Marks</p> <p>4</p> <p>4 Marks</p>
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<b>31.</b>	When a product code is scanned at a stock warehouse the scanning software performs a validity check by calculating a check digit. The first ten digits are added together and then divided by nine. The check digit is the <b>remainder</b> after dividing by nine.		
	(a) The code to calculate the check digit is saved as a <i>library function</i> . What is a library function?	<b>1 Mark</b>	<b>1 Mark</b>
	<b>Any reasonable description of a section of pre-written code available for use by programmers. (1 mark)</b>		<b>1 Mark</b>
	(b) The function uses a loop to calculate the check digit. Using pseudocode, or another design notation, <b>fully</b> describe the check digit function.  <pre> set sum = 0 FOR digit = 1 TO 10     sum = sum + scanned(digit) NEXT digit set checksum = REMAINDER(sum,9) IF checksum = scanned(maxarray) THEN report VALID ELSE prompt for rescan </pre>		<b>3</b>
	(c) Explain the use of a debugger at the implementation stage.  <b>Any reasonable description of the use of a utility for line-by-line scanning of code for logic, or runtime, errors by programmer (1 mark)</b> <b>More detail regarding the reporting of variable values etc (1 mark)</b>	<b>6 x 0.5 Marks</b>	<b>3 Marks</b>
			<b>2</b>
		<b>2x1 Marks</b>	<b>2 Marks</b>

	<p>(d) The product codes and the number of items of each product are kept in two parallel arrays as shown below.</p> <table border="1" data-bbox="263 750 395 1751"> <tr> <td>Product Code</td> <td>3542568390</td> <td>8745359826</td> <td>2575389925</td> <td>6541212003</td> <td>7437645426</td> <td>8734521892</td> </tr> <tr> <td>Number</td> <td>150</td> <td>160</td> <td>145</td> <td>110</td> <td>250</td> <td>150</td> </tr> </table> <p>(i) Explain <b>two</b> difficulties that could result from errors from a solution using parallel arrays.  (ii) Describe an alternative to using parallel arrays for the above problem and show how this would solve one of the problems identified in (i) above.</p>	Product Code	3542568390	8745359826	2575389925	6541212003	7437645426	8734521892	Number	150	160	145	110	250	150		4
Product Code	3542568390	8745359826	2575389925	6541212003	7437645426	8734521892											
Number	150	160	145	110	250	150											
	<p>(i) <b>Any reasonable description of <u>two</u> difficulties (1 mark each error <u>with effect</u>)</b>  <b>Examples are:</b>  <b>deletion from only one array results in wrong calculation of product numbers</b>  <b>sorting of arrays must be in parallel if numbers are to remain associated with correct items</b>  <b>any other valid</b></p> <p>(ii) <b>Two alternatives might be 2D array or records (1 mark for full description of the method)</b>  <b>Advantage must be clearly expressed to gain full credit. (1 mark)</b></p>	<p><b>2x1 Marks</b></p> <p><b>2x1 Marks</b></p>	<b>4 Marks</b>														

Section III Part D – Multimedia

32.	<p>When creating a multimedia presentation, many different types of software could be used.</p> <p>(a) (i) Describe <b>two</b> different types of <b>authoring software</b> which could be used to create a multimedia presentation.  (ii) Describe <b>one</b> advantage of each type.</p> <p>(i) <b>icon-based</b> - use of <b>preprogrammed buttons, icons or menus</b> (<u>1 mark</u>)  <b>script-based</b> – <b>input from keyboard to create commands</b> (<u>1 mark</u>)</p> <p>(ii) <b>Icon-based</b> – <b>n o commands need to be remembered, easier to create presentations using graphical images etc</b> (<u>1 mark</u>)  <b>Script-based</b> – <b>more flexibility as user is not restricted to pre-given tools</b> (<u>1 mark</u>)</p>		4
		2x1 Marks	4 Marks
		2x1 Marks	4 Marks

	<p>(b) Both hardware and software for multimedia are subject to international standards.</p> <p>(i) Explain the purpose of MPC standards.</p> <p>(ii) Name one minimum <b>hardware</b> requirement for an MPC computer and explain why your choice is a necessary feature of a multimedia computer.</p>		3
	<p>(i) MPC standards describe the minimum hardware specification requirements that a computer must have in order to be classified as a multimedia machine(1 mark)</p> <p>(ii) Any from: 64+Mb RAM, 333+MHz processor, backing storage (CD-R, CD-RW, Hard Disc), CD-ROMs (600kps),sound card (16-bit, MIDI playback), video (640x480x64) (1 mark for name and appropriate units) 1 mark for reason appropriate to choice eg fast processor needed to play animations/video smoothly</p>	<p>1 Mark</p> <p>2x1 Marks</p> <p>3 Marks</p>	3
	<p>(c) The World Wide Web allows interactive multimedia presentations to be viewed around the world. It allows users to download multimedia elements such as graphics and videos.</p> <p>(i) How have <i>hypertext</i> systems contributed to the development of the World Wide Web?</p> <p>(ii) Explain the need for <i>compression</i> when storing multimedia elements.</p> <p>(iii) Explain the legal implications of downloading media elements from the World Wide Web.</p>		3
	<p>(i) Hypertext system allows the navigation of text using links - fundamental feature of WWW (1 mark)</p> <p>(ii) Compression reduces file size which reduces download time (and storage space) (1 mark)</p> <p>(iii) Description of copyright laws as relevant to copying elements (1 mark)</p>	<p>1 Mark</p> <p>1 Mark</p> <p>1 Mark</p>	3 Marks

33.	A graphic artist uses <i>image processing</i> software to produce various artwork pieces. The artist has decided to use a bit-mapped package.		
(a)	The image processing software allows the artist to edit individual pixels. Describe <b>three</b> other features of this type of image processing software.		3
	<p><b>Scaling – the image can be pulled or squeezed</b>  <b>Filling – using solid colours or patterns to fill in a shape</b>  <b>Clipping/Cropping – taking out unimportant detail from image</b>  <b>Morphing – joining two images together showing the transformation from one to the other</b>  <b>Smearing – rubbing over to produce a smudging effect</b>  <b>Blending – to mix different colours together</b>  <b>Gamma correction – changes brightness and ratios of colours</b></p> <p><b>(Any <u>three</u> - <u>1 mark each</u>, <u>no marks for name only</u>)</b></p>	<b>3x1 Marks</b>	<b>3 Marks</b>
(b)	(i) Identify <b>two</b> file formats the artist could use to save her artwork. (ii) Describe <b>one</b> advantage for each of your formats.		3
	<p><b>(i) JPEG, GIF, TIFF, BMP (<u>1 mark for two appropriate formats, no half marks</u>)</b></p> <p><b>(ii) JPEG – millions of colours can be used, common format, small size due to compression.</b>  <b>GIF – common format, lossless compression so original file stored as small file size.</b>  <b>TIFF – any number of colours and options available</b>  <b>BMP – Windows standard, uncompressed complicated true colour pictures are stored so no decoder necessary</b>  <b>(<u>Two descriptions</u> - <u>1 mark each</u>)</b></p>	<b>1 Mark</b>	<b>3 Marks</b>

	<p>(c) The artist wants to store her artwork to allow it to be distributed to prospective buyers.</p> <p>(i) What backing storage medium would you recommend? Give <b>two</b> reasons for your choice.</p> <p>(ii) A buyer has the appropriate backing storage device to read the medium from (i). Describe <b>two</b> possible problems a buyer could still have when trying to access the artwork.</p>		4
	<p>(i) <b>CD-R or CD-RW (do not accept CD-ROM or CD) – common backing storage device can be used by clients, can store up to 850 Mb, durable, cheap and lightweight, portable DVD-R (not DVD) – large storage up to 20Gb, faster access than CD</b></p> <p>(Any <u>two</u> valid reasons – <u>1 mark each, no mark for device on its own</u>)</p> <p>(ii) <b>Wrong OS, not enough RAM, files saved in wrong format, no appropriate software on client's machine</b></p> <p>(1 mark for each reason)</p>	<p>2x1 Marks</p> <p>2x1 Marks</p>	<p>4 Marks</p>

Answer either Question 34 or Question 35

<p><b>34.</b> A company produces videos for various occasions such as parties and weddings. They use standard analogue video cameras. The company wishes to use a computer with video editing software to edit the videos captured by the camera.</p>			
<p>(a) (i) Explain how the frames stored in the camera can be captured and saved to backing storage. Your answer should include relevant hardware and software at each stage. (ii) How could a <b>digital</b> video camera benefit the company in this situation?</p>		4	
<p>(i) <b>Camera (or video digitiser) connected to computer via video capture card (1 mark)</b> <b>Analogue to digital conversion required (1 mark)</b> <b>Compression (MPEG) must be used before the frames can be saved (1 mark)</b></p>	<p><b>3x1 Marks</b></p>	<p><b>4 Marks</b></p>	
<p>(ii) <b>No analogue to digital conversion required, , quality improved, faster to capture. (1 mark)</b></p>	<p><b>1 Mark</b></p>	<p><b>4 Marks</b></p>	
<p>(b) Most videos are captured at 25 frames per second. (i) State <b>one</b> advantage and <b>one</b> disadvantage of capturing at 10 frames per second compared to 25 frames per second (ii) State <b>one</b> advantage and <b>one</b> disadvantage of capturing at 50 frames per second compared to 25 frames per second.</p>		2	
<p>(i) <b>Fewer frames - less storage required (½ mark) but jerky motion. (½ mark)</b></p>	<p><b>2x½ Marks</b></p>		
<p>(ii) <b>More frames - smoother motion (½ mark) but more storage required (½ mark)</b></p>	<p><b>2x½ Marks</b></p>		<p><b>2 Marks</b></p>

	<p>(c) (i) Describe <b>two</b> features of video editing software.  (ii) Describe <b>two hardware</b> requirements of a computer system which is to be used for video editing.  Your answer must include appropriate units.</p> <p>(i) <b>Clips can be cropped</b>  <b>Frames can be deleted</b>  <b>Timeline can be used to change frames around</b>  <b>Transitions can be used to make video more interesting (fade in/out, dissolve, ripple etc)</b>  <b>Sound can be edited, removed or created</b>  <b>(Any two - 1 mark each)</b></p> <p>(ii) <b>RAM - 128Mb + so that the clips can be viewed</b>  <b>Backing storage - 2Gb+ (video projects are large files even under compression)</b>  <b>Processor – 500MHz+ to ensure computer can cope with large projects with many frames</b>  <b>(Any two - 1 mark each)</b></p>		4
		2x1 Marks	4 Marks
		2x1 Marks	4 Marks

35.	Sound and animation are two examples of multimedia elements that can be used when creating presentations and web pages. Various file formats and compression techniques are commonly used when storing these elements.		
	(a) Explain the difference between <i>lossy</i> and <i>lossless compression</i> .	1 Mark	1
	<b>Lossy compression leads to a loss of information whereas lossless compression encodes data so that the original file can be recreated in its entirety. (1 mark)</b>	1 Mark	1 Mark
	(b) Scanners are now a common feature of multimedia technology to capture images and text. Explain, in detail, how a scanner could be used to capture text as a text file.		3
	<b>Text document is scanned to produce a bit map (1 mark) Group of pixels are pattern matched against character (bit maps) stored within the OCR software (1 mark) When a match is found the character is Ascii code is stored in a text output file (1 mark)</b>	3x1 Marks	3 Marks
	(c) Describe two different file formats which could be used to save text documents.		2
	<b>ASCII (Plain text) – each character is stored but no formatting information is stored. (1 mark) RTF (Rich Text Format) - formatting information (text font, size, style etc) is stored as well as the text itself (1 mark)</b>	2x1 Marks	2 Marks

	<p>(d) Many multimedia presentations use sound for music, voice playback and sound effects.</p> <p>(i) Explain the difference between <i>sampled</i> sound and <i>synthesised</i> sound.</p> <p>(ii) Describe <b>two</b> functions of a basic sound card.</p>		4
<p>(i) <b>Sampled – naturally occurring sounds (1 mark)</b>  <b>Synthesised – computer-generated sounds (1 mark)</b></p> <p>(ii) <b>Recording of sound into digitized data for future use</b>  <b>Playback of digitized sound</b>  <b>Allows connection of microphone, speakers, MIDI equipment</b>  <b>FM Synthesis where digitized sounds are generated mimicking natural sounds</b></p> <p><b>(Any two - 1 mark each)</b></p>		2x1 Marks	4 Marks

[END OF MARKING INSTRUCTIONS]