X206/12/01

Attempt **all** questions in Section I.

Attempt **all** questions in Section II.

Attempt **one** sub-section of Section III.

For the sub-section chosen, attempt **all** questions.

Read all questions carefully.

Do not write on the question paper.

Write as neatly as possible.

Attempt all questions in this section.

1. Characters can be stored using either *Unicode* or *ASCII*. State **one** advantage and **one** disadvantage of using Unicode when compared to ASCII. **2**

2. State the **minimum** number of bits needed to represent the range of positive whole numbers from 0 to 16777215. **1**

**3.** The image shown was created using a *bitmapped* graphics package.
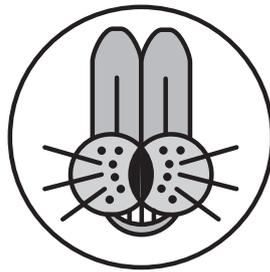
Describe how **bitmapped** graphics are stored. **2**

4. One possible threat to computers comes from *viruses*.

(*a*) Name the **type** of computer virus that attaches itself to documents created in applications. **1**

(*b*) Anti-virus software is often installed when a computer is set up. Describe **one** reason why the computer may still become infected. **1**

5. A school office has a networked laser printer.

Name and describe a method that could be used to deal with **additional** print jobs when the printer's buffer is full. **2**

6. *Read* and *write* are two control lines. Name **two** other control lines. **2**

Marks

7. Two *network topologies* are shown below. Describe the effect **on the network** of the failure of:

    • node X in Diagram A

    • node Y in Diagram B.

Key

• Node

— Channel

Diagram A   Diagram B
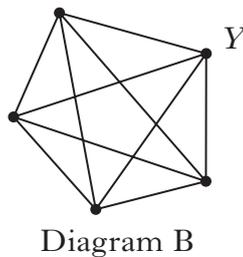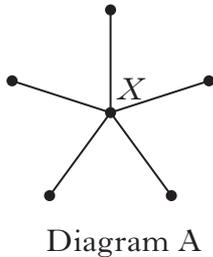
2

8. The steps involved in a *write* to memory operation are given below. State the **two** missing steps.

    1   ....

    2   Data bus is set up with the data to be written.

    3   ....

    4   Data from data bus is placed into specified memory location.

2

9. State why *data flow* should be included in an algorithm.

1

10. The variable **firstTerm** contains "super" and the variable **secondTerm** contains "symmetry". The variable **physicsTerm** is assigned the value "supersymmetry". All three are *string* variables.

firstTerm	**secondTerm**	**physicsTerm**
super	symmetry	supersymmetry
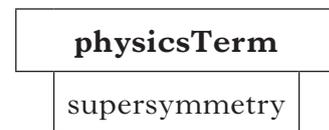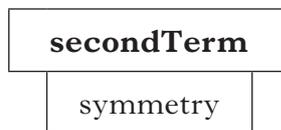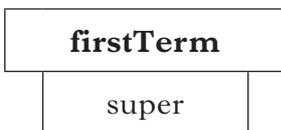
    Using a programming language of your choice, show how *concatenation* is used to assign the value "supersymmetry" to the variable **physicsTerm**.

2

11. In the case of **both** a *local* variable and a *global* variable, explain what is meant by the term *scope*.

2

[Turn over

SECTION I (continued)

12. Describe **two** characteristics of a *1-D array*.   **2**

13. State **two** benefits of a *scripting* language.   **2**

14. State **one** reason why an *independent test group* may be used to test software.   **1**

15. Describe what is meant when a computer program is described as *portable*.   **2**

16. The documentation for each subroutine in a *module library* will identify the name of the subroutine. State one **other** item of information that might be included in such documentation.   **1**

17. The main screen from software containing information about the universe is shown.
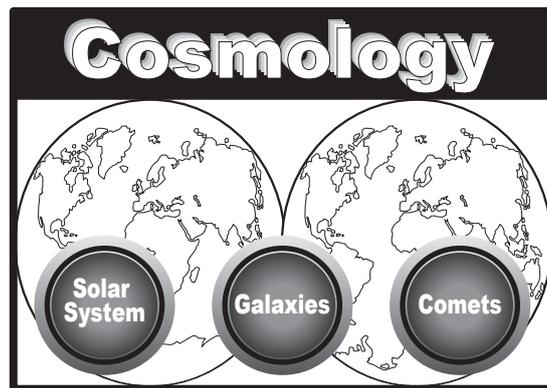
The **original specification** for the software required three buttons on the main screen. The client now requires a fourth button called Stars. State the **type** of *maintenance* required. Justify your answer.   **2**

   (30)

[*END OF SECTION I*]

Attempt all questions in this section.

18. Formula One cars make use of computing technology during races. Every Formula One car is equipped with an on-board computer which records information during a race.

    (*a*) The on-board computer makes use of *solid state storage*. Other than robustness and cost, state **two** reasons why solid state storage is used. **2**

    (*b*) During a race, measurements are made from temperature sensors. These sensors are connected to the on-board computer using interfaces. Name **two** functions of an interface that will be needed to transfer these measurements to the on-board computer and describe the operation of each during the transfer. **4**

    Wiktoria regularly visits races to take photographs of the cars. She transfers them from her camera to her computer, edits them and uploads them to her website.

    (*c*) Wiktoria has bought a 12 Gigabyte flash card. She takes 4 inch by 6 inch photographs with a resolution of 1024 dpi and using 24-bit colour depth. Calculate the maximum number of photographs which can be stored on this card.

    Show all working. **4**

    (*d*) Wiktoria transfers all of her pictures from the flash card to her hard disk. Name **two** functions of an operating system and describe how each will be involved in this process. **4**

    (*e*) The writer of a new Formula One book discovers Wiktoria's website. He copies the pictures and puts them into his new book, which he then sells. Name the law which this writer has broken. **1**

[Turn over

19.   Colin recently started to work at a university. He was given funds to select a suite of computers for his lab. The IT department gave him two options to choose from.

	MegaPCII	**PeartronIII**
Clock Speed	3·4 GHz	3·6 GHz
Installed RAM	4 Gigabytes	8 Gigabytes
Maximum addressable RAM	32 Gigabytes	32 Gigabytes
Hard Disk	2 Terabytes	2 Terabytes
Cache Memory	8 Megabytes	8 Megabytes
Data bus	8 bit	64 bit

(*a*)   Looking at the **MegaPCII**, Colin spots an obvious typing mistake in the information given. Identify the mistake and explain why it is incorrect.   **2**

(*b*)   Calculate the width of the **address** bus for the **PeartronIII.**   **3**

(*c*)   Both systems have *cache memory*. Explain how cache memory improves system performance.   **2**

(*d*)   In order to make his choice, Colin uses the results of *application based tests*. State **two** reasons why Colin chose to use application based tests.   **2**

Computer systems in the university are networked in a *client/server network*.

(*e*)   Explain one reason why a **peer-to-peer** network may not be suitable for the university.   **2**

(*f*)   *Hubs* and *switches* are used in the university network. Explain **one** difference between a hub and a switch.   **2**

(*g*)   All university computers have *anti-virus* software installed. Anti-virus is classed as *utility software*. State **two** other utility programs which are likely to be installed.   **2**

20. DeskCom create mathematics software for schools. A systems analyst from DeskCom has been sent to visit an interested school.

(*a*) Describe **two** methods the systems analyst may use to gain knowledge of the school's current system for teaching mathematics.

2

(*b*) After the school visit, the systems analyst produces the *software specification* for creating new mathematics software for the school. State **two** purposes of this document.

2

(*c*) The initial design for the new mathematics software was created using a *graphical design notation*. Name **one** graphical design notation.

1

(*d*) *Top down design* and *stepwise refinement* will also be used in the design of the mathematics software. Explain the terms "top down design" and "stepwise refinement".

2

(*e*) DeskCom programmers will consider many factors when deciding which programming language to use to code the new software. Describe **one** factor they should consider when choosing a programming language.

1

(*f*) It is important that the new mathematics software is *efficient*. Describe **two** items of **evidence** that could be gathered to support measurement of the efficiency of code.

2

[Turn over

21. ModernCorp manufacture tablet computers. Their recent sales initiative is shown.

Tablet Computer Price	Discount Rate %
<=£500	10
>£500 and <£1000	12
>=£1000	15

A program is to be created to calculate the **discount rate** due.

(*a*) The price of a tablet computer is held in the variable **price**. The discount to be applied is stored in the variable **discountRate**. Use **pseudocode** to design an algorithm, which uses a *CASE* statement (or equivalent) to assign the correct discount rate.

3

MoodyZak is software which comes free with a ModernCorp tablet computer. MoodyZak creates a song list from stored music based on data entered about the user's mood. Mood data is entered into MoodyZak, through a touch screen, on a list of check boxes.

Dark   Sad   Bored   Quiet   Bright   Happy

(*b*) State a *data structure* and *data type* that could be used to record the mood list for a single song.

2

(*c*) The use of a *declarative* programming language was considered for the creation of MoodyZak. Explain why a declarative programming language might be suitable in this case.

2

(*d*) The use of check boxes as the input for MoodyZak is an *event driven* feature. State the meaning of the term "event driven".

1

(*e*) The author of the MoodyZak code did not provide any supporting documentation. Only the compiled program, the program listing and a software licence were provided. Describe **two** examples of problems that this missing documentation could cause.

2

22. A horse race produced the set of results shown below. The names and times are held as two lists.

Name	Mister McGee	Kelly's Hero	Fred's Folly	The Tool Inns	Fizzy Lizzie
Time: *Minutes*	8·15	7·12	8·65	9·15	7·08

(*a*) (i) Use **pseudocode** to design an algorithm that would store the **time** of the **winning** horse in the variable **Fastest**. **4**

(ii) The time for the **Slowest** horse is also to be identified. Other than the change of variable name, state **one** change that would have to be made to your algorithm for part (i) to achieve this. **1**

(iii) The number of horses who have a race time greater than 8 minutes is also to be identified. State the name of a *standard algorithm* that could achieve this. **1**

(*b*) Explain why a *compiler* makes more efficient use of the processor when compared to an *interpreter* during translation/execution of a loop. **2**

(*c*) *Systematic* and *comprehensive testing* can be used to test progams.

(i) State the meaning of **systematic** testing. **1**

(ii) State the meaning of **comprehensive** testing. **1**

(60)

[Turn over

[END OF SECTION II]

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SECTION III

Attempt one sub-section of Section III.

For the sub-section chosen, attempt *all* questions.

PART A — Artificial Intelligence

Attempt all questions.

23. Computers have had success playing games against human opponents. Chess is an example of one such game.


(*a*) State **one** characteristic of chess that makes it suitable for computers to play.　　**1**

(*b*) Some people would argue that a chess computer is an example of *artificial intelligence*.

  (i) State **one** definition of artificial intelligence.　　**1**

  (ii) State **one** argument to support the view that the chess computer exhibits artificial intelligence.　　**1**

  (iii) State **one** argument against the view that the chess computer is artificially intelligent.　　**1**

(*c*) In chess, white plays first and can make one of twenty possible moves; black can then make one of twenty possible moves. Explain how the term *combinatorial explosion* applies to the game of chess.　　**1**

(*d*) A search technique uses an evaluation function in order to identify more promising nodes.

  (i) State the search technique being used.　　**1**

  (ii) Describe **one** advantage of this search technique over other search techniques.　　**2**

PART A — Artificial Intelligence (continued)

24. The paragraph below contains some information about spiders.

> Spiders have eight legs. They have both silk and venom.
>
> Black Widow and Huntsman are types of spider.
>
> Huntsman spiders have eight eyes.

This knowledge is represented graphically as:
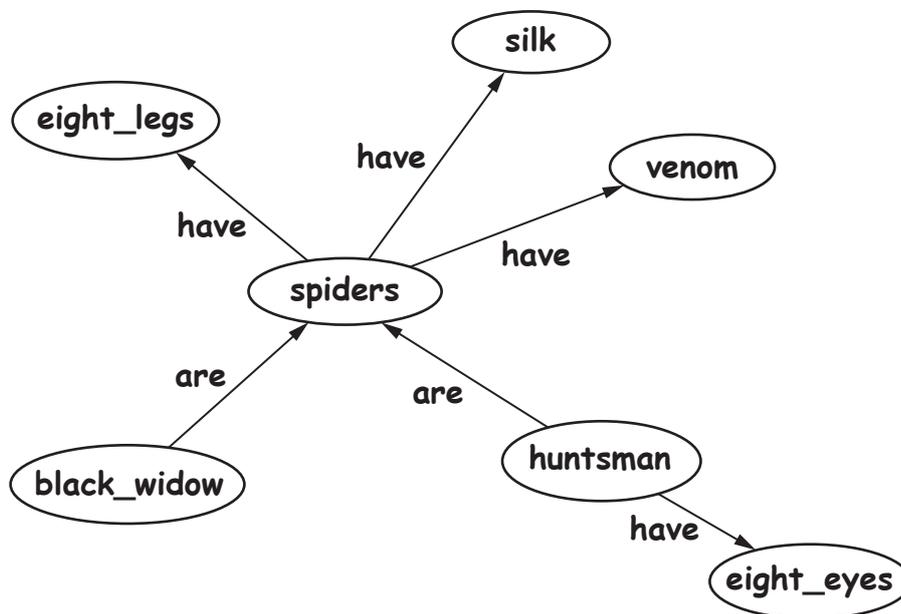
(*a*) (i) State the **name** of this graphical technique for representing knowledge. **1**

(ii) State **one** reason why this knowledge representation technique aids the implementation in a declarative language. **1**

(*b*) (i) Use the information in the diagram above to state **one** fact using Prolog or similar. **2**

(ii) Both the Huntsman and the Black Widow have eight legs. Write **one** rule so that they *inherit* this property. **3**

(iii) State **one** benefit of using an *inheritance* rule. **1**

[Turn over

PART A — Artificial Intelligence (continued)

25. Matches is a puzzle where twenty-four matches are arranged into three bundles of eleven, ten and three.

11 matches   10 matches   3 matches
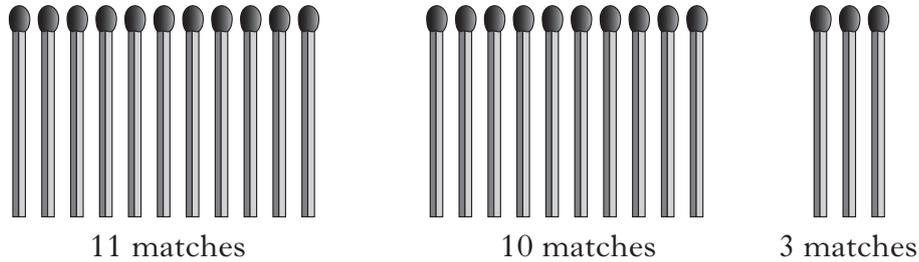
The object of the puzzle is to create the goal state of three **equal** bundles of eight matches.

8 matches   8 matches   8 matches

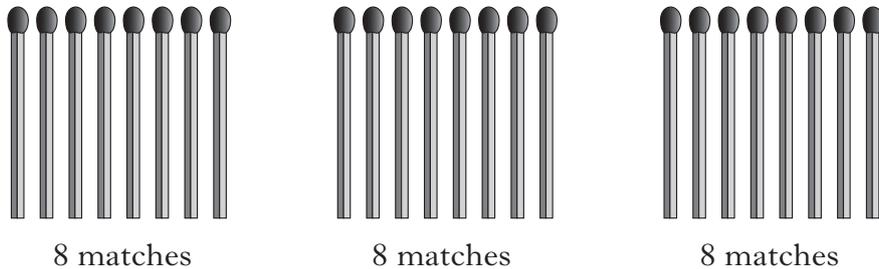Matches must be transferred from one bundle to another so that:

- the number of matches in the receiving bundle is **doubled**
- there is **at least** one match in the original bundle.

(*a*) The initial state of the puzzle could be represented as (11, 10, 3). Use this notation to write down the *goal state*.   **1**

(*b*) One possible move would be to take ten matches from the left bundle and place them on the middle in order to **double** the middle bundle to twenty. This is represented in a search tree as:

(11, 10, 3)
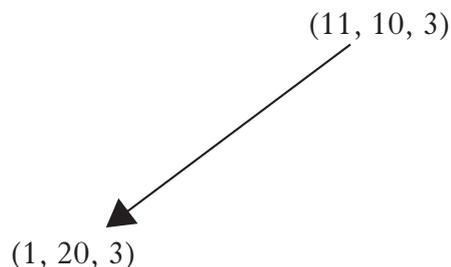
(1, 20, 3)

(i) State the next **two** nodes in this tree that would be generated using a *breadth-first search*.   **2**

(ii) State the next **two** nodes that could be generated using a *depth-first search* from the node (1, 20, 3).   **2**

(iii) State **one** advantage of breadth-first compared to depth-first.   **1**

(*c*) Explain how *parallel processing* could improve the speed of finding the goal state in this problem.   **2**

PART A — Artificial Intelligence (continued)

26. A knowledge base contains the following information on Scottish mountains.

1 munro(benmacdui, cairngorms, 1309).   Ben MacDui is a Munro in the Cairngorms. It is 1309 metres high.
2 munro(cairntoul, cairngorms, 1291).
3 munro(bennevis, grampians, 1344).
4 munro(blaven, cuillins, 928).

5 higher(A,B)   IF munro(A,__,P) AND   Munro A is higher than Munro B if Munro A is of height P and
                     munro(B,__,R) AND   Munro B is of height R and
                     P>R.   P is greater than R. We ignore the variable at the underscore.

    (*a*) State the solution to the following query:

                      ? munro(A, cuillins, B).   **2**

    (*b*) Use the line numbers to trace the solution to the following query as far as the **first** solution.

                      ? higher(A, B).

    In your answer you will be given credit for the correct use of the term *backtrack*.   **6**

    (*c*) Explain what is meant by *instantiation* when evaluating a query.   **1**

[Turn over

PART A — Artificial Intelligence (continued)

27. An expert system is used to diagnose different diseases of a patient's respiratory system. The expert system contains rules. Part of one rule is shown below.

> IF the severity of obstruction of the airways IS greater than or equal to mild AND
> the degree of diffusion defect of the patient IS greater
> the TLC observed/predicted of the patient
> the observed/predicted difference in R
> THEN there is evidence that the sub

(*a*) (i) State the component of the expert system in which this rule would be found. **1**

(ii) Describe **two** ways in which justification could be used in a consultation. **2**

(iii) State **one** benefit of including a *justification* facility. **1**

(*b*) One criticism of the expert system is that is has a *narrow domain*.

(i) Describe what is meant by the term "narrow domain". **1**

(ii) Explain **one** benefit of a narrow domain. **1**

(iii) State **one** other disadvantage of an expert system when compared to a human expert. **1**

(*c*) Users complained that the expert system is giving wrong advice in some situations. It is decided to alter some of the rules.

(i) State the **type** of *maintenance* being undertaken. **1**

(ii) Explain why the maintenance of an expert system is difficult. **2**

PART A — Artificial Intelligence (continued)

28. A journalist uses a mobile phone application to translate sentences into other languages. The journalist speaks into the phone and the sentence is displayed in English. The phone then translates the sentence into a language chosen by the journalist.

    (*a*) The journalist says the following sentence:

    | I don't know how mature people enjoy such a show. |

    The phone displays:

    | I don't know how much your people enjoy such a show. |

       (i) Describe how *speech recognition* is used to identify the words from the digitised sound captured by the microphone. **2**

       (ii) State **one** reason for the mistaken identification of the sentence. **1**

    (*b*) The phone correctly identifies the following sentence:

    | Charges dropped in submarine attack. |

    Explain why the application might have difficulties **interpreting** this sentence. **2**

    (*c*) The phone can also speak the translated phrase back to the journalist. Name this stage of natural language processing. **1**

    (*d*) Other than automatic translation, state **one** other application of natural language processing. **1**
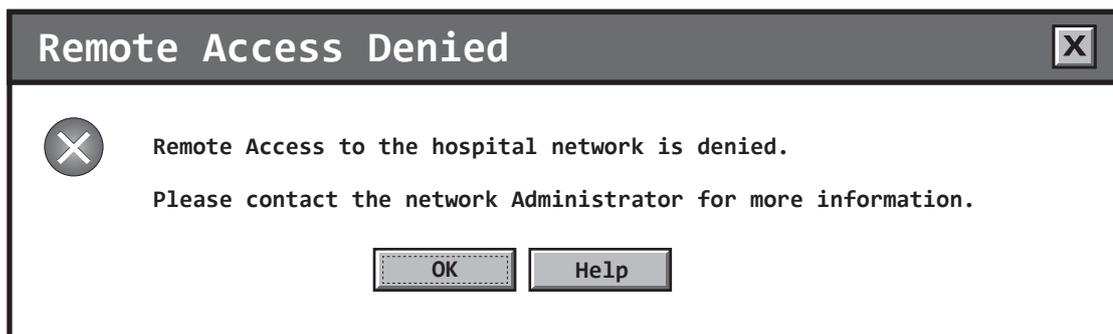
    (50)

[*END OF SECTION III—PART A*]

[Turn over

SECTION III

PART B — Computer Networking

Attempt all questions.

29. Computers within a hospital are connected together using a computer network.

    (*a*) Hospital staff are given a username and password to allow them to securely logon to the network. Describe **two** other **software** methods of providing security for the hospital network. **2**

    (*b*) The hospital network operates using *circuit switching*.

        (i) Describe "circuit switching". **2**

        (ii) The use of *packet switching* could provide several benefits to the hospital network. Describe **one** benefit of packet switching. **2**

        (iii) A network uses *CSMA/CD*. Describe **two** functions of CSMA/CD. **2**

    (*c*) The hospital network uses *TCP/IP* to transfer files across the network.

        (i) State **three** operations of the **TCP** part of this protocol. **3**

        (ii) State **two** operations of the **IP** part of this protocol. **2**

        (iii) Name **one** other common protocol that could be used to transfer files across the hospital network. **1**

    (*d*) A nurse tries to access the hospital network from his home computer using the correct login details. The following error message is displayed.

    ```
    Remote Access Denied                                    [X]

      (X)    Remote Access to the hospital network is denied.

             Please contact the network Administrator for more information.

                  [  OK  ]      [  Help  ]
    ```

    State **one** reason why this error message would have been displayed. **1**

PART B — Computer Networking (continued)

29. **(continued)**

(*e*) The hospital has a website. Some of the web pages can be accessed from WAP enabled devices. These web pages are written using *WML*. The WML code below is entered into a text editor.

```
<wml>
    <card id="Card" title="Doctor Details">
    <p>Dr Smith</p>
</wml>
```

Identify the error in the above WML code. **1**

[Turn over

PART B — Computer Networking (continued)

30. I-Play is an online games company. The I-Play website can be found using a search engine.

(*a*) Below are two descriptions of methods used by search engines to build their indexes. Name **each** of the methods.

(i) "Finds pages by following the links in webpages and adding them to their search engine indexes." **1**

(ii) "Passes queries on to several search engines and then summarises all the results." **1**

(*b*) Describe the purpose of the *Domain Name Service* (DNS) when a customer tries to access the I-Play website. **2**

In the past, when a customer purchased a game from the I-Play website a CD-ROM was sent out by post. However, customers are now able to download games direct from the I-Play website.

(*c*) State **one** benefit of allowing customers to download the games. **1**

(*d*) A 200 megabyte game is downloaded in 3 minutes. Calculate the transfer rate used to download this game. Express your answer in megabits per second and to 1 decimal place. Show all working. **2**

(*e*) Multi-player games are available to play on the website. There is a criticism that these games could make players socially isolated. Explain **one** reason why this might not be the case. **2**

(*f*) I-Play is worried that its computer network may develop faults, causing its website to become inaccessible to its users. Name and describe **two** *disaster avoidance* techniques to help prevent its network from breaking down. **4**

(*g*) I-Play is also worried about threats to its network security, in particular *passive* and *active attacks*.

(i) Describe an example of a passive attack that could take place on I-Play's network. **1**

(ii) Describe an example of an active attack that could take place on I-Play's network. **1**

(iii) Explain why I-Play would find it difficult to detect a passive attack. **1**

PART B — Computer Networking (continued)

30. (continued)

(*h*) An I-Play customer sets up a *WPAN* between some of his devices. Each device is configured and working correctly and has the required hardware and software installed. However, some of the devices will not connect to this network. State **one** reason why the devices might not connect.   **1**

(*i*) An I-Play customer has recently upgraded their Internet connection from ISDN to ADSL. State **two** benefits that the customer will gain from upgrading to an ADSL connection.   **2**

[Turn over

Marks

PART B — Computer Networking (continued)

31. A local tax office has 300 computers connected together in a Local Area Network with access to the Internet.

(*a*) The network conforms to the *Open Systems Interconnection (OSI) model.*

   (i) State which **layer** of the OSI model carries out **encryption**. **1**

   (ii) State which **layer** of the OSI model carries out **routing**. **1**

(*b*) Explain which class of IP address is most appropriate for the tax office to use to network their computers. **2**

(*c*) A former employee attempts a *Denial of Service (DOS)* attack on the tax office.

   (i) Name and describe **one** type of DOS attack that the former employee could have attempted. **2**

   (ii) Explain **one** reason why this DOS attack might succeed despite the correct installation of a firewall and anti-virus software. **2**

(*d*) Due to the DOS attack, the police are now investigating the network usage of the tax office. Explain how The Regulation of Investigatory Powers Act would help the police carry out this investigation. **2**

(*e*) The tax office has a website which offers advice and support to clients. One webpage contains the text "Tax Calculator". This text is **centred** and is in **bold**.
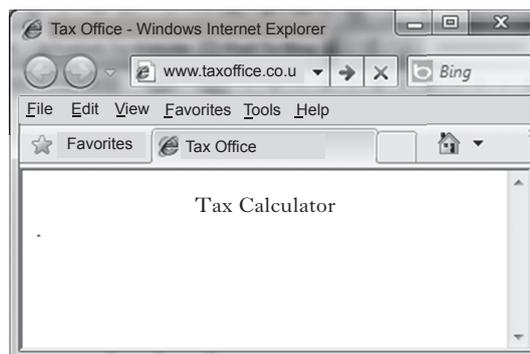
Write the HTML code required for this line of text. **3**

Marks

PART B — Computer Networking (continued)

31. (continued)

(*f*) This photograph is to be added to the above web page.

Explain why the web designer has chosen to store the image as a JPEG.　　**2**

(50)

[*END OF SECTION III—PART B*]

[Turn over

PART C — Multimedia Technology

Attempt all questions.

32. A task to create an interactive presentation is given as part of a multimedia course.

> ## *Multimedia Course Task*
>
> • Create an interactive presentation to guide new students around the college.
>
> • Your presentation must include the sound files and video clips provided.
>
> • The completed presentation must be submitted as a single file.

(*a*)   (i) Name **one** technique that could be used to design the presentation.   **1**

     (ii) State **one** feature or item that should be included in the design.   **1**

(*b*) WYSIWYG allows students to see what their slides look like as they are created. State **one** other benefit of using WYSIWYG during the creation of slides.   **1**

(*c*) The presentation will make use of a computer's graphics and sound cards. Graphics and sound cards have a *Digital Signal Processor (DSP)*. State **two** purposes of a DSP.   **2**

(*d*) Several of the sound files provided are in the *MIDI file format*. A student decides to edit the attributes of a MIDI file.

    (i) Describe the effect on a note of increasing the value of the *duration* attribute.   **1**

    (ii) Describe the effect on a sound of increasing the value of the *tempo* attribute.   **1**

(*e*) One of the sound files has two channels but one channel is much louder and is drowning out the other. Name a **technique** that could be used to correct this problem.   **1**

(*f*) Name and describe **one** method which students could use to submit their completed presentation as a **single** file.   **2**

PART C — Multimedia Technology (continued)

33. A new logo has been designed for the Summit Walking Club. The logo has been stored in *SVG, JPEG* and *GIF* file formats.

(*a*) Explain why **SVG** is a suitable file format for this logo. **2**

(*b*) The **GIF** and **JPEG** versions of the logo are placed onto a photograph to produce the images below.
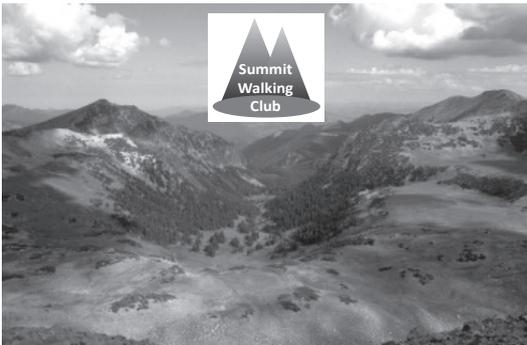

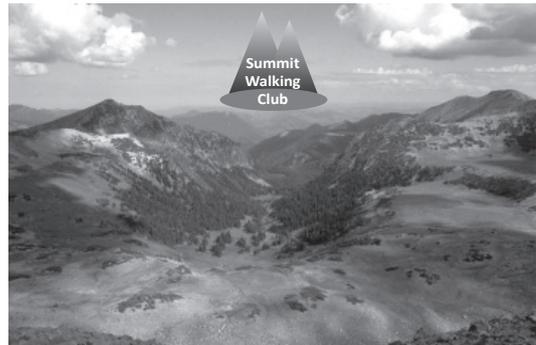Image A   Image B

State which image uses the **GIF** version. State **one** reason for your answer. **2**

(*c*) *Interlacing* is supported by the GIF file format. Explain the effect of interlacing when an image is displayed on a web page. **2**

[Turn over

PART C — Multimedia Technology (continued)

33. (continued)

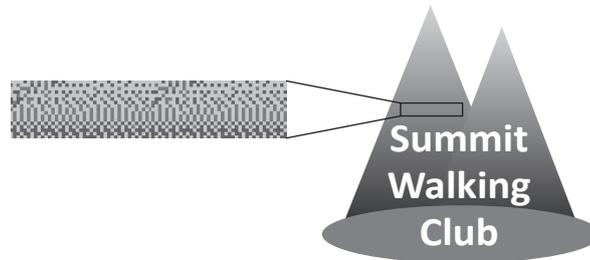(*d*) Image C shows an enlarged area of the GIF logo and the effect of *dithering*.

Image C

  (i) Explain the technique of dithering.   **2**

  (ii) State why dithering is often used with the GIF file format.   **1**

(*e*) The GIF file format stores a *CLUT* along with the image.

  (i) State the purpose of a CLUT.   **1**

  (ii) Describe **one** benefit given by the use of a CLUT.   **1**

(*f*) Both the JPEG and GIF file formats feature *compression*.

  (i) The JPEG file format uses the *RLE* technique. Describe the RLE technique.   **2**

  (ii) The GIF file format used the *LZW* technique. Describe the LZW technique.   **2**

(*g*) One colour used in the logo can be represented using the *RGB* colour code **(80, 80, 80)**.

  (i) Explain how an RGB colour code represents a colour.   **1**

  (ii) Describe the effect of editing the code to **(80, 80, 190)**.   **1**

  (iii) Each part of the RGB code is represented as an 8 bit binary number. State the number of different colours which can be represented in RGB code.   **1**

PART C — Multimedia Technology (continued)

34. Jakub plays in a band. The band often uses a digital sound recorder during rehearsals.

(*a*) The uncompressed file size of a 24 bit stereo recording sampled at 88·2 KHz is 60 Mb. Calculate the time that the file plays for. Show all working. State your answer to the nearest second.　　**3**

(*b*) State **one** benefit of the digital sound recorder having a *memory card reader* rather than internal *solid state storage*.　　**1**

(*c*) Explain why the digital sound recorder requires an *ADC*.　　**2**

(*d*) The digital sound recorder can store files in either *WAV* or *MP3* file format. Explain why the band may prefer to listen to recorded sound stored in the WAV file format rather than MP3 file format.　　**2**

(*e*) Jakub has a *surround sound* system at home. Explain why Jakub may notice little difference between recordings played on his surround sound system and other stereo systems.　　**2**

(*f*)　(i) Jakub usually uses *WiFi* to transfer a video clip from his phone to the drummer's phone. State **two** reasons why Jakub uses WiFi for this transfer.　　**2**

　　(ii) While rehearsing in a games hall, Jakub has no WiFi access. State **one other** wireless standard that Jakub could use. Justify your choice.　　**2**

(*g*) Jakub has a video clip taken using his phone. The 60 second video was recorded at 15 fps using a bit depth of 16 bits and a resolution of 640 × 360. Calculate the uncompressed file size for this video clip to the nearest megabyte. Show all working.　　**3**

[Turn over

PART C — Multimedia Technology (continued)

35. Ms Masters is teaching her class about using *vector file formats* to store graphics. She tells the class "Vector graphic file formats are more storage efficient than bit-mapped file formats".

    (*a*) Describe the type of graphic Ms Masters might use to show that the statement above is true.   **1**

    (*b*) Describe what happens to a vector graphic in order for it to be displayed on a monitor.   **1**

    The class are instructed to draw a *3D* object, apply a *texture* and store it in a vector graphic file format.

    (*c*) Explain the term "texture" when applied to a **3D** object.   **1**

    (*d*) Name **one** possible *attribute* required to store a 3D object **in addition** to those attributes required to store a 2D object.   **1**

    (*e*) Name a file format suitable for storing a 3D vector graphic image.   **1**

                                                                                        (50)

[*END OF SECTION III—PART C*]

[*END OF QUESTION PAPER*]