

# X206/301

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NATIONAL  
QUALIFICATIONS  
2011

FRIDAY, 3 JUNE  
9.00 AM – 11.30 AM

COMPUTING  
HIGHER

Attempt **all** questions in Section I.

Attempt **all** questions in Section II.

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

Part A	Artificial Intelligence	Page 10	Questions 17 to 20
Part B	Computer Networking	Page 14	Questions 21 to 24
Part C	Multimedia Technology	Page 18	Questions 25 to 28

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

Read all questions carefully.

Do not write on the question paper.

Write as neatly as possible.



## SECTION I

**Attempt all questions in this section.**

1. State the largest whole number that can be stored as a 10-bit positive integer. 1
  
2. Name and describe a method for measuring the performance of computers. 2
  
3. Data storage compensates for differences in speed between computers and peripherals. This is achieved through *buffering* and *spooling*.
  - (a) Explain the difference between buffering and spooling. 2
  
  - (b) Compensation for differences in speed between the computer and peripherals is one function of an *interface*. State **two** other functions of an interface. 2
  
4. (a) State the **type** of virus that may affect a computer during the start up process. 1
  - (b) *Replication* and *camouflage* are two *virus code actions*. State **two** other virus code actions. 2
  
5. State **one** advance in computer **hardware** that has led to the increased use of computer networks. 1
  
6. (a) Describe an example in which an image stored as a vector graphic could have a larger file size than if the same image was stored in a bitmapped format. 2
  - (b) A bitmapped graphic has a *bit-depth* of 24 bits and a *resolution* of 300 dpi.
    - (i) State the number of colours that may be represented in this graphic. 1
  
    - (ii) State the effect that increasing the bit-depth will have on the file size of the graphic. 1
  
7. *Analysis* is the first stage of the software development process.
  - (a) Name the document produced at the end of the analysis stage. 1
  
  - (b) Explain why the production of this document could be an *iterative* process. 1

**SECTION I (continued)**

8. *Pseudocode* is a design notation often used during the software development process.
- (a) Pseudocode should include *data flow*. State the purpose of data flow. 1
  - (b) Other than data flow, state **two** benefits to a programmer of a design written in pseudocode. 2
9. State what is meant by the term “boolean variable”. 1
10. Software is usually written using *subprograms*. Two types of subprogram are *procedures* and *functions*.
- (a) State how the use of subprograms increases the *maintainability* of a program. 1
  - (b) Readability of code affects maintainability. Other than using subprograms, state **one** way to improve **readability** of code. 1
  - (c) Explain **one** difference between a procedure and a function. 2

11. A program contains three variables, of **the same type**, with the following values:

variable1	variable2	variable3
8	4	84

The program is written in a new language called SQAM. It contains the line of code shown below. The symbol **?** represents a particular operation.

$$\text{variable3} = \text{variable1} \text{ ? } \text{variable2}$$

- (a) The value 84 is assigned to **variable3**. State the single common operation carried out by the **?** symbol. 1
  - (b) State the *data type* that must have been used for **all three** of the variables. 1
12. A *macro* can be used within application software to automate a task.
- (a) Name the *type* of programming language used to create macros. 1
  - (b) Other than saving time, for example during writing or testing, state **two** further benefits of using macros. 2

**(30)**

## SECTION II

**Attempt all questions in this section.**

- 13.** Paula buys a new laptop computer which has 4 Gigabytes of *main memory* and 12 Megabytes of *cache* memory.
- (a) State **two** differences between main memory and cache memory. 2
- (b) The computer has a **maximum** addressable memory of 16 Gigabytes. Its *address bus* width is 32.
- (i) Calculate the width of the *data bus*. 3
- (ii) State why computers do not come with the maximum addressable memory installed. 1
- (iii) State the effect that adding **one** new line to the address bus would have on the maximum addressable memory. 1
- (c) Describe the function of each of the following in a memory *read* operation:
- address bus.
  - data bus.
  - control lines. 3
- (d) The laptop computer has several *utility programs* including a *disk defragmenter*.
- (i) State what is meant by the term “utility program”. 1
- (ii) Fragmentation of the hard disk decreases the performance of the computer. Explain why performance decreases. 2
- (e) The laptop computer has anti-virus software. State an *anti-virus software detection technique*. 1

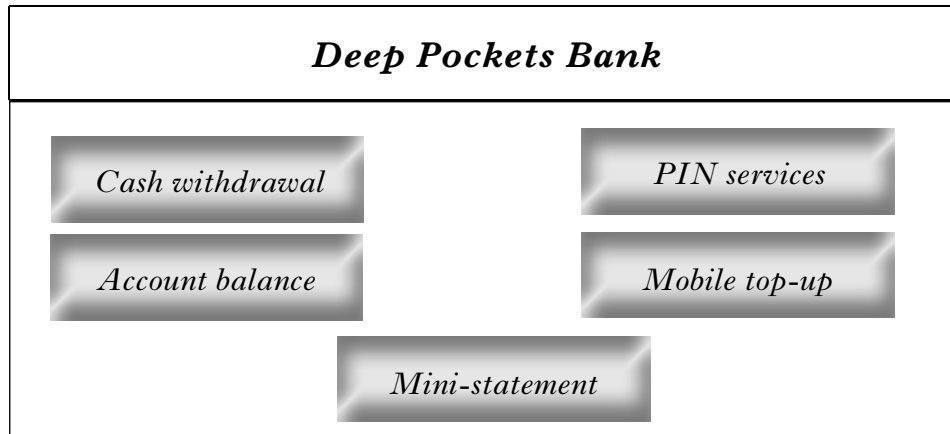
## SECTION II (continued)

14. Murray Components is a small business that sells computer hardware. They have a shop that employs four people.
- (a) Networks can be set up as either *peer-to-peer* or *client server*.
- (i) In terms of data backup, describe **one** difference between a peer-to-peer network and a client server network. 2
  - (ii) Murray Components have a peer-to-peer network with four workstations. Describe **one** reason why they may have chosen a peer-to-peer network. 2
- (b) Murray Components is advised that a *ring topology* is not the most suitable topology to use for their LAN.
- (i) Draw a **labelled** diagram of a ring topology. 2
  - (ii) State a more suitable topology and state **one** advantage it has over a ring topology. 2
- (c) Murray Components requires a network printer to print advertising leaflets.
- (i) State **two** technical requirements that should be considered when selecting a suitable printer. 2
  - (ii) State **two** roles of the *operating system* and describe how each is used to ensure that data is printed correctly. 4
- (d) State **one** function of a *print server*. 1
- (e) Murray Components starts to sell much more *solid state* storage. State **two** reasons why solid state storage is becoming more popular. 2

[Turn over

## SECTION II (continued)

15. RightIT, a software company, is currently developing a cash machine program for a bank. The cash machine will offer five options to customers.



- (a) RightIT decided to use an *event-driven* programming language to write the software. State **two** reasons why an event-driven programming language is suitable for this software. 2
- (b) (i) State **one** other type of programming language RightIT could have used for this software. 1
- (ii) Justify why it would also have been suitable. 1
- (c) The options selected during a day are stored as a list. The bank would like the software to calculate the number of times the **mobile top-up** option appears on this list. Use pseudocode to design an algorithm to carry out this calculation. 4
- (d) Once the software has been written RightIT carries out *systematic* testing. Explain how systematic testing is carried out. 2
- (e) The bank is anxious that RightIT also carries out *comprehensive* testing on the software. State what is meant by comprehensive testing. 1
- (f) The final version of the software is ready to be distributed to the bank. A *compiler* is chosen as the most suitable translator. Explain why a compiler is suitable at this stage. 2
- (g) Several months after the software has been in use, the bank asks RightIT to include another option in the menu. This option should allow customers to withdraw cash in Euros. Name the **type** of *maintenance* required and justify your answer. 2

## SECTION II (continued)

16. Sidney is an experienced programmer. He decides to write a book called “The Good Programming Guide”.

(a) Chapter one of the book is entitled “Characteristics of a well written program”. Two characteristics of a well written program are *reliability* and *efficiency*.

(i) Define the term “reliable”.

1

(ii) Explain **one** way in which a program can be written to make it efficient in terms of **processor** usage.

2

(b) A well written program should make use of *parameter passing*.

(i) State the **purpose** of an *in parameter*.

1

(ii) State the **purpose** of an *out parameter*.

1

(c) Chapter two of the book is entitled “Being a team player”. Sidney is keen to emphasise that on most projects there will be a team of programmers writing the software. Describe **one** example of how a programming team can ensure they will work together effectively.

2

(d) Another chapter is entitled “Saving time whilst programming”. A *module library* will save programmers time as they will not have to code or test these modules independently. State **one** further benefit of making use of a module library.

1

(e) When working with data, the use of *1-D arrays* can save time.

(i) State **two** characteristics of a 1-D array.

2

(ii) Data can be stored using individual variables or using a 1-D array. Describe how the use of a 1-D array can save time when writing a program compared to several individual variables.

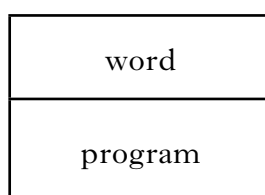
2

(f) Sidney sets a short programming challenge at the end of each chapter. One of these programs involves identifying a computing term from another computing related word. For example, “ram” from “program”.

Using code from a programming environment with which you are familiar, show how you would extract the term “**ram**” from “**program**”, when “program” has been assigned to the variable called “word”.

2

(60)



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### SECTION III

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

<b>Part A Artificial Intelligence</b>	<b>Page 10</b>	<b>Questions 17 to 20</b>
<b>Part B Computer Networking</b>	<b>Page 14</b>	<b>Questions 21 to 24</b>
<b>Part C Multimedia Technology</b>	<b>Page 18</b>	<b>Questions 25 to 28</b>

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

## SECTION III

## PART A — Artificial Intelligence

Attempt all questions.

17. An “intelligent” computer system has been designed to compete against people on a televised quiz show. A human presenter reads out a question and the contestant quickest to respond gets to answer the question.



Some examples of the quiz questions are shown below:

Question	Answer
What word means a water sport and also browsing the web?	Surfing
What word meaning “also” sounds like a number?	Too
Which animal is known as “the ship of the desert”?	Camel

- (a) (i) The computer system requires the ability to process *natural language*. State **two** other aspects of intelligence involved in playing this quiz game. 2
- (ii) Explain why **this** computer system better justifies a claim of “artificial intelligence” than a chess system developed to play the world champion at chess. 2
- (b) The first stage of natural language processing is *speech recognition*.
- (i) Name and describe the **two** other stages of *natural language processing* that the computer system will use. 4
- (ii) Describe **one** difficulty in natural language processing using the quiz questions to illustrate your answer. 2
- (c) Speed of response is important when playing the game. Describe how **one** advance in hardware would improve response times. 2

## SECTION III

## PART A — Artificial Intelligence (continued)

18. A Scottish law firm is involved in the development of an expert system that will be used on the World Wide Web. The purpose of the expert system is to create legal documents after an online consultation with a client.
- (a) (i) Name and describe **two** components of an *expert system shell*. 4
- (ii) The *expert system* will use *working memory* when consulting with a client. State **one** way in which information will be added to working memory during a consultation. 1
- (b) Once created, the expert system will be rigorously tested.
- (i) Explain the importance of testing during the software development process. 2
- (ii) State **two** reasons why it is important for the law firm to be involved in the testing of an expert system. 2
- (c) Explain why making this expert system available online might lead to difficulties for anyone using the system. 2
- (d) Describe **one** situation where a lawyer is better at providing legal documents than an expert system. 2
- (e) Name and describe another real world application of an expert system with which you are familiar. 2

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SECTION III

PART A — Artificial Intelligence (continued)

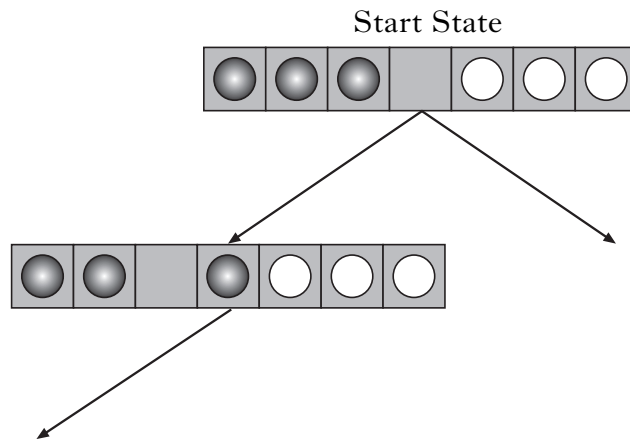
19. The “six stones” puzzle starts with three black counters and three white counters on a board with seven spaces as shown:



The puzzle is solved when the black and the white counters have swapped places. However, black counters can only move right and white counters can only move left according to the following four possible moves:

1. A black counter can move one space to the right into an empty space
2. A black counter can jump to the right over a white counter into an empty space
3. A white counter can move one space to the left into an empty space
4. A white counter can jump to the left over a black counter into an empty space.

(a) A search tree is shown below with the first move already completed.



- (i) Draw the node that would be generated next if *breadth-first* searching is used. 1
  - (ii) Draw the node that would be generated next if *depth-first* searching is used. 1
  - (iii) Use the “six stones” puzzle to explain the term *backtracking* in depth-first searching. 2
- (b) State **two** advantages of breadth-first when compared to depth-first searching. 2
- (c) State another method of searching large search trees. 1

## SECTION III

## PART A — Artificial Intelligence (continued)

20. A company offers flights to various destinations stated below.

There are direct flights from Glasgow to London and from London to Paris. Direct flights from Paris go to Rome and Seville. There is also a direct flight from Rome to Berlin.

(a) Represent the information in the paragraph above using a *semantic net*.

3

The company creates a knowledge base to provide information on their flights.

1. `direct(glasgow london)`. *There is a direct flight from Glasgow to London.*
2. `direct(london paris)`.
3. `direct(paris rome)`.
4. `direct(paris seville)`.
5. `direct(rome berlin)`.
6. `fly_direct(P Q) IF direct(P Q)`. *You can fly directly from P to Q if there is direct flight from P to Q.*
7. `one_stop(X Y) IF fly_direct(X Z) AND fly_direct(Z Y)`. *There is only one stop in the flight from X to Y if you can fly directly from X to Z and fly directly from Z to Y.*

(b) Explain the term *sub-goal*.

2

(c) State the solutions to the query:

? `direct(paris X)`

2

(d) State the complex query that will determine which airport can fly to both Rome and Seville.

2

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

? `one_stop(glasgow Y)`

In your answer you will be given credit for the correct use of the term *instantiation/instantiated*.

7

(50)

[END OF SECTION III—PART A]

## SECTION III

## PART B — Computer Networking

21. A holiday park has a website on the Internet.

Below is part of the home page for the holiday park.



(a) The *HTML* code required to create this part of the home page is shown below. Identify the **tags** represented by **A**, **B** and **C**.

```

<A>
  <head>
    <B>Bailey's Holiday Park</B>
  </head>
    <C>
    <h1>Welcome to the World of Family Fun</h1>
    </C>
</A>

```

3

(b) A software development company was appointed to create this website. State the **job title** of the person who should keep the project on track and within timescale and budget.

1

(c) The holiday park has many activities on offer such as cycling or rock climbing. There are a limited number of spaces available for each activity. The website allows guests to book and pay for these activities online before going on holiday.

(i) Describe **one** benefit to the customer of booking these activities online.

2

(ii) The holiday park notices that the number of activities booked has increased. State **one** possible reason for this increase.

1

(iii) Customers are worried about the security aspect of paying online for these activities. State **one** way that the holiday park could reassure customers that paying online is safe.

1

(d) The software development company has created some web pages using *WML* code so that they can be displayed in a *WAP* browser. *WML* code is more limited than *HTML* code. State **two** limitations of *WML* code when creating the web pages.

2

## SECTION III

## PART B — Computer Networking (continued)

22. A car sales company has many branches throughout the United Kingdom. Details of all cars for sale are accessible through their *intranet*.
- (a) A salesperson has to download a 200 Megabyte file which is stored on the central file server. The actual file downloads at a speed of 512 kilobits per second. Calculate the time taken in minutes for this file to be downloaded using this connection. Express your answer to one decimal place. 2
- (b) The *OSI* model is a set of protocols used within computer networks. State the **purpose** of the *OSI* model. 1
- (c) Two protocols used to transmit data are HTTP and TCP/IP.
- (i) Describe the role of the IP protocol when transmitting data over an intranet. 2
- (ii) Name **one** other protocol that could be used to transfer files across an intranet. 1
- (d) When sending data across a network, *packet switching* may be used. Describe how packet switching operates. 3
- (e) A *parity check* is carried out when transmitting data around a network.
- (i) Describe **one** situation where a parity check would fail to detect an error. Use an example to illustrate your answer. 2
- (ii) Explain **one** way in which using a parity check decreases network performance. 1

**[Turn over**

## SECTION III

## PART B — Computer Networking (continued)

23. Ti-Ket Web is a small ticket agency. Ti-Ket Web sells event tickets over the telephone or on the Internet.

- (a) (i) “A rival company sends millions of simultaneous online requests to generate a ticket availability report for a particular concert. At this point the system is inaccessible to normal user requests.”

Name the type of server attack described above.

1

- (ii) State **two** financial consequences of this attack on Ti-Ket Web.

2

- (iii) Describe **two** ways in which the use of a firewall could help to prevent Ti-Ket Web from further attacks.

2

- (b) Ti-Ket Web has a local area network. This network has a *switch*. Explain **one** reason why Ti-Ket Web decided to add a switch rather than a *hub* to the local area network.

2

- (c) The IP addresses for some of the devices on the network are as follows:

Computer 1	198.169.120.100	File Server	198.169.120.103
Computer 2	198.169.120.101	Router	198.169.120.104
Computer 3	198.169.120.102	Printer	198.169.120.105

- (i) State the *class* of IP address used within this network. Justify your answer.

2

A new computer is added to the network. It is allocated the IP address **198.198.120.278**

- (ii) State **one** reason why the second octet is invalid.

1

- (iii) State **one** reason why the fourth octet is invalid.

1

- (d) *Carrier Sense Multiple Access with Collision Detection* (CSMA/CD) is used on this network to control which node can transmit at any one time. State **two** ways in which CSMA/CD might increase transmission time.

2



## SECTION III

## PART B — Computer Networking (continued)

24. Many families use the Internet to search for information and communicate using e-mail.

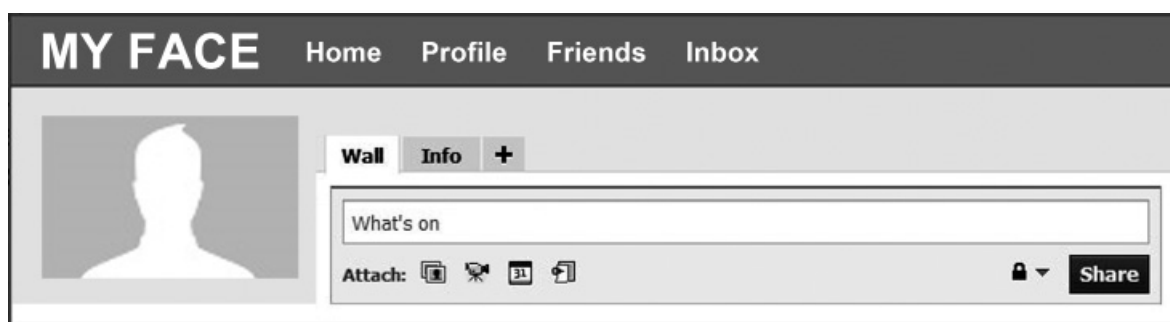
(a) A *meta-search engine* can be used to find information on the World Wide Web.

(i) Explain how a meta-search engine works. 3

(ii) Name **one** method that a search engine could use to build its indexes. 1

(b) State the purpose of SMTP. 1

Social networking sites are used by many children to communicate with other people.



(c) State **two** reasons why some parents may be concerned about their children accessing such sites. 2

(d) (i) A parent has set up a *walled garden*. Explain the term “walled garden”. 2

(ii) His child uses the Internet for homework. State why the child may **not** be happy with the walled garden. 1

(iii) An alternative method that the parent could use is “Internet filtering software”. Explain why this would be more suitable for the child. 1

(e) Some people believe that access to the Internet leads to an *Information Rich* society.

(i) Explain the term “Information Rich”. 2

(ii) State **two** benefits of being Information Rich. 2

**(50)**

[END OF SECTION III—PART B]

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## SECTION III

## PART C — Multimedia Technology

25. The logo for a new business has been drawn on paper and then scanned into a computer. The logo is shown below.



- (a) (i) *CCDs* are used by both scanners and digital cameras when capturing an image. Explain how the *CCD* in a scanner differs from those in a digital camera. 2
- (ii) The edges of the scanned logo appeared slightly jagged. *Anti-aliasing* was used to smooth the edges. Describe how *anti-aliasing* achieves this. 2
- (iii) Explain how *resampling* might remove the jagged edges. 2
- (b) It is suggested that the logo may be stored as a vector graphic. Explain why this logo should be stored as a vector graphic rather than a bitmapped graphic. 2

## SECTION III

## PART C — Multimedia Technology (continued)

26. The members of the Metro Gnome Jazz Club have decided to create a club website. Members are allowed to download files; visitors can *stream* files.

- (a) (i) Explain the term “stream”. 1
- (ii) Describe **one** advantage to the Jazz Club of only allowing visitors to stream files. 2

*Codecs* play an important role during the streaming of files and can be implemented in hardware or software.

- (b) A codec codes and decodes streamed files. State **two** other purposes of a codec during the streaming of a file. 2
- (c) Explain the benefit of having codecs implemented in hardware when receiving streamed multimedia files. 2

The website includes a library of sound files stored in MIDI, WAV and MP3 formats.

- (d) Two of the attributes stored in MIDI files are *duration* and *tempo*. Name **one** other attribute stored in a MIDI file. 1
- (e) State **one** type of sound for which MIDI is unsuitable. 1

A particular piece of music is stored in MIDI and MP3 file formats. Both files are the same size.

- (f) (i) Explain **one** advantage of storing files in MIDI rather than MP3 file format. 1
- (ii) A member downloads both versions of the file. Explain why the sound differs when each file is played back. 2
- (iii) State **two** ways that compression is achieved in the MP3 file format. 2

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## SECTION III

## PART C — Multimedia Technology (continued)

27. David is a car racing fan. He records short video clips of races at a local circuit and transfers the clips to his computer for editing. David uses video editing software to join the video clips taken into one continuous video clip.
- (a) When he joins the clips together, David uses the *timeline* and *transition* features.
- (i) Explain why the timeline feature will be useful for David when he is producing the single continuous clip. **1**
  - (ii) Name **one** transition David could use. **1**
- (b) One of David's video clips plays for 4 minutes. David recorded the clip using 24 bit colour with a resolution of 720,000 pixels per frame at 15 frames per second. Calculate the file size of the uncompressed video. Show all working and express your answer in appropriate units. **3**
- (c) David stores some video clips in the MPEG file format. Describe how MPEG achieves compression. **3**
- (d) David stores other video clips in the AVI file format. Unlike MPEG, AVI does not allow compression. State **two** reasons why the AVI format might still be a suitable file format for some video clips. **2**
- (e) David has old analogue video recordings that he is transferring onto his computer. Describe the roles of the ADC and DSP on the video capture card during the transfer. **2**

## SECTION III

## PART C — Multimedia Technology (continued)

28. Super Tutorials create multimedia lessons.

- (a) All the lessons begin with the Super Tutorials theme tune. The tune plays for 1 minute and was recorded in 32 bit stereo using a sampling frequency of 44.1 kilohertz. Ignoring compression, calculate the file size for the theme tune. Express your answer in appropriate units and show all working. 3

The multimedia lessons include text, video and a voice track.

- (b) Lesson voice tracks are initially stored using the RAW file format. State the name of the **technique** used to convert the analogue signal into a digital form. 1

- (c) The completed lessons, which include video and voiceover sound files, are usually distributed in the RIFF file format.

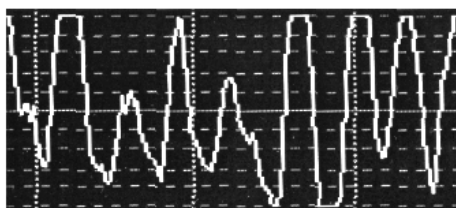
- (i) The RIFF file format is an example of a *container file*. Explain the term “container file”. 2

- (ii) Explain the benefit of using container files in the distribution of multimedia files. 2

- (d) During testing some problems were found with the voice tracks. It was noted that some voice tracks were too loud but others were too quiet.

- (i) Name and describe the function of sound editing software which could be used to make the voice tracks play at the same volume. 2

One voice track file also contained some unclear words. The waveform for part of this file shows the problem.



- (ii) State the term for this problem. 1

- (iii) The problem identified in Question (d)(ii) may have been caused by recording at too high a volume setting. State **one** other possible reason for this problem. 1

[Turn over for Question 28 (continued) on Page twenty-two

## SECTION III

## PART C — Multimedia Technology (continued)

## 28. (continued)

(e) Super Tutorials also supplies lessons on DVD. It has been suggested to Super Tutorials that *holographic* disks may replace DVDs in the future.

(i) Describe how the physical storage of data on a holographic disk differs from a DVD. 2

(ii) Holographic disks allow faster data transfer than DVDs. Explain **why** this is the case. 2

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[END OF SECTION III—PART C]

[END OF QUESTION PAPER]

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