

# X206/301

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NATIONAL  
QUALIFICATIONS  
2008

MONDAY, 2 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 11	Questions 18 to 22
Part B	Computer Networking	Page 15	Questions 23 to 26
Part C	Multimedia Technology	Page 18	Questions 27 to 30

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

Read all questions carefully.

Do not write on the question paper.

Write as neatly as possible.

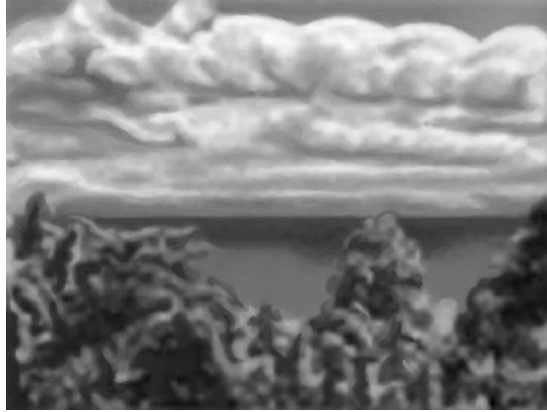


## SECTION I

Attempt all questions in this section.

Marks

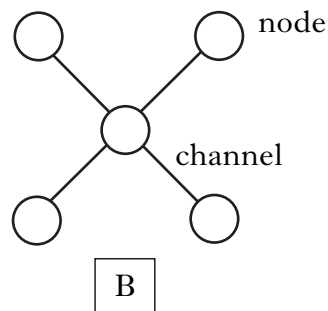
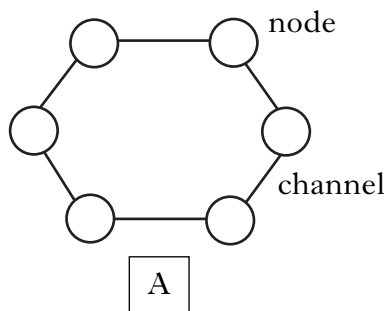
1. Images are stored as *bit-mapped* or *vector* graphics.
- (a) (i) Describe how **bit-mapped** images are stored. 1
- (ii) Describe how **vector** images are stored. 1



- (b) Is the above image bit-mapped or vector? Justify your answer. 2
2. Anti-virus software uses various techniques to detect viruses. One of these techniques is *heuristic detection*.
- (a) Explain how the heuristic detection technique is used to detect a virus. 1
- (b) Explain why a *trojan horse* is **not** classified as a computer virus. 1
3. What is the decimal representation of the 8 bit *two's complement* number 10110110?
- A -182
- B -74
- C -53
- D 182 1
4. (a) The processor has a number of control lines. What is the function of the *reset* line? 1
- (b) Explain why the *address bus* in a computer is unidirectional. 1
5. (a) A *virus checker* and a *disk defragmenter* are *utility programs*. Name **one** other utility program. 1
- (b) Explain how the use of a **disk defragmenter** can improve the system performance of a computer. 2

## SECTION I (continued)

6. Two network topologies are shown below.



- (a) (i) Identify the network topology of Network A. 1
- (ii) Identify the network topology of Network B. 1
- (b) Which of the above topologies would be **least** affected by a channel failure? 1
7. Numbers can be stored within a program as *integer* or *real* variables.  
Explain what is meant by an “integer” variable. 1
8. One task of the evaluation stage of the software development process is to ensure the program meets the *software specification*.
- (a) State **two** other criteria used to evaluate software. 2
- (b) Describe what is meant by the phrase “the software development process is an iterative process”. 1
9. A bank manager uses a *macro* once a month to create an alphabetical list of customers whose account balance is over £5000.
- (a) State **two** benefits of using macros for this type of task. 2
- (b) The macro is written in a high level language. State the **type** of high level language that is used to write macros. 1
10. A program contains the following statement:  
`is_a (rover, dog).`  
State which **type** of programming language is being used. 1

[Turn over

**SECTION I (continued)**

**11.** A holiday booking website includes a currency converter which asks for the amount in pounds sterling and converts it to euros. Here is the top-level algorithm, including data flow for steps 1 and 2.

- |    |                      |  |
|----|----------------------|--|
| 1. | get amount of pounds | (out: <b>pounds</b> )                  |
| 2. | calculate euros      | (in: <b>pounds</b> out: <b>euros</b> ) |
| 3. | display conversion   | .....                                  |

(a) State which *design notation* is being used. **1**

(b) Step 3 results in the following being displayed on screen:

£500 converts to 750 euros.

State the *data flow* for step 3. **2**

(c) Identify whether the **pounds** variable in step 1 should be passed *by value* or passed *by reference*. Explain your answer. **2**

**12.** Explain the purpose of a CASE statement in a high level language. **2**  
**(30)**

[END OF SECTION I]

## SECTION II

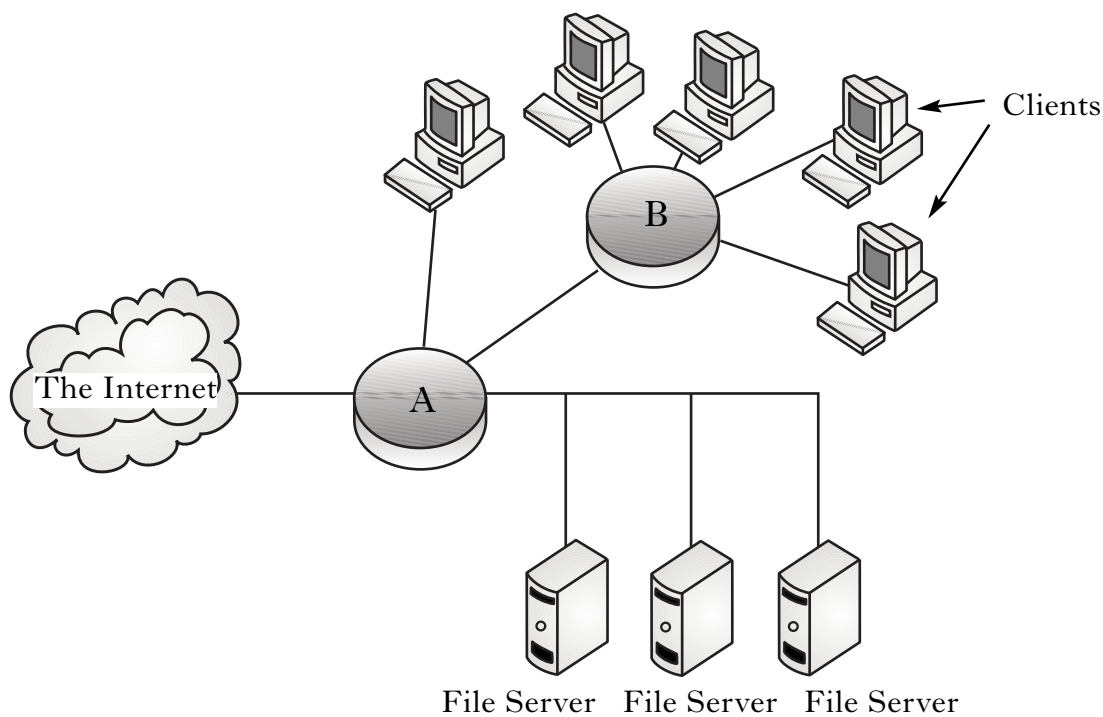
**Attempt all questions in this section.**

13. When designing a new computer the manufacturer could improve system performance by increasing the *clock speed* or adding more *RAM*.
- (a) (i) Describe one **other** way to improve the system performance **and** explain why it would be effective. 2
- (ii) Explain why it is **not** possible to keep improving performance by increasing clock speed. 1
- (b) (i) Describe how *FLOPS* **and** *application based tests* are used to measure system performance. 2
- (ii) Explain why application based tests could be described as the best measure of system performance. 1
- (iii) Explain why FLOPS could be described as the best measure of system performance. 1
- (c) A new computer system has a 3 GHz processor with a 64-bit data bus and a 32-bit address bus. Calculate the maximum amount of memory that can be addressed by this computer. Show all working and express your answer in appropriate units. 3
- (d) Describe how a processor distinguishes one memory location from another. 1

**[Turn over**

## SECTION II (continued)

14. The proposed layout of a new office network is shown below. Cables are used to connect the network.



- (a) A router and a hub are used in the above network.
- (i) State which device, A or B, is the router. State **one** reason to justify your choice of device. 2
  - (ii) State which device, A or B, is the hub. State **one** reason to justify your choice of device. 2
- (b) After the network has been installed, it is discovered that data traffic on the network is slow.
- (i) State **one** technical change which could be made to improve network performance. 1
  - (ii) Explain how this change will improve network performance. 1
- (c) Name a **type** of server that allows Web pages to be accessed within a LAN. 1

## SECTION II (continued)

15. James wants to make copies of some photographs. He intends to use a scanner to capture the photographs and an ink jet printer to print the final images.
- (a) State the function of the operating system that is responsible for the data transfer between the processor and scanner. **1**
- (b) (i) Explain why saving the scanned image as a *gif* would **not** be appropriate in this case. **1**
- (ii) State a suitable file format for saving the file. **1**
- (c) The scanner is set to a resolution of 1200 dpi using *24 bit colour depth* and the photographs are 6 inches by 8 inches. Calculate the uncompressed size of the file. Express your answer in appropriate units. Show all working. **3**
- (d) One function of the printer interface is to inform the processor that it is ready to receive the next photograph. State the name of this function. **1**
- (e) State **one** advantage of using *serial* over *parallel* transmission when sending data to a printer. **1**
- (f) State **one** technical characteristic that the printer should have. Justify your answer. **2**
- (g) When James prints his images he discovers lines across some of them. The lines are where the original photographs had been folded over. Explain why he would use a bit-mapped package to remove the lines. **2**

[Turn over

## SECTION II (continued)

16. An international athletics competition between eight countries has a number of events. Here are the results for one race.

Lane Number	Country	Time (secs)
1	Ireland	40.23
2	Italy	41.05
3	England	42.88
4	France	39.89
5	Germany	40.55
6	Poland	40.01
7	Scotland	39.87
8	Wales	42.55

The stadium's computer system has a program which processes and displays the results.

- (a) State **two** system requirements that would have been specified for the installation of the program. 2
- (b) The program is modular. State **two** benefits of creating modular code. 2
- (c) At the end of a race, messages are displayed. For example:

**Winner: Sco 39.87**

The winning country for a race is stored in a string variable called **winner**.

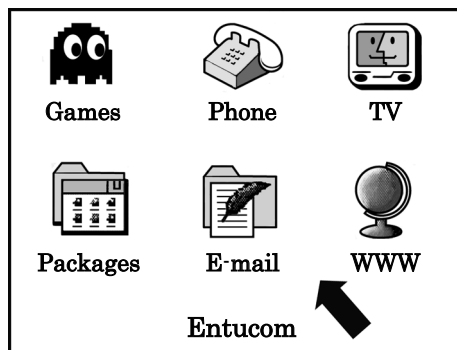
Using code from a programming environment with which you are familiar, show how to extract the first three characters from the variable **winner**. 2

- (d) The program stores the list of race times in a single data structure.
- (i) State the data structure and data type used to store the race times. 2
- (ii) The program must find the fastest time for a race. Use pseudocode to design an algorithm to find the fastest time. 4
- (iii) It is suggested that it would be preferable for the algorithm to find the **lane number** of the fastest time rather than the fastest time. Explain how this could be achieved. 1



## SECTION II (continued)

17. Entucom is a television broadcaster that gives customers access to various services. Customers will access these services using their television and a set-top box with wireless keyboard and mouse.



The television broadcaster employs a software development company to provide the range of software required.

- (a) The software development company appoints a *systems analyst* during the analysis stage of the software development process.
- (i) Describe **two** tasks carried out by the systems analyst. 2
- (ii) State **two** benefits that the analysis stage has for the **remaining** stages of the software development process. 2
- (b) During implementation, the software development company consider the use of either a *procedural* or an *event-driven* language.
- (i) Describe **two** similarities of **procedural** and **event-driven** languages. 2
- (ii) State **two** reasons why a programmer would use an **event-driven** language to develop software. 2
- (c) During the development of the software, *module libraries* are used. The modules limit the *scope* of certain variables.
- (i) What is a **module library**? 1
- (ii) Describe **one** way in which the **scope** of a variable may be limited. 1
- (iii) Explain why the programmer might want to **limit** the scope of a variable. 2
- (d) The software developed should be subject to testing using a comprehensive set of **test data**. State **two** other methods of testing comprehensively. 2
- (e) Entucom insist that the software is *portable*. Explain why portability is important in this situation. 1
- (f) New set-top boxes may be developed in the future. State which type of maintenance could be required to ensure the software works with the new boxes. Explain your answer. 2

(60)

[END OF SECTION II]

### SECTION III

Attempt ONE sub-section of Section III

<b>Part A</b>	<b>Artificial Intelligence</b>	<b>Page 11</b>	<b>Questions 18 to 22</b>
<b>Part B</b>	<b>Computer Networking</b>	<b>Page 15</b>	<b>Questions 23 to 26</b>
<b>Part C</b>	<b>Multimedia Technology</b>	<b>Page 18</b>	<b>Questions 27 to 30</b>

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

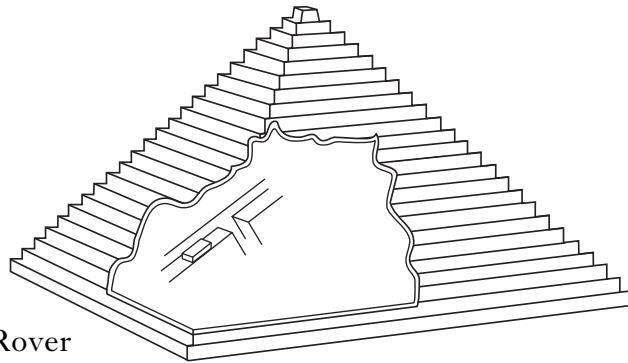
SECTION III

Marks

Part A—Artificial Intelligence

Attempt all questions.

18. Archaeologists are still exploring areas of the Great Pyramids in Egypt. These pyramids have a maze of tunnels with sharp turns and sudden drops. Unknown routes through tunnels are explored by robots such as Pyramid Rover. The robot is operated by humans from a control room.



Pyramid Rover

- (a) State **two** reasons why Pyramid Rover has its movement controlled by humans. 2
- (b) Describe **two** practical problems that had to be overcome when the Pyramid Rover was designed. 2
- (c) Despite having its movement controlled, Pyramid Rover is classed as an *intelligent robot*, rather than a *dumb robot*.
- (i) Describe **one** situation where Pyramid Rover would **need** intelligence as well as, or instead of, user control. 1
- (ii) Explain how Pyramid Rover would apply intelligence in this situation. 1
- (d) After using the control software on Pyramid Rover, the archaeologists ask for several new features to be added. Name this type of software maintenance. 1
19. Computer games have been available since the 1960s.
- (a) State **two** differences that a **user** of modern computer games would notice compared to these early games. 2
- (b) State **two** benefits that modern software development environments offer programmers of current games. 2
- (c) (i) Explain how the use of parallel processors has aided the performance of computer games. 2
- (ii) Other than parallel processing, state **two** other advances in hardware which have led to improvements in the performance of computer games. 2
- (iii) Explain how each of these advances has led to this improvement in performance. 2

## SECTION III

## Part A—Artificial Intelligence (continued)

20. (a) Artificial Intelligence programming languages are categorised as either *functional* or *declarative* (logic).
- (i) Name a functional language. **1**
- (ii) Name a declarative language. **1**
- (iii) State whether the following section of code is written using a functional or a declarative language. **1**

```
(defun eliza ()
  "Respond to user input using pattern matching rules."
  (loop
    (print 'eliza>)
    (write (flatten (use-eliza-rules (read))) :pretty t)))
```

- (b) *Semantic nets* are used to represent knowledge before coding.

Use a semantic net to represent the following information about some herbs.

*Mint and basil are herbs.*

*Pennyroyal and spearmint are types of mint.*

*Genovese basil and purple basil are two types of basil.*

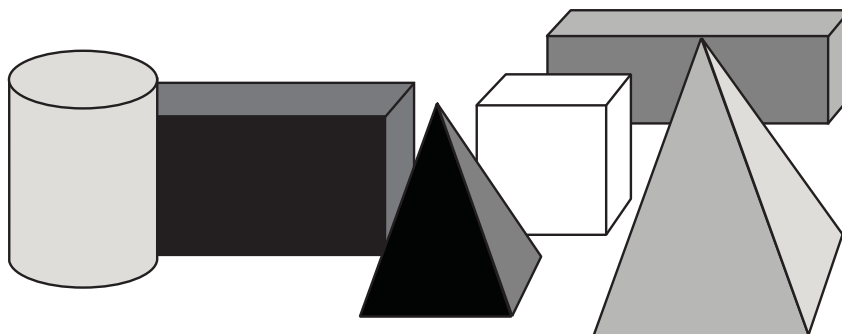
*Mints can be used in making tea, basil is used in the making of pesto.*

**6**

## SECTION III

## Part A—Artificial Intelligence (continued)

21. SHRDLU is a program which uses *natural language processing* (NLP) to manipulate blocks of various colours, shapes and sizes. An initial setup of the objects is shown below.



SHRDLU understands commands such as:

put the grey cylinder on top of the black block

put the white cube in front of the grey block

- (a) Here are two commands from a SHRDLU dialogue. What is the problem with each command?

(i) put it on its side 1

(ii) put the pyramid on the grey block 1

- (b) SHRDLU will accept the command

grasp the grey block

Explain why SHRDLU might not understand the following command:

grip the grey block 1

- (c) State **one** reason why there are more problems with natural language processing than with more formal programming languages. 1

- (d) In speech recognition software, there are four main stages of NLP. The first is speech recognition and the last is speech synthesis. Name the remaining **two** stages. 2

- (e) Eliza is an application of NLP. Explain how Eliza responds to user input. 2

[Turn over

## SECTION III

## Part A—Artificial Intelligence (continued)

22. There have been nine manned Apollo space flights to the moon. Six have landed astronauts on the surface of the moon. Two of the crew would land on the moon whilst the other would remain in orbit.

The following is an extract from a knowledge base recording space expeditions to the moon.

```
1 apollo(7, schirra, eisele, cunningham).
2 apollo(8, borman, lovell, anders).
3 apollo(11, armstrong, collins, aldrin).
4 apollo(12, conrad, gordon, bean).
5 apollo(13, lovell, swigert, haise).
6 apollo(16, young, mattingly, duke).
7 apollo(17, cernan, evans, schmitt).
```

*On Apollo 7, Schirra, Eisele and Cunningham were the crew.*

```
8 crew_landed_on_moon(A) IF apollo(A,_,_,_) AND
                           A>10 AND
                           not(A=13).
```

*A landed on the moon if A was an Apollo mission and the flight was after Apollo 10 and A was not 13.*

```
9 walked_on_moon(X,Z) IF apollo(A, X,_,Z) AND
                        crew_landed_on_moon(A).
```

*Astronauts X and Z walked on the moon if X and Z were the first and third crew members of Apollo A and Apollo A landed on the moon.*

**Note:** The underscore ‘\_’ in lines 8 and 9 is used when the value of the argument is irrelevant to the rule and can be ignored.

- (a) Use the line numbers to identify an example of each of the following in the above program:

(i) a fact; 1

(ii) a rule. 1

- (b) Name the **two** search techniques used in artificial intelligence. 2

- (c) State the solution to the query:

?apollo(A, armstrong, Y, aldrin). 2

- (d) Trace the first solution to the query:

?walked\_on\_moon(conrad, bean).

In your answer, you will be given credit for the correct use of the terms “sub-goal” and “instantiated”. 8

- (e) Explain why there is a problem with the solution to the following query:

?walked\_on\_moon(duke, young). 2

**(50)**

[END OF SECTION III—PART A]

## SECTION III

## Part B—Computer Networking

Attempt all questions.

23. Ditton High School plans to set up a network of computers throughout the school. The school is made up of three separate buildings. Within each building a wired network is created. Wireless technology is used to share data between the buildings.
- (a) Describe **one** economic reason why the school would have chosen to connect the school buildings using wireless technology. 1
- (b) Describe **two** reasons in favour of using a *star* topology rather than a *bus* topology in each of the separate buildings. 2
- (c) The school network consists of 256 devices. Which *class* of IP address should be used within the network? 1
- (d) Describe **one** implication of a network being allocated an inappropriate class of IP address. 1
- Two methods used by the school to protect the network and the pupils are a *firewall* and a *walled garden*.
- (e) Describe how a **firewall** protects a local area network with an Internet connection from outside attacks. 1
- (f) Why would the school have decided to set up a **walled garden**? 2
24. Mel is creating a website to show images and video clips from a recent holiday. The homepage contains the title “Mel’s Website”. The title is in bold and italics.
- (a) Write the *HTML* code required for the title. 3
- (b) Mel publishes her webpage and submits the page to various *meta-search engines*. Describe how a **meta-search engine** operates. 2
- (c) Describe in detail how the increase in the availability of ADSL connections has affected the design of web pages. 2
- (d) The TCP/IP protocol will be used when uploading certain files. Describe **two** operations carried out by the TCP part of the protocol. 2
- (e) State which layer of the *OSI model* is described by the following:
- (i) “provides a means for the user to access information on a network using appropriate software”; 1
- (ii) “translates data into a format suitable for the other layers to deal with”. 1
- (f) The OSI model describes seven layers or levels. State **one** benefit of breaking the process of network communication into different layers. 1

## SECTION III

## Part B—Computer Networking (continued)

25. Module libraries are to be used in the development of a piece of software that will be used to transfer data across a local area network.
- (a) State **two** reasons why the use of module libraries speeds up the development of software. 2
- (b) The program can allow data to be sent *synchronously* or *asynchronously*.  
Describe asynchronous data transmission. 2
- (c) Data can be sent using *packet switching* or *circuit switching*.  
Describe fully **one** advantage of packet switching over circuit switching. 3
- (d) Error checking is an essential component of data transmission. *Parity check* is one method of error checking.
- (i) Describe **one** instance where a parity check would not detect an error that has occurred during transmission. You should use an example to illustrate your answer. 2
- (ii) Name **one** other method of **detecting** data transfer errors within a network. 1
- (iii) Describe how this method works. 2
- (e) “Error checking increases data transfer time whilst improving network performance.”  
Justify this statement. 2



## SECTION III

## Part B—Computer Networking (continued)

26. Gordon frequently accesses websites as part of his work as a salesman.
- (a) Gordon enters the URL of a site he wishes to visit. This URL is sent to a *domain name server* to be resolved.  
What occurs during domain name resolution? 2
- (b) Describe **two** reasons why a domain name server may be unable to resolve a URL. 2
- (c) Gordon lives in a rural village where high speed Internet access is not available through telephone or cable lines. However, he often works at home using his laptop to connect to the company server.
- (i) State **one** way in which Gordon could obtain high speed Internet access. 1
- (ii) Describe **two** security issues that Gordon’s employers will have to consider when allowing their employees to remotely access the company server. 2
- (iii) Other than allocating usernames and passwords, describe how each of the security issues you have described in part (ii) could be overcome. 2
- (d) Gordon creates a *wireless personal area network* (WPAN).
- (i) Other than a desktop or laptop computer, state **two** other devices commonly found in a WPAN. 2
- (ii) Describe **two** reasons why Gordon would create a WPAN with these devices. 2
- Gordon’s managers are concerned over possible misuse of the IT equipment issued to their staff. They begin to check the content of their employees’ e-mails.
- (e) (i) State the Law which allows the managers to carry out these checks. 1
- (ii) Describe **two** other surveillance activities that this Law allows employers or the police to carry out. 2
- (50)

[END OF SECTION III—PART B]

## SECTION III

## Part C—Multimedia Technology

Attempt all questions.

27. A multimedia application called “Chef” is to be created to accompany a new cookbook. The software development process is applied to the creation of “Chef” software.
- (a) The purpose of the multimedia application is one aspect which must be investigated during the *analysis* stage.  
State **two** other aspects which must also be investigated. 2
- (b) Presentation software allows the inclusion of media elements and the use of hyperlinks to move between pages.  
Describe **two** advanced features of authoring software which make it more suitable for creating a multimedia application. 2
- (c) Describe **two** ways in which “Chef” should be tested. 2
- (d) When “Chef” is released, it is distributed along with software used to view the application.
- (i) State **two** benefits of this distribution method for the user. 2
- (ii) State **one** benefit of this distribution method for the software development team. 1
- The performance of a multimedia application can depend on the hardware components of the system. These could include a powerful processor and the use of *holographic storage*.
- (e) Explain how the use of a more powerful processor will benefit the performance of a multimedia application. 2
- (f) Explain how **holographic storage** can be used to store terabytes of data. 2
- (g) Other than processing and storage, name **one** development in computer **hardware** and describe how it has supported advances in multimedia. 2

## SECTION III

## Part C—Multimedia Technology (continued)

28. The image shown below is being used in the advertising campaign for a new dog biscuit called “Bonzo Bites”.



- (a) The original image is a bitmap file.

Explain the purpose of a *CLUT* in this file format.

1

- (b) Describe a benefit of using a *CLUT* when applying effects to a bitmap image.

1

The biscuit name was created using graphics software. It was saved as a graphic file type. It is shown below.

# Bonzo Bites

- (c) (i) State the technique that could be applied to the text to improve its appearance.

1

- (ii) Explain how the use of this technique improves the appearance of the text.

2

The text is added onto the image. The text appears in a white box as shown below.



- (d) (i) Name the feature which will avoid showing the white box.
- (ii) Name **one** graphics file format that provides this feature.

1

1

## SECTION III

## Part C—Multimedia Technology (continued)

## 28. (continued)

- (e) The image file is edited and saved as a compressed bitmap file.
- (i) Describe how the *RLE* compression method reduces the file size. 2
- (ii) Explain why this compression method may **not** be effective on this image file. 2
- (f) *Object oriented* data storage is more efficient than *bitmap* storage.
- (i) Explain when this statement is **not** true. 2
- (ii) Name and describe **one** file type suitable for 3D object oriented data storage. 2

## 29. A website is being developed for Write Rhymes, a company that writes poems and rhymes.

- (a) A video clip is placed on the home page. It contains a child introducing the company by reciting a rhyme. The video will be played using *streaming*.
- (i) What is meant by the term “streaming”? 1
- (ii) Describe **one** reason why it was decided to stream the video clip. 1
- (b) The video clip was recorded using 15 frames per second in 24 bit colour depth with  $600 \times 800$  pixels. The clip lasts for 2 minutes.
- Calculate the file size of the video clip. Ignore sound and compression in your calculation. Show all working and express your answer in appropriate units. 3
- (c) The font used on each page was specially created for Write Rhymes. When the pages are viewed by potential customers they see a substitute font instead.
- What should have been done to ensure this font is shown correctly? 1
- (d) On the birthday rhyme page, audio clips of sample rhymes can be played. Each rhyme is stored as a *RIFF* file.
- (i) Name the *codec* used by RIFF. 1
- (ii) Describe the technique used for compression by this *codec*. 1
- (e) The rhymes are recorded in mono.
- Explain why the recording was not made in stereo. 1
- (f) Copyright is held by Write Rhymes for all content on the website.
- Describe **two** examples of how users could breach copyright. 2

## SECTION III

## Part C—Multimedia Technology (continued)

30. A choir use a recording studio to produce their own CD.
- (a) The vocals for each track are captured using *digitised sound*.  
 Explain the term “digitised sound”. 1
- (b) The backing music for each track is an instrumental MIDI file.
- (i) State **one** reason why MIDI would produce a high quality sound. 1
- (ii) MIDI has a small file size compared to digitised sound.  
 State **one** further benefit that MIDI has over digitised sound. 1
- (iii) State **two** reasons why some musical artists do not use MIDI. 2
- (c) The vocals and backing music are combined to produce each completed track.  
 Name **two** features of sound editing software and explain how **each** may be used to improve the completed track. 4
- (50)**

[END OF SECTION III—PART C]

[END OF QUESTION PAPER]

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