# X206/301

NATIONAL QUALIFICATIONS 2007

MONDAY, 28 MAY
1.00 PM – 3.30 PM

# COMPUTING
# HIGHER

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.

SA X206/301 6/3/8670

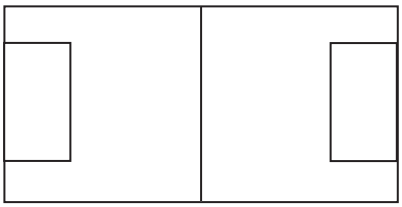
SCOTTISH QUALIFICATIONS AUTHORITY

## SECTION I

**Attempt all questions in this section.**

*Marks*

**1.** Two versions of the image below have been created. One in a *bit-mapped* graphic package and the other in a *vector* graphic package.



If a circle is added to the centre of the graphic, what is the effect on the file size in each case? **2**

**2.** *ASCII* and *UNICODE* are both used to represent text in computer systems.

(*a*) Describe one **advantage** of UNICODE over ASCII. **1**

(*b*) Describe one **disadvantage** of UNICODE over ASCII. **1**

**3.** What is the **8 bit** *two's complement* representation of the number **–72**? **1**

**4.** Explain why increasing the width of the *data bus* improves *system performance*. **1**

**5.** The *read* and *write lines* are two *control lines*. Name **two** other control lines. **2**

**6.** Describe how a printer *spooler* operates. **2**

**7.** When a program is loaded from a hard disk drive into *RAM* which function of the *operating system* is responsible for ensuring that there is enough RAM available to load the file? **1**

**8.** (*a*) Draw and label a diagram of a *mesh* network with five nodes. **1**

(*b*) Explain how the topology of a mesh network includes protection against the consequences of channel failure. **1**

**9.** When a computer is switched on part of the operating system (OS) is already in memory.

(*a*) What is the name given to the part of the OS that locates and loads the rest of the OS into memory? **1**

(*b*) State the **type** of virus that can affect the computer **during** the loading of the operating system. **1**

## SECTION I (continued)

**10.** Software can be evaluated in terms of its *portability*. Describe what is meant by "portability". **2**

**11.** A software development company prefers to employ an *independent test group* during the test stage.

(*a*) Describe what is meant by an "independent test group". **1**

(*b*) Explain why the software development company prefers to use such a group. **1**

**12.** *Maintainability* is an important characteristic of software. State **two** characteristics of program code that improve maintainability. **2**

**13.** One type of high level language is a *declarative language*. State **two** features of a declarative language. **2**

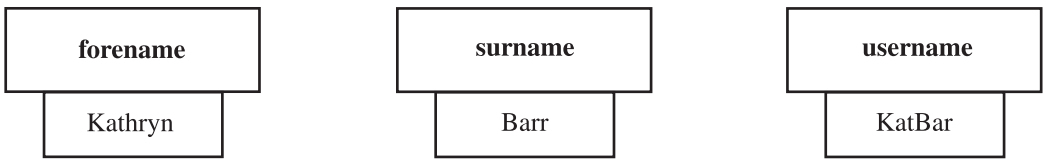
**14.** Programmers make use of different types of variables including *Boolean*.

(*a*) Describe what is meant by a "Boolean" variable. **1**

(*b*) Describe, using *pseudocode*, how a Boolean variable would be used. **1**

**15.** A *macro* extends the functionality of a general-purpose package. State **two** methods of creating a macro. **2**

**16.** The string variable **forename** contains "Kathryn" and the variable **surname** contains "Barr". The variable **username** is assigned the value "KatBar" using the first three characters of each name.




Use a language of your choice to show how substrings and concatenation would be used to assign the value "KatBar" to the variable **username**. **3**

**(30)**

[*END OF SECTION I*]

*Marks*

## SECTION II

**Attempt all questions in this section.**

**17.** John uses his digital camera to take photographs. It has a 512 Megabyte memory card. His camera uses 16,777,216 colours and is set to a *resolution* of 3000 × 2000 pixels.

(*a*) (i) Calculate the file size of a single image. Your answer should be in appropriate units. Show **all** working. **3**

(ii) What is the maximum number of images of this size that can be stored on John's memory card? **2**

(*b*) State **two** reasons why digital images are stored as *JPEGs*. **2**

(*c*) He changes the setting in his camera to reduce the *bit-depth*.

Describe **one** effect that this will have. **1**

(*d*) He connects his camera to his computer. One function of the interface is the handling of *status signals*. Describe what is meant by the term "status signals". **2**

(*e*) There are a large number of pictures on his hard disk. The combined size of all of his photographs is 3 Gb.

He can use a *solid-state storage device* or Rewritable DVD to take **all** of his photographs to his chemist shop for printing. Recommend one of these devices and justify your choice. **1**

**18.** Crawford Construction Ltd has employed a *systems analyst* to investigate the possibility of networking all of the computers in the company.

(*a*) Describe **one** technique the systems analyst could use at the analysis stage. **1**

(*b*) The systems analyst recommends a *client-server* network.

State **two** benefits of a client-server in terms of network management. **2**

(*c*) Describe **two** technical factors that have contributed to the growth of *local-area networks* (LANs). **2**

(*d*) LANs may use a *hub* or a *switch*.

Explain the difference between a hub and a switch. **2**

(*e*) The LAN is to be connected to the Internet.

(i) State **one** benefit of installing a *web server*. **1**

(ii) Describe **two** possible problems which could arise from connecting the LAN to the Internet. **2**

**SECTION II (continued)**

**19.** Hazeltown Basketball Club would like to set up a computer system to manage their membership details. The Secretary already has a computer but does not have any suitable software.

(*a*) Before purchasing the new software the Secretary must ensure that the software is compatible with his computer. Processor speed is one hardware factor which should be considered when making the purchase.

(i) Name **one** other hardware factor which should be considered. **1**

(ii) Name and describe **one** piece of documentation likely to be provided with the software. **2**

(*b*) The secretary decides to buy a new computer. He has a choice of either the Mercury ZX or the Phantom IV.

| **Mercury ZX** |
|---|
| 3·7 GHz Ami Processor |
| 1 Mb Cache memory |
| 32 bit Data Bus |
| 24 bit Address Bus |
| 512 Mb RAM |
| 400 Gb Hard Disk |

| **Phantom IV** |
|---|
| 3·9 GHz Storm Processor |
| 2 Mb Cache memory |
| 32 bit Data Bus |
| 24 bit Address Bus |
| 512 Mb RAM |
| 320 Gb Hard Disk |

(i) Explain **one** technical reason why the Phantom IV may give the best performance. **2**

(ii) State **one** technical reason why the Mercury ZX may give the best performance. **1**

(iii) Calculate the maximum amount of memory which the Phantom IV computer can address. Give your answer in appropriate units. Show **all** working. **3**

**[Turn over**

**SECTION II (continued)**

**20.** Scientists are interested in studying the possible effects of global warming. Devices are placed at various locations to record temperatures. Each device takes one thousand temperature readings per day. Sample readings are shown below.

| Temperature |
|---|
| 2·04 |
| 1·62 |
| 0·04 |
| 1·42 |
| 2·56 |
| 3·52 |

A program has been written to perform some analysis on the data collected.

(*a*) The temperature readings are stored in a 1-D array.

(i) What is meant by a 1-D array? **2**

(ii) Which data type is suitable for the array? **1**

(*b*) The program must find how many of the 1000 readings are above zero and less than ten degrees. Use *pseudocode* to write an algorithm which would determine the number of readings in this range. **5**

(*c*) The data is imported into a spreadsheet to perform additional analysis using a *scripting language*.

(i) Describe **two** features of a scripting language. **2**

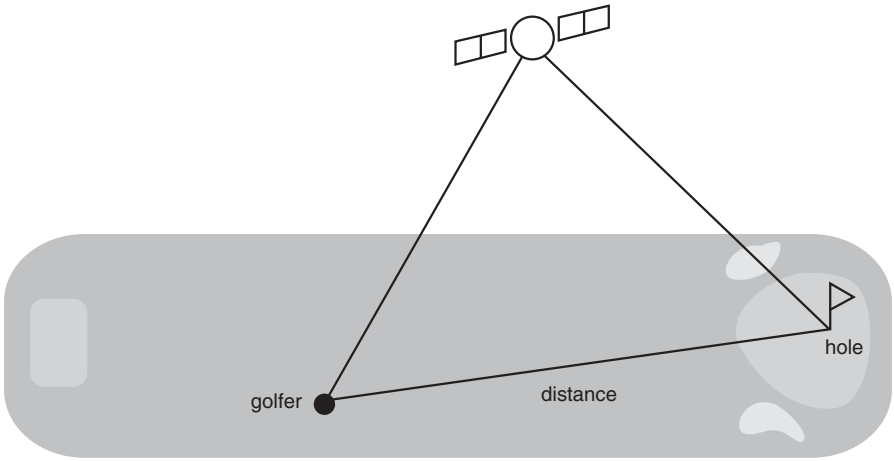
(ii) Describe **two** advantages of using a scripting language within the spreadsheet compared to developing all of the code using a high level programming language. **2**

(iii) Other than importing data suggest another use for a script. **1**

(*d*) Another device records air pressure as a 16 bit positive integer. Calculate the range of numbers that this device can store. **2**

**SECTION II (continued)**

**21.** A manufacturer of palmtop computers with a global positioning system wishes to offer its customers the facility to obtain distances when playing golf. It is helpful for golfers to know the distance from where they are to the hole. This helps the golfer play the next shot.




They appoint a software development company to create the software for this new system.

(*a*) The software company appoints a project manager. Describe **two** aspects of the role of the *project manager*. **2**

(*b*) (i) Name and describe a document that the systems analyst will produce as a result of the analysis stage. **2**

(ii) Describe **two** ways in which this document could be used later in the software development process. **2**

(*c*) The software company uses *stepwise refinement*. Describe what happens during stepwise refinement. **2**

(*d*) The software company is keen that the software written should be *efficient*. Give **two** reasons why it is important that software written for a handheld computer should be efficient. **2**

(*e*) The software is released to customers but the golfers complain that the calculated distances are very inaccurate.

(i) Which type of maintenance is required? Give a reason for your answer. **2**

(ii) Explain why documenting the testing stage of the software development process will aid maintenance. **1**

(*f*) The software could be translated using a *compiler* or an *interpreter*. State **two** reasons why a compiler is a more suitable translator for this application. **2**

**(60)**

[*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.**

*Marks*

## SECTION III

### Part A—Artificial Intelligence

**Attempt all questions.**

**22.** Mobile robots use *computer vision systems* when carrying components around a factory.

(*a*) *Image acquisition* and *signal processing* are the first two of the five stages of computer vision. What are the last **three** stages? **3**

(*b*) State **two** difficulties that a vision system on a mobile robot may have in interpreting a new layout of machinery in a factory. **2**

(*c*) The factory has recently replaced dumb robots with intelligent robots. State **two** reasons why they may have done this. **2**

(*d*) (i) Describe **one** legal implication which may arise from the increasing use of intelligent robots. **1**

(ii) How can this legal implication be addressed by the robot manufacturer? **1**

**23.** *Natural language processing* is one area of artificial intelligence that will enable many more people to use computers.

(*a*) Ambiguity of meaning and similar sounding words both cause problems to developers of natural language processing.

(i) Name **one** other type of problem, generated by everyday language, that developers face. **1**

(ii) Give an example to show how your answer to (i) may cause the developer a problem. **1**

(*b*) A school pupil uses an automatic translator to help with his Spanish homework. Describe **two** problems that might be associated with using this translator. **2**

(*c*) Eliza was an early natural language application.

Explain how Eliza would select a response to the following user input:

"I find my homework hard." **2**

(*d*) Explain how faster processors and more memory have improved the performance of modern *chatterbots*. **2**

(*e*) Some modern game programs learn how their human opponent is playing and work out strategies to respond. Explain how the availability of parallel processing might aid the development of game playing programs. **2**

## SECTION III

### Part A—Artificial Intelligence (continued)

**24.** Modern computers can now demonstrate many aspects of intelligence. Creativity and language processing are two aspects of intelligence which may be included as part of an artificial intelligence system.

(*a*) Name and describe **one other** aspect of artificial intelligence which is currently being developed. **2**

(*b*) Describe **two** reasons why creativity is difficult to include as part of an artificial intelligence system. **2**

**25.** A mobile phone shop uses an *expert system* to advise customers which phone is best for them. It is essential that the user interface in such a system offers *justification facilities*.

(*a*) (i) Explain what justification facilities do. **2**

(ii) Explain why these are important to the customer. **2**

(*b*) Explain **two** problems that the customer might experience when using this expert system. **2**

(*c*) What is the role of the sales staff at the mobile phone shop during the testing stage of the development process? **1**

(*d*) A *neural network* could also be used to advise the customer.

(i) Explain **one** difference between a neural network and an expert system. **2**

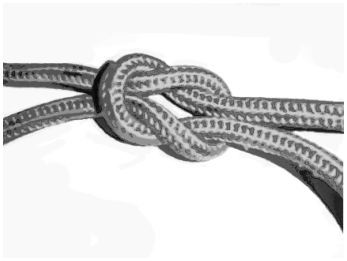
(ii) Explain how the neural network could be trained. **3**

**[Turn over**

## SECTION III

### Part A—Artificial Intelligence (continued)

**26.** The type of rope used for tying knots will affect the usefulness of the knot. Prolonged exposure to sunlight will reduce the strength of the rope and each type of rope has a sunlight rating, 1 is poor, 4 is excellent.



A rope seller has started to create a knowledge database about the type of rope he sells; this is part of it:

| | | |
|---|---|---|
| 1 | fibre(sisal, sinks). | *Sisal is a fibre that sinks in water* |
| 2 | fibre(manilla, sinks). | |
| 3 | fibre(polythene, floats). | |
| 4 | fibre(polycot, floats). | |
| 5 | rating(sisal, 4). | *Sisal has a sunlight rating of 4* |
| 6 | rating (manilla, 4). | |
| 7 | rating(polythene, 2). | |
| 8 | rating(polycot, 3). | |
| 9 | used_on_boats(X) IF fibre(X, floats). | *Rope X can be used on boats if rope X floats* |
| 10 | sailing_in_med(X) IF used_on_boats(X) AND rating(X,Y) AND Y>2. | *Rope X can be used for sailing in the Mediterranean if it can be used on boats and has a rating Y which is greater than 2* |

(*a*) What would be the solution to the query?

?used_on_boats(X) **2**

(*b*) (i) What is the solution to the query?

?NOT(fibre(cotton, floats)) **1**

(ii) Explain why the program arrived at this solution. **2**

(iii) What is the problem with this solution? **1**

## SECTION III

### Part A—Artificial Intelligence (continued)

**26. (continued)**

(*c*) Assuming that a *depth-first search* is used, trace the first solution to the query

?sailing_in_med(X)

You must include the correct use of each of the following words in your trace.

**sub-goal, backtrack** and **instantation** (or **instantiated**).

Use the line numbers to help your explanation. **9**

**(50)**

[*END OF SECTION III—PART A*]

**[Turn over**

*Marks*

## SECTION III

### Part B—Computer Networking

**Attempt all questions.**

**27.** A small sports clothing company decide to sell their goods via the Internet. Their website is http://www.sportsclothingdirect.co.uk. As a result they now pay less on wages and rent.

(*a*) State **two** additional benefits to a company of trading via the Internet. **2**

(*b*) The company is allocated a class C IP address instead of a class A. Explain why this is the case. **1**

(*c*) The website is created using HTML. The first three lines of coding for a page are shown:

```
<title>Welcome to Sports Clothing Direct
<body>
<i><b>Great deals at Sports Clothing Direct!!</i></b>
```

Identify **two** errors present in this HTML code. **2**

(*d*) The company is keen to adapt the website so that it would be available to devices equipped with WAP technologies.

(i) Describe **two** factors that the company should take into account when adapting the site for use with WAP technologies. **2**

(ii) *Wireless Mark-up Language* (WML) is used to produce Web content that can be read from WAP devices. Describe **two** ways in which WML differs from HTML. **2**

(*e*) Explain how staff at the sports company may have been involved at the testing stage of the development of the website. **1**

## SECTION III

### Part B—Computer Networking (continued)

**28.** Gayle is a weather forecaster. She uses her computer to transmit data across networks in different parts of the United Kingdom.

(*a*) Explain why it is important that networks are designed using international standards such as the *Open Systems Interconnection* (OSI) model. **1**

(*b*) When Gayle sends a file across the network the TCP/IP protocol is used. What part does the TCP/IP protocol play in the transfer of files over a network? Your answer must clearly identify which protocols are used at each stage. **5**

(*c*) A *Cyclic Redundancy Check* (CRC) is often used when sending data around a network.

(i) Describe how CRC operates. **4**

(ii) Explain **two** ways in which CRC **decreases** network performance. **2**

**29.** GraphicComs is a large graphic design company. It requires a backup strategy to minimise data loss. It intends to use a *backup server*, *mirror disks* and a *backup schedule*.

(*a*) How would GraphicComs use a backup server, mirror disks and a backup schedule to implement a backup strategy? **3**

(*b*) The company also puts in place disaster avoidance techniques.

Name and describe **one** *disaster avoidance* technique that the company could use. **2**

(*c*) This network uses CSMA/CD.

(i) Describe how CSMA/CD operates. **4**

(ii) Explain why CSMA/CD is often used within networks. **2**

**[Turn over**

## SECTION III

### Part B—Computer Networking (continued)

**30.** The Singh family purchases a home computer system and sign up for Internet access. The parents intend to use the Internet for on-line banking. They are however, worried about the security of on-line banking. Their bank's website states that it uses *encryption* when transferring sensitive information.

(*a*) Explain **two** other ways in which the bank could ease the security concerns of the parents. **2**

(*b*) The children of the family are keen to purchase music on-line. They would like the files to download quickly.

(i) Suggest **one** type of Internet connection that would help minimise the time spent downloading these music files. **1**

(ii) Justify your answer. **1**

(*c*) The parents are concerned that their children spend too much time on the Internet. They believe that their children are not developing social skills.

Are the parents justified in their concerns? Explain your answer. **1**

**31.** In a hospital, data is held in a central server. All staff can access patient details such as name, address and contact details. Only doctors can access confidential information such as a patient's medical history and previous treatments.

(*a*) Describe how the access to information could be set up so as to ensure that the confidential information was only viewed by the correct personnel. **1**

(*b*) The hospital uses a **star** network. The network consists of one server, a switch and four client machines. Sketch this star network, fully labelling your diagram. **3**

(*c*) Confidential data is sent around the network using *packet switching*.

(i) Name the other method of switching data. **1**

(ii) Describe **two** advantages of using packet switching over the method named in part (i) when transmitting confidential data. **2**

(*d*) The doctors want to monitor the network activities of their employees.

(i) Which law allows them to engage in this monitoring? **1**

(ii) Describe **two** ways in which the doctors could use the powers given to them by this law to monitor the employees. **2**

(iii) Explain how a firewall is used to monitor Internet access in the hospital. **2**

**(50)**

[*END OF SECTION III—PART B*]

*Marks*

## SECTION III

### Part C—Multimedia Technology

**Attempt all questions.**

**32.** A Web design company is creating a website for BuyBuy supermarket.

(*a*) The website is to contain multimedia elements such as video.

(i) Describe **one** benefit of including video in the website. **1**

(ii) Describe **one** technical implication for the customer of including video in the website. **1**

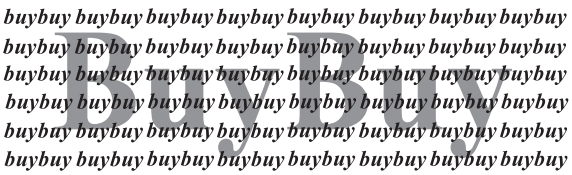
(*b*) A container file is used to send multimedia to the Web design company.

What is a container file? **1**

(*c*) The supermarket logo is shown below.

Figure A


Figure B




(i) What additional attribute is present in the logo in Figure B? **1**

(ii) Name **one** file type which supports this attribute. **1**

(*d*) The final image created is 2 × 3 inches at 2048 dpi and has a file size of **exactly** 72 Mb.

What is the colour depth of the image? **4**

(*e*) The supermarket is also planning an interactive multimedia information service within their stores.

Which type of application software would you recommend for the creation of this information service? Justify your answer. **2**

**[Turn over**

## SECTION III

### Part C—Multimedia Technology (continued)

**32. (continued)**

(*f*) The image on the opening screen of the information service is shown below. The image has bands of colours instead of a gradual transition between colours.

Name and describe **one** technique that could be used to improve the appearance of the bands of colour. **2**


**33.** Lewis has purchased some music on-line. His computer contains a sound card which is used when playing the music.

(*a*) Describe **two** features of a sound card. **2**

(*b*) It is often necessary to *normalise* a sound file.

(i) Why is it often neccessary to normalise a sound file? **1**

(ii) How is *normalisation* achieved? **1**

(*c*) Describe **two** ways in which compression can be achieved using the MP3 file format. **2**

(*d*) Calculate the uncompressed file size of a 2½ minute audio clip recorded in stereo at 44·1 kHz using 65536 different sounds. Show all your working. **4**

## SECTION III

### Part C—Multimedia Technology (continued)

**34.** (*a*) Vanessa buys a 2 Gb USB pen drive, a solid state storage device, and connects it to the USB port on her computer. The manufacturer claims that data could be transferred at rates up to 480 megabits per second. The actual transfer rate is 125 megabits per second. Suggest **one** reason for this. **1**

(*b*) Vanessa is transferring a 1·4 Gb file from the pen drive to the hard drive of her computer. How long will it take to transfer this file at 125 megabits per second? **2**

Multimedia technology is constantly improving. Improvements include communications and storage technologies.

(*c*) One recent development is Firewire.

(i) What is Firewire used for? **1**

(ii) State **one** reason why Firewire is a popular choice for communications. **1**

(*d*) State **two** technological factors influencing the growth of multimedia communications. **2**

**35.** The department of medicine use various graphics packages for teaching.

(*a*) The students use vector graphics to create 2D diagrams. Describe **two** advantages of using vector graphics over bit-mapped graphics. **2**

(*b*) The images created have to be changed into 3D. Describe **two** additional attributes used for a 3D image. **2**

(*c*) State **one** method of creating 3D images. **1**

(*d*) A simulation program is used to train students on routine operations. The simulation is currently run on flat screen monitors. The lecturers have read an article about Real 3D displays.

(i) State **one** advantage of using a Real 3D display over a flat screen monitor. **1**

(ii) State **one** disadvantage of using a Real 3D display over a flat screen monitor. **1**

(*e*) A DVD does not have sufficient storage capacity to store the simulation program. A hard disk has sufficient capacity but is still unsuitable.

(i) State a suitable alternative optical backing storage technology **1**

(ii) Explain why this method of storage is more suitable. **1**

**[Turn over for Question 36 on *Page twenty***

*Marks*

## SECTION III

### Part C—Multimedia Technology (continued)

**36.** The band Atomic Heatwave have just finished filming a video for their latest single at a castle.

(*a*) State an item of hardware required to transfer the digital video from the camera to the computer. **1**

(*b*) Describe how video is compressed and stored using the MPEG format. **3**

(*c*) *Container* files are also used in multimedia.

State **one** example of a typical "container" file for video. **1**

(*d*) (i) Name **two** features of video editing software that may be used when the Atomic Heatwave video is being put together. **2**

(ii) Describe the **two** features named in part (i). **2**

(*e*) Atomic Heatwave wish to put video onto their website. The file size is extremely large. Other than compression, describe **two** methods that could be used to reduce the file size. **2**

**(50)**

[*END OF SECTION III—PART C*]

[*END OF QUESTION PAPER*]