X216/301

NATIONAL QUALIFICATIONS 2007

THURSDAY, 24 MAY
9.00 AM – 11.30AM

INFORMATION SYSTEMS
HIGHER

Attempt **all** of Section I, **all** of Section II and **one** part of Section III.

Sections I and II — Attempt **all** questions.

Section III — This section has three parts, choose **one** part and attempt all of the questions in this part.

Part A—Applied Multimedia

Part B—Expert Systems

Part C—The Internet

Read all questions carefully.

Write your answers in the answer book provided. Do not write on the question paper.

Write as neatly as possible.

SA X216/301 6/3/5370

SECTION I

Marks

Attempt ALL questions in this section.

1. Below is a sample taken from a travel agency's holiday booking database. All data is held in a single table.

Booking reference	HT6745
Date of arrival	21/07/07
Length of stay	7 nights
Hotel name	Hilton
Hotel location	Glasgow
Customer name	John Jackson
Customer address	25 Brighton Place, Hamilton
Customer telephone number	02654 576431

Describe **one** problem with deleting a holiday booking record from this database. **2**

2. A driving licence number is a *meaningful identifier* made up from data based on a person's surname, date of birth and initials. For example,

SMITH 804017 AA3QZ

The last 3 characters are generated randomly.

(*a*) Explain why the last 3 characters must be included for the driving licence number to be used as a primary key. **2**

(*b*) Describe a problem in using the driving licence number as a primary key. **2**

3. What is a *foreign key* in a relational database? **2**

4. A characteristic of normalised data is that it allows for *referential integrity*. Define the term *referential integrity*. **2**

5. KwikShop supermarket stores information about each customer sales transaction. It uses the structure

TRANSACTION(Transaction Number, Till Number, Operator, Item, Price)

(*a*) Identify a *multi-valued attribute* from this structure and give a reason for your choice. **2**

(*b*) State what is meant by the *domain* of an attribute. **2**

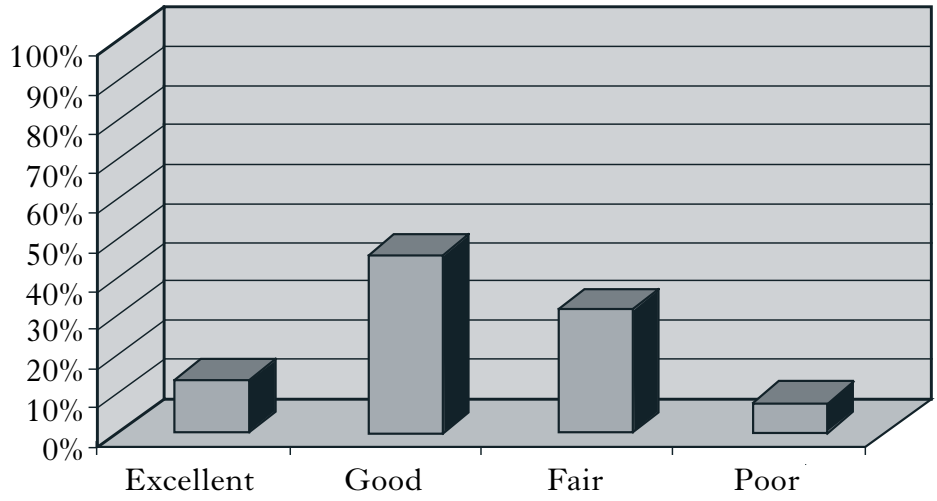
(*c*) State **one** *domain constraint* which might apply to the Operator attribute. **1**

6. Define the term *knowledge*. **2**

7. Describe **one** use hospitals make of *expert systems*. **2**

SECTION I (continued)

8. The chart below shows results of a survey of customer satisfaction with the standard of food at a motorway service area.



(*a*) Explain how this information can be both *quantitative* and *qualitative*. **2**

(*b*) State **one** factor which may affect the reliability of the information. **1**

9. An *executive information system* (EIS) is used at the strategic level of an organisation. Describe **one** function of an EIS that supports decision making at this level. **2**

10. Other than cost, state **two** criteria for evaluating computer software. **2**

11. Describe **two** steps which employers should take to comply with Health and Safety regulations for those working with computer equipment. **2**

12. State the purpose of the Regulation of Investigatory Powers Act (2000). **2**

(30)

[*END OF SECTION I*]

[Turn over

SECTION II *Marks*

Attempt ALL questions in this section.

13. Discovery Gym Club keeps records of club members' fitness and performance levels on record cards. Each member of the gym has a trainer who recommends exercises for the club member. When an exercise is carried out, the equipment used calculates a performance score based on how well the user performed the exercise. The club member writes the date of the exercise and performance scores for each exercise on a record card as shown below.

Member Performance Record

Member name: Andrew Johnstone **Member no:** 97842
Member address: 27 High Street, Craigbank **Trainer:** W Lennon
Member telephone: 01235 457632

Date	Exercise ID	Equipment	Duration	Level	Performance Score
26/06/07	EB21	Exercise Bike	10	5	13
26/06/07	ST04	Stepper	15	4	15
28/06/07	EB21	Exercise Bike	10	5	14
28/06/07	ST04	Stepper	15	4	16
28/06/07	ST05	Stepper	15	5	14
28/06/07	EB22	Exercise Bike	12	6	15

Member Performance Record

Member name: Chris Lee **Member no:** 41845
Member address: 42 Low Road, Craigbank **Trainer:** C Kent
Member telephone: 01235 439582

Date	Exercise ID	Equipment	Duration	Level	Performance Score
26/06/07	EB21	Exercise Bike	10	5	16
26/06/07	ST04	Stepper	15	4	15
26/06/07	CT17	Cross Trainer	15	3	16
27/06/07	ST04	Stepper	15	4	16
27/06/07	TM27	Treadmill	25	6	17
28/06/07	EB22	Exercise Bike	12	6	12

Only registered trainers are permitted to devise exercise programs for members. Details of trainers are stored as follows:

Discovery Gym Club
Registered Trainers List

Trainer ID	Trainer name	Trainer address	Trainer telephone
01231	W Lennon	42 Wilson Avenue, Doonbrae	01233 665571
01245	C Lamont	11 The Glebe, Strathcraig	01222 699123
01249	L Lamont	11 The Glebe, Strathcraig	01222 699123
01258	C Kent	42 Willow Place, Doonbrae	01233 423145

- Each exercise has a unique Exercise ID and is for a fixed duration and level.
- Trainers insist that the performance score for each exercise is recorded only **once** per day.

SECTION II (continued)

13. (continued)

(*a*) Data from these records can be represented in un-normalised form as:

Member no
Member name
Member address
Member telephone
Date
Exercise ID
Equipment
Duration
Level
Performance score
Trainer ID
Trainer name
Trainer address
Trainer telephone

(i) Using Member no as the primary key, transform this un-normalised data to first normal form by removing repeating groups. **3**

(ii) Identify all primary and foreign keys. **3**

(*b*) (i) Transform this first normal form to second normal form by removing partial dependencies. **4**

(ii) Identify all primary and foreign keys. **2**

(*c*) (i) Transform this second normal form to third normal form by removing non-key dependencies. **3**

(ii) Identify all primary and foreign keys. **2**

[Turn over

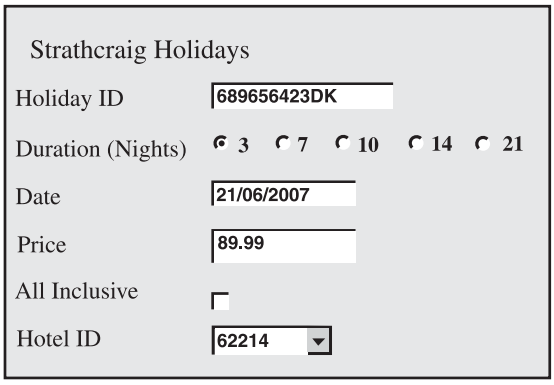
SECTION II (continued)

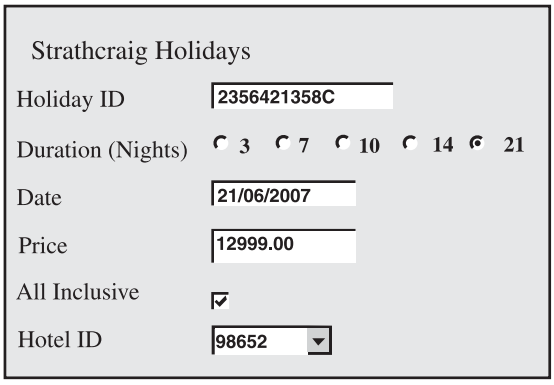
14. Strathcraig Holidays is a firm of travel agents. It has set up a booking system using a relational database. The data is held in the following tables:

Customer	**Holiday**	**Hotel**	**Booking**
Customer ID	Holiday ID	Hotel ID	Customer ID*
Customer name	Duration (nights)	Hotel name	Holiday ID*
Customer address	Date	Hotel address	
Customer phone	Price		
	All inclusive		
	Hotel ID*		

(*a*) Draw an entity relationship diagram to represent this data model. **6**

(*b*) The forms shown below are used to enter holiday details into the database.





The data dictionary shown below represents the **Holiday** entity. It has a number of missing entries which are highlighted as A, B, C, D, E, F and G. With reference to the forms shown above, state a suitable entry for each of the **seven** missing values.

Name	**Data Type**	**Validation**	**Required**	**Key**
Holiday ID	A		Y	PK
Duration (Nights)	B	D	Y	
Date	Date		Y	
Price	Real	E	Y	
All inclusive	C		Y	
Hotel ID	Integer	F	Y	G

7

SECTION II (continued)

15. Discovery Designs Ltd is a web design company with a network of over 50 computers. Each department of Discovery Designs Ltd is allocated a budget for the financial year. Mr MacGregor, manager of the Accounts Department, decides this year to use his allocation to purchase a new word processing package for his department. Mr MacGregor's decision may cause problems for his department and other users in the company.

(*a*) Describe **four** potential problems that may arise. **8**

(*b*) State **two** types of strategy that the company should put in place to prevent this situation occurring. **2**

[Turn over

16. The Mathematics Department of Dee Valley College uses the following spreadsheet to record marks and automatically generate grades and bands.

	A	B	C	D	E
1	**Maths Department**		**Ms H Smyth**		**2006**
2	**Prelim Results**				
3	**Forename**	**Surname**	**Mark**	**Grade**	**Band**
4	Peter	McLean	62	B	4
5	Jonathon	Spence	49	F	Fail
6	Sally	Ferguson	56	C	5
7	Hugh	MacNab	54	C	6
8	Louise	Simpson	58	C	5
9	Nicole	Wyness	43	F	Fail
10	Thomas	Benzie	65	B	3
11	Anthony	Peterson	75	A	2
12	Duncan	Jarvis	61	B	4
13	Ashley	Morrison	88	A	1
14					
15	**No of pupils present**		**10**		

The cut-off scores for grades are as follows:

A	70
B	60
C	50

Any mark less than 50 is awarded a grade F.

(*a*) Write down a suitable formula for cell C15. **2**

(*b*) Using the IF function, write down a suitable formula for cell D4. **4**

(*c*) The formula in cell E4 uses the following table to display the appropriate band.

	G	H
1	**Mark**	**Band**
2	0	Fail
3	50	6
4	55	5
5	60	4
6	65	3
7	70	2
8	85	1

The formula is made up of several parts. It uses a function with two necessary arguments as shown below.

= A (B , C)

(i) Describe the function labelled A.

(ii) Describe the necessary arguments labelled B and C. **4**

SECTION II (continued)

17. A company uses software to monitor employees' usage of its network.

(*a*) Why might the company choose to monitor network usage in this way? **2**

(*b*) Describe **one** method of monitoring employees' use of the network. **2**

(*c*) Comment on the ethics and legality of monitoring employees in this way. **4**

(*d*) An employee applies to the company under the Freedom of Information (Scotland) Act (2002) to see the full monitoring reports for the company. Is the employee entitled to this information? Give a reason for your answer. **2**

(60)

[*END OF SECTION II*]

[Turn over

SECTION III

Section III—This section has three parts, choose **one** part and attempt **all** of the questions in this part.

SECTION III

Marks

Part A—Applied Multimedia

Attempt ALL questions in this part.

18. Simon is studying a computing course at college. The course requirements state that students have to complete a project to help the local community. Simon has agreed to help the local primary school develop a multimedia product. The Head Teacher has e-mailed the following project brief to Simon.

> *Dear Simon*
>
> *Could you please develop a stand alone multimedia product to help children learn the basic Road Safety code.*
>
> *Yours sincerely*
>
> *Mrs Adams*
> *Head Teacher*

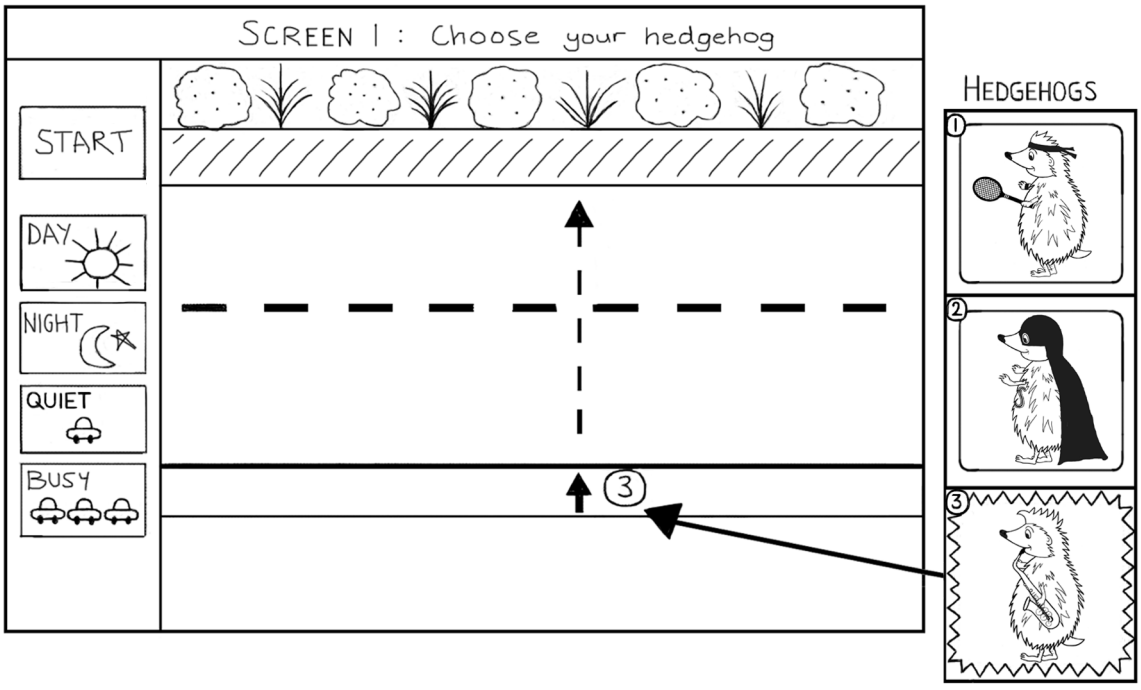
(*a*) State **three** further pieces of information Simon would require which have been omitted from the project brief. **3**

After the project brief has been clarified, a *requirements specification* is drawn up.

(*b*) Explain why this document is important. **3**

(*c*) State the most important type of *user interface* for this product. Justify your choice. **3**

Simon has created an *outline storyboard* for the product. Children are able to choose traffic conditions, the time of day and a hedgehog to cross the road.



(*d*) State **three** additional pieces of information that Simon should include in the detailed storyboard. **3**

SECTION III

Part A—Applied Multimedia (continued)

18. (continued)

(*e*) Composite/Hybrid is one type of navigation structure.

State **two** further types of navigation structure and describe how each of these would affect the operation of Simon's product. **6**

(*f*) Simon has decided to create this product using *authoring* software. Justify his choice by describing **two** features of this type of software. **4**

(*g*) In this product, children are allowed to choose a hedgehog and name it.

How is this similar to the way in which many people communicate on the Internet? Give **one** example to illustrate your answer. **4**

19. Testing is an important stage in the development of a multimedia product.

(*a*) State **four** aspects of a product that would be tested during *screen testing*. **4**

(*b*) Describe how *usability testing* is carried out. **2**

20. Virtual Vet would like to develop an interactive computer simulation specifically aimed at providing training and support for Veterinary students. Students would be able to use this product to train on virtual animal bodies.

(*a*) Before the project can begin, the company needs to fill a vacancy that has arisen within the multimedia development team. An advertisement is placed in the local paper for a *multimedia designer*.

The multimedia designer would have to liaise closely with other personnel within the multimedia development team.

State **two** of these personnel and describe their roles in creating this product. **6**

(*b*) Describe **three** examples of how multimedia elements could be used in this product. **6**

SECTION III

Part A—Applied Multimedia (continued)

21. Strathmobile Telecom is launching a new company logo. Graphic designers have produced a logo in colour. The company intends to use the logo on all its merchandising including posters, magazine advertising, television and website.

(*a*) The colour depth of the logo is reduced before it is used on the website. One reason for this is to reduce the file size of the image. State **one** other reason for reducing colour depth. **2**

(*b*) Describe **one** problem that may be caused by reducing the colour depth and explain how this problem can be solved. **4**

(50)

[*END OF SECTION III—PART A*]

SECTION III

Part B—Expert Systems

Attempt ALL questions in this part.

22. Dragons of Discovery is a computer game with the object of attacking dragons in order to capture their magical teeth. The user is given advice from a character called Mogo. The advice is generated by an expert system. Here are some of the rules which are used to determine the advice given.

IF dragon IS sleeping
AND dragon can breathe fire
AND dragon IS hungry
THEN Advice IS Attack with magic CF 90.

IF dragon IS sleeping
AND dragon IS hungry
THEN Advice IS Attack with sword CF 80.

IF dragon IS sleeping
AND dragon can breathe fire
THEN Advice IS Attack with lance CF 70.

The following facts are known with the certainty factors given.
Dragon is sleeping 60%
Dragon can breathe fire 80%
Dragon is hungry 40%

(*a*) (i) Calculate the certainty of the advice "Attack with magic". Show your working. **2**

(ii) What advice would Mogo give based on the rules shown? Explain your answer. **4**

(*b*) Here are the rules which are used to determine if the dragon is angry.

IF it is raining
THEN the dragon is awake.

IF the dragon is awake
AND the goblins are dancing
THEN the dragon is angry.

Draw a rule tree to show how Mogo could give the reasons for concluding "The dragon is angry". **3**

(*c*) The expert system uses *forward chaining*. In a forward chaining expert system:

(i) explain what is meant by the *working memory*; **2**

(ii) explain what is meant by a *conflict set*; **2**

(iii) explain how a conflict set is identified; **2**

(iv) describe how the *specificity* conflict resolution strategy works. **2**

23. The members of a knitting group are graded by their knitting experience, as grade 1, grade 2 or grade 3. A knitting expert system advises members on suitable patterns according to the members' knitting experience. The expert system makes use of the following information.

A	A grade 1 member is one who has never knitted anything before. Members who have knitted a scarf are classed as grade 2. Members are classed as grade 3 if they have knitted a jumper, gloves or socks.
B	The art of knitting involves following a pattern which describes the stitches to be used and colours and types of wool. Simple patterns involve using a single colour of wool and a single type of stitch. Complex patterns involve using a mix of colours of wool or a combination of different stitches or both.
C	Grade 1 members are only able to attempt a simple pattern. Grade 2 members can tackle complex patterns for scarves and simple patterns for socks and jumpers. Grade 3 members can tackle all knitting patterns.

(*a*) Using a factor table, represent the knowledge contained in paragraph B above. The factor table should show the pattern types and whether there are one or many colours or stitches. **4**

(*b*) The following rule indicates whether a member can knit a complex scarf pattern:

IF garment IS scarf
AND pattern IS complex
AND grading IS > 1
THEN member can knit garment.

Represent the knowledge contained in paragraph C above to provide advice on the suitability of patterns for knitting scarves, jumpers, gloves and socks, given a member's knitting experience. The rules should be of the form IF <conditions> THEN <conclusions> as shown above. **4**

(*c*) The knitting experience of the group can also be represented as a series of predicates, as follows:

Predicate	**Statement**
has_knitted(janet, scarf, complex)	Janet has knitted a complex scarf
grade(calum, grade_1)	Calum is graded Grade 1.

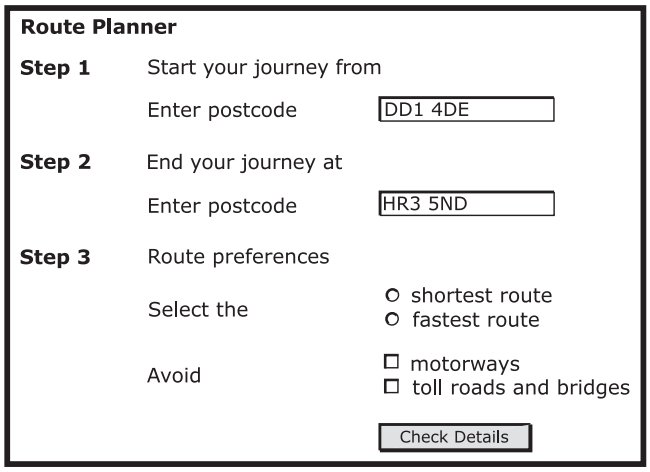
Represent the following statements in predicate logic:

(i) Ailsa is Grade 3 and has knitted a complex jumper; **2**

(ii) anyone who has knitted simple socks is graded grade 2. **3**

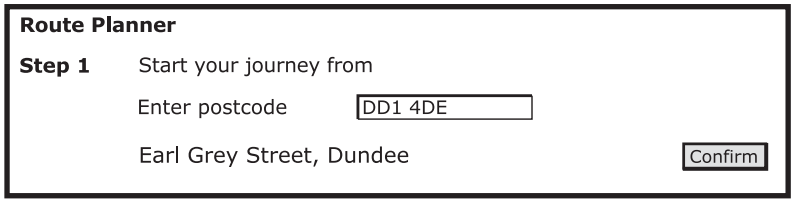
24. Expert systems are used in a wide range of subject domains. Describe the *domain*, *category* and *main characteristics* of the DENDRAL expert system. **4**

25. Alison uses a route planning website to help her plan a journey from her home in Dundee to see her aunt and uncle who live in Kington.



She enters the postcodes of her starting point and destination, and can also specify whether she wants the fastest route, shortest route, or a route that avoids motorways or toll roads and bridges.

(*a*) When Alison clicks on the Check Details button, the following screen is displayed in which she is asked to confirm the address of the start and end points of her journey, as shown.



Explain how a database could be used to provide the additional information. **2**

(*b*) The route planner makes use of an expert system to produce the route plan. Describe **two** reasons why route planning is a suitable domain for an expert system. **4**

(*c*) The expert system provides a detailed route which includes a total distance and estimated time.

(i) Alison decides to check an alternative route planning website which also uses an expert system. She finds that the recommended route from this website is longer than the route from the first website.

Describe **three** reasons why the routes may be different. **6**

(ii) When Alison makes her journey, she finds that it takes her 1 hour longer than indicated on the route plan.

Describe **two** limitations of a route planning expert system which may have contributed to this result. **4**

(50)

[*END OF SECTION III—PART B*]

Marks

SECTION III

Part C—The Internet

Attempt ALL questions in this part.

26. MP3s4Sale is a web-based company which sells MP3 recordings of local bands via the World Wide Web. The home page at present is shown below.

MP3s4Sale

The following acts and performances have been added this week

- China Cats – Diesel Hi-lites
- East Coast Boys – Who Me?
- Halos – No Angel

+27 more

Click here for list of all new additions Click here for list of all 1239 files

The owners of MP3s4Sale would like to alter the image of the company and have some changes made to the website. The company name is to appear on every page in size h1, colour red, centre aligned and in Arial font.

(*a*) The company have used Cascading Style Sheets in their website design.

(i) State what is meant by *Cascading Style Sheets*. **2**

(ii) Describe how the use of *Cascading Style Sheets* will make it easier to implement this uniformity of presentation. **2**

(iii) Part of the style sheet the company used is shown below.

```
1.   h1
2.   {text-align : centre
3.
4.
5.   }
```

Write lines 3 and 4 for this style sheet to produce the required effect. **2**

(iv) The company has produced the correct external style sheet but the heading is displayed in black and left aligned. Describe **two** reasons why this has happened. **4**

(v) Styles were introduced by The World Wide Web Consortium (W3C). Describe the role of the W3C and describe how it differs from that of the Internet Engineering Task Force (IETF). **4**

(*b*) The website requires updating every week since new MP3s are added every week. Describe how this site could be implemented by using *dynamic* web pages. **3**

SECTION III

Part C—The Internet (continued)

Marks

27. A group of students are considering starting an on-line business. The home page for their company is shown below.

Academic Solutions

The Final Word in University and College Study Guides

Our Study Guides will cover all courses at any University or College

Pick your subject below.

95 % of our customers pass with merit.

Accounting	Art History	Bioengineering
Biology	Business Administration	Chemistry
Chinese	Civil Engineering	More . . .

E-mail us with any special requirements

Confidentiality Guaranteed – Study Guides sent as encrypted e-mails.

(*a*) The students apply to Nominet to register gradewhackers.ac.uk as the domain name.

(i) Are they likely to be successful? **1**

(ii) Give **two** reasons to justify your answer. **2**

The URL of the home page would be http://gradewhackers.ac.uk/home.html

(*b*) Explain how the Domain Name Server (DNS) protocol would allow this home page to be located and displayed in a browser. **3**

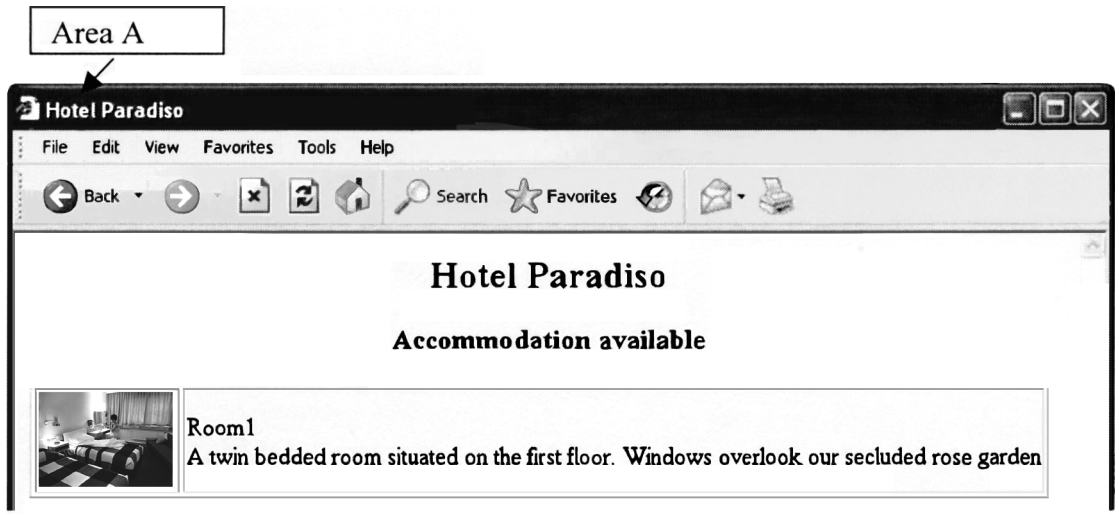
(*c*) The transfer of the home page from server to client will make use of routers and routing tables.

Define the terms *router* and *routing table* and describe the part played by both in the transfer of data through the Internet. **8**

(*d*) Comment on the *credibility* of the information displayed on the homepage. **4**

(*e*) The Study Guides are sent as encrypted e-mails. Name and describe a method which can be used for exchanging encrypted e-mail. **4**

28. Below is an extract from Hotel Paradiso's home page showing some of the rooms available. The HTML code used to produce the page is illustrated below the extract.




```
1.  <html>
2.  <head>
3.
4.  </head>
5.  <body>
6.  <div align = "centre">
7.  <h2> Hotel Paradiso </h2>
8.  <h3> Accommodation available </h3>
9.  </div>
10. <table>
11.
12. <td> <img src = "Images/Room1thumb.jpg"> </td>
13. <td>Room1.<br> A twin bedded room situated on the first floor.
    Windows overlook our secluded rose garden </td>
14. </tr>
15.
16. </body>
17. </html>
```

(*a*) Complete the HTML code required in line 3 to display "Hotel Paradiso" in area A. **2**

(*b*) What is the purpose of the tag as used in line 6? **3**

(*c*) The hotel management would like a user to be able to click on the small picture of the room to open a larger picture on a new page. The larger image is stored as "Room1.jpg" in the folder named "Images".

Rewrite the code in line 12 in order to achieve this. **4**

[Turn over for Question 28(*d*) on *Page twenty*

Marks

28. (continued)

(*d*) Complete the HTML code missing from:

(i) line 11;

(ii) line 15. **2**

(50)

[*END OF SECTION III—PART C*]

[*END OF QUESTION PAPER*]