X216/13/01

NATIONAL QUALIFICATIONS 2013

TUESDAY, 7 MAY
1.00 PM – 3.30 PM

INFORMATION SYSTEMS
ADVANCED HIGHER

Attempt **all** questions in Section I.

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

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

Read all questions carefully.

Do not write on the question paper.

Write as neatly as possible.

Each section should be answered in a separate answer book.

SECTION I

Marks

Answer ALL questions in this section.

1. A software company is developing a replacement booking system for a sports centre.

(*a*) State **two** resources that should be considered in the *project plan*. **2**

(*b*) At the end of the analysis stage, the *systems specification* is produced.

Describe **two** *functional requirements* that would be stated in the systems specification for the sports centre. **2**

(*c*) During the analysis stage of the development, *data flow diagrams* (*DFDs*) and an *entity relationships diagram* (*ERD*) were produced. Explain why a new ERD and new DFDs are created during the **design** stage of the development. **1**

(*d*) State **two** features of a *user guide*. **2**

(*e*) Once the replacement booking system is completed, an *evaluation* is performed. Describe **two** aspects of the booking system that would be considered during the evaluation. **2**

(*f*) The booking system includes a number of elements including:

- *forms*
- *queries*
- *reports*
- *tables*.

A member of the sports centre enquires about the availability of badminton courts on a particular day. Explain how the four elements of the booking system listed above would be used to handle the member's enquiry. **4**

2. A chain of pizza restaurants is upgrading its online ordering system.

(*a*) A *feasibility study* is carried out.

(i) Describe the purpose of a feasibility study. **1**

(ii) Describe **two** aspects you would expect to find in the feasibility report. **2**

(*b*) Copy and complete the table below to indicate a suitable *investigation result*, *investigative technique* and source of information in each case:

Investigation Result	Investigative Technique	Source of Information
Components in existing system		
		Online customers

4

(*c*) The interface of the upgrade is developed using *Rapid Application Development* (*RAD*) *tools*. Give **one** reason why the use of RAD tools may lead to:

(i) reduced costs; **1**

(ii) less efficient code. **1**

(*d*) The pizza chain does not want to lose too much time or business when changing to the upgraded system. Select a suitable *conversion technique* that could be used to convert to the upgraded system and describe how this method would be used to carry out the changeover. **2**

(*e*) The need for an upgrade to an online ordering system can arise for a number of reasons. State **one** reason why the following types of *maintenance* may be required.

(i) Adaptive **1**

(ii) Perfective **1**

[Turn over

3. The Green Garage has a contract to repair vehicles belonging to taxi companies. The description below details the processes carried out by the garage.

DEALING WITH BREAKDOWN

When a taxi breaks down or develops a fault, the taxi company notifies the garage of the details of the taxi and its whereabouts. The garage gets the taxi company details from its customer file and stores those details along with details of the broken down taxi in a job file. It then uses its contractor file to find a breakdown truck owner who is contacted with instructions to collect the taxi.

DEALING WITH REPAIR

The breakdown truck collects the taxi and delivers it to the garage. The garage inspects the vehicle to determine what work needs done. The details and prices of the replacement parts are retrieved from the parts file and saved in the job file. An estimate of repair costs is then calculated and e-mailed to the taxi company. Once the taxi company has given confirmation to proceed with the repair, the garage carries out the work and adds the actual time taken to a time sheet.

INVOICING

The garage then prepares an invoice – an example of which is shown. This is sent to the taxi company for payment and the invoice data is added to the invoice file.

THE GREEN GARAGE **INVOICE**

14 Hamilton Street
DUNMILLER
Phone 0199 999999 Fax 0199 999998

INVOICE #123
DATE: OCTOBER 5 2012

TO:
The Manager
MERLIN TAXIS
54 Freeway Drive
MAXTON

FOR:
Repair of taxi - SB10BER

DESCRIPTION	HOURS	RATE	AMOUNT
Replacement of exhaust			
Front Section			£45·45
Rear Section			£69·67
2 Clamps		3·85	£7·70
Time taken	2 hours	24·00	£48·00
		TOTAL	£170·82

Use the description and sample invoice above, to draw a *level one data flow diagram* for the processes of the Green Garage. **10**

4. An allergy clinic employs a number of doctors to treat patients. A patient makes an appointment for a set date and time. A doctor sees the patient for the appointment, and may prescribe or administer one or more treatment.

The appointment system is to be converted from a manual system to a computerised one using a relational database system. In designing the system, an entity-relationship diagram is to be created.

After normalisation to *Third Normal Form* (3NF), the following entities and attributes have been identified. In this representation, underlined attributes represent Primary keys, while asterisked attributes represent Foreign Keys*.

Appointment [Appointment No., Date, Time, Doctor Name*, Patient ID*]
Doctor [Doctor Name, Doctor Room No., Doctor Phone No.]
Treatment [Treatment ID, Treatment Description]
Appointment Treatment [Appointment No.*, Treatment ID*]
Patient [Patient ID, Patient First Name, Patient Surname, Patient Postcode, Patient Phone No.]
Allergy [Allergy ID, Allergy Description]
Patient Allergy [Patient ID*, Allergy ID*]

The following information should be noted:

- Appointment No., Doctor Name, Treatment ID, Patient ID and Allergy ID are unique identifiers
- patients are only registered when they first make an appointment
- all doctors see patients for appointments
- appointments sometimes end without a treatment
- some treatments have not yet been used
- all patients referred to the clinic have allergies, and an individual patient may have several allergies
- some allergies have yet to be found in patients.

Using the information provided above, design an *entity-relationship diagram* which shows:

- the *cardinality* of all relationships;
- any *weak entities* and *weak relationships*;
- the *optionality* of all relationships. **10**

[Turn over

5. A hotel is upgrading its online booking system.

(*a*) Show how the following events would be recorded in the *entity-event matrix* for the hotel booking system.

Event \ Entity	Customer	Guest	Room	Booking	Charge
A new customer makes a booking for his parents as a surprise anniversary gift. Since his parents are regular guests at this hotel, their details are already stored in the system. At the time of the booking, the cost of the room is paid in full; this is recorded as a new charge.					
During their stay at the hotel, his parents charge use of the beauty salon and restaurant to their booking.					

3

(*b*) The booking system also includes an entity called "Room Facility". Sample data stored in this entity is shown below.

RoomID	FacilityID	Facility Description	Comment
125	26	Network point	Fibre Optic LAN
125	63	Fridge	Installed 26/4/09
382	63	Fridge	Repositioned by window
470	11	TV	Upgraded 18/10/11

(i) Define the validation needed for the "RoomID" attribute of this entity. **1**

(ii) Explain why the "Room Facility" entity is a weak entity. **1**

(iii) The "Room Facility" entity may be considered to be inefficient in terms of memory. Explain why this is the case and suggest a more efficient solution. **2**

Marks

5. (continued)

(*c*) The completed entity-event matrix entry for the "Room Facility" entity is shown below.

Event	Room Facility
Add new room to hotel	C
Install new facility in room	C
Upgrade facility in room	M
Reposition facility in room	M
Remove facility from room	D

Use the information in the entity-event matrix above to create the *entity life history* diagram for the "Room Facility" entity of the booking system. **4**

(*d*) An extract from the *test plan* for the hotel booking system is provided below.

Test Number	Details	Type of Testing	Element(s) to be tested
	.....		
Test 14	Test validation rules for customer entity	**A**	Customer form
	.....		
Test 23	Create new booking for existing customer	Integrative	**B**
	.....		
Test 78	Ensure system meets client's expectations	**C**	User interface
	.....		

Complete the test plan to indicate the *type of testing* and the *element to be tested* in each case by identifying the missing entries labelled A, B and C. **3**

[*END OF SECTION I*]

SECTION II

Attempt ONE sub-section of Section II

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

SECTION II

Marks

Part A—Information Systems Interfaces

Answer ALL questions in this part.

6. A company offers sightseeing tours around six Scottish cities: Aberdeen, Dundee, Edinburgh, Glasgow, Inverness and Stirling. A special sightseeing bus is driven around the city as a commentary is played to inform the passengers of interesting facts about the city. A relational database system is being developed to store details of the tours.

(*a*) Normalise the attributes listed below.

Attribute	Sample Data
City	Glasgow
Main depot	Buchanan Street
Tour manager ID	1234
Tour manager name	J Smith
Tour manager contact number	01419999991
Bus registration number	AB01RTF
Tour date	15/05/2013
Route number	3
Start point	Buchanan Street
End point	Hampden Park
Driver ID	FT4455
Driver name	P Anderson

You must show all stages of normalisation, from un-normalised form through to third normal form and your solution should take account of the following information.

- Each city has at least 5 buses
- Each bus may be used on a number of different routes on the same day
- The registration number of each bus is unique
- Each city has only one tour manager **10**

(*b*) Read the following *structured English* which is used to calculate the total revenue for each tour.

```
total revenue = 0
loop for each passenger
       if passenger is OAP
          apply 20% discount to ticket price
       end if
       add tour price to total revenue
end loop
```

Convert this structured English to a *graphical design notation* with which you are familiar. **3**

Marks

7. A group of travel and photography enthusiasts is putting together a website called MyFotoDiary.com. The site will allow the uploading and sharing of photographs of people and places from around the world.

The site will include facial recognition software for photographs and will allow users to "tag" the faces with a person's name. The software will then search for similar faces in other photos and tag them with that person's name.

(*a*) The site is to contain a search facility. Explain how a *predictive interface* would make the search facility easier to use. **1**

(*b*) State the name of the intelligent feature that finds and tags similar faces in other photographs. **1**

(*c*) A mobile version of the website is to be developed for smart phones and small wireless media players.

(i) State **two** *technological* differences which would have to be taken into account when converting from the laptop and desktop version to the mobile version of the site. **2**

(ii) For each of your answers to part (*c*) (i) above, describe the changes that have to be made to the website. **2**

(*d*) New browser software displays a gallery of images that represents the sites most visited by the user. Over time, the contents of the gallery are updated frequently. Name a feature of an intelligent interface which could update the gallery contents. **1**

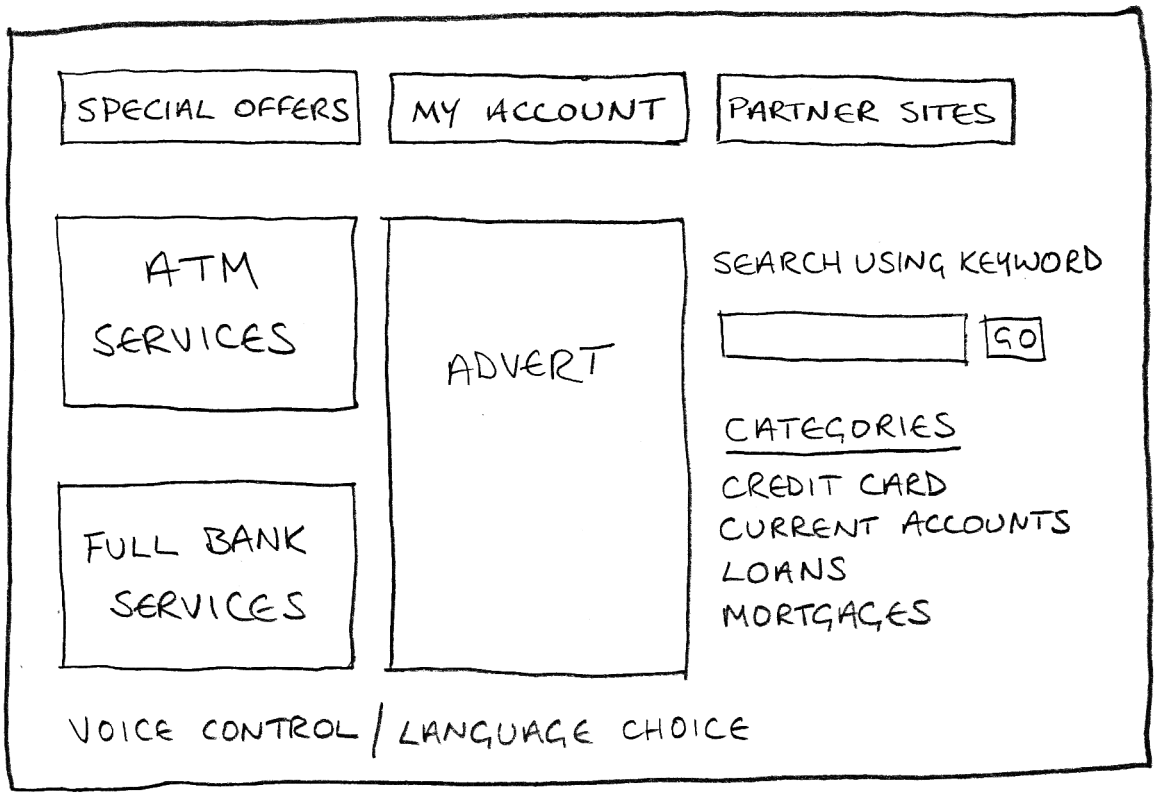
Marks

8. A new generation of automated cash machines is being developed.

(*a*) Describe the purpose of *system refinement* during the design stage of any development. **1**

(*b*) State **one** reason why it is necessary for any system being developed to undergo *systematic testing*. **1**

(*c*) The developer sketches a *low fidelity prototype* of the introductory screen.



(i) With reference to the sketch above, explain **one** difference between the terms *syntax* and *semantics*. **2**

(ii) State **two** characteristics of a low fidelity prototype. **2**

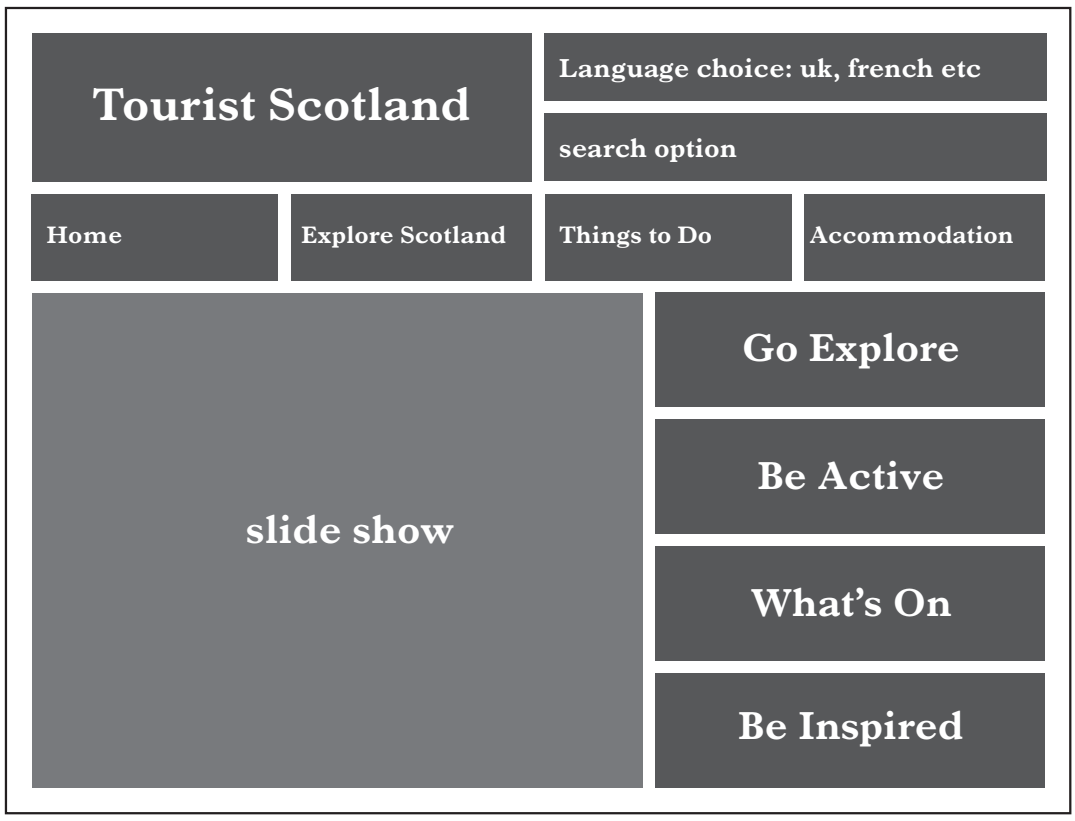
(iii) Describe **one** advantage of prototyping as a method of interface design as opposed to the use of a *state transition diagram* for the same purpose. **1**

[Turn over

Marks

9. A website is being developed to help promote Scotland as a tourist destination. The website aims to allow as many people as possible to access the information.

(*a*) The *storyboard* of the website includes the layout of the home page as shown below.



Each screen layout in the storyboard shows the options in the same position with the same formatting used.

(i) Name **one** *quality inspection method* that has influenced the layout of the storyboard. **1**

(ii) Explain how *time to learn* could be used to determine the effectiveness of this layout for new visitors to the site. **1**

(*b*) The design team must decide between a text element and a graphical element to represent the help option on each screen. State **one** benefit of having the help option shown as:

(i) text; **1**

(ii) a graphic. **1**

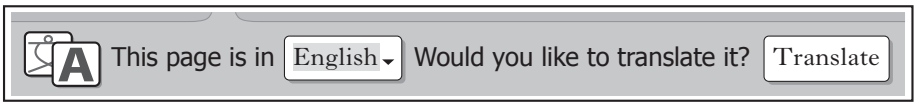
(*c*) The designers are aware of the need to *adhere to standards*.

Name **one** standard the designers of this website would need to consider. **1**

Marks

9. (continued)

(*d*) Once implemented and viewed from outside the UK, the website displays a message similar to the one shown below:

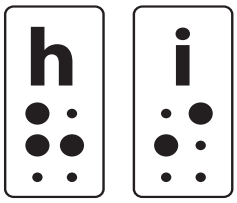


(i) Describe **one** technique that may be used to change a web page from English to another language selected by the user. **2**

(ii) A web page includes a facility that allows users to search for information by entering their own wording in the search box.

Name this feature of an intelligent interface. **1**

10. A phone company is developing a mobile phone that will allow blind people to make phone calls and send text messages. They will use a keypad to press keys, identified by Braille letters and numbers, which are patterns of raised dots.



(*a*) State the *mode* of the keypad interface for the new phone. **1**

(*b*) As an alternative method to keying in text or numbers using the Braille keypad, a blind person could use *speech driven software*. State **two** disadvantages of speech driven software over keying in text. **2**

(*c*) When text messages are received, they will be read using a touch sensitive screen which gives vibrational feedback to the fingers of the user in the form of Braille text.

Describe an alternative method that could be used for the output of text messages received by a blind person. **1**

(*d*) The company will use the *LUCID methodology* to develop the new phone.

Name the first stage of this methodology and describe **two** processes that the company would carry out during this stage. **3**

(*e*) (i) State **one** *qualitative technique* which would be suitable for usability testing of how easy it is for users to create and send text messages with the phone. **1**

(ii) Describe how this technique would be used. **1**

(*f*) After release of the new mobile phone, the company wishes to evaluate its usability by using either a *survey* or a *questionnaire*.

(i) Describe **one** difference between a survey and a questionnaire. **1**

(ii) Explain which would be better, a survey or a questionnaire, to evaluate the usability of the new mobile phone. **1**

Marks

11. The new MoOS operating system is being developed. Key features of the user interface of the new operating system are described below.

- Optimised for touch but works equally well with a mouse and keyboard, including keyboard shortcuts.
- Fast launching of applications from tile-based start screen, similar to that used in smart phones.
- Suitable for desktop PCs, laptops, tablet computers and notebook PCs.
- Designed to go from 10" tablet screen to big screens in your living room, from ultra-portable notebooks to large gaming systems and business desktops.

A screenshot of the MoOS operating system is shown below.

(*a*) Discuss the interface of the MoOS operating system in terms of:

- *typical users*
- *physical constraints*.

Justify each comment by making reference to the screenshot or relevant statements in the description above. **4**

11. (continued)

(*b*) The MoOS operating system incorporates a number of features of an *intelligent interface*. One such feature is described below.

> Applications running under the MoOS operating system are context-aware making it possible for users to have direct access to system functions such as the volume buttons when watching video.

State the type of intelligent interface exemplified in the description of the user interface described above. **1**

(*c*) Describe **one** additional feature that could be added to the new MoOS operating system to support *knowledgeable intermittent users* who are already familiar with other operating systems. **2**

(*d*) Several *quantitative techniques* are used to measure the usability of the MoOS operating system.

(i) Describe **one** suitable piece of data that would be gathered to measure *user error rates* and explain how this data would be used by the development team. **2**

(ii) Name **one** quantitative technique **other than** user error rates that could be used to provide feedback to the development team on the quality of the user interface. Justify your answer. **2**

(*e*) Developers of the new MoOS operating system claim that its start-up time is significantly faster than the start-up time of previous operating systems.

(i) Describe **one** *social factor* that has led to this improvement in start-up time. **1**

(ii) The developers' own research shows that 57% of desktop PC users and 43% of laptop users shutdown their machines rather than put them into sleep mode.

Describe **one** *inquiry method* that could be used to gather this information without making excessive demands on users. You should indicate clearly how this method would be used to gather the information required. **2**

[*END OF SECTION II — PART A*]

[Turn over

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SECTION II

Marks

Part B—Online Database Systems

Answer ALL questions in this part.

12. A company offers sightseeing tours around six Scottish cities: Aberdeen, Dundee, Edinburgh, Glasgow, Inverness and Stirling. A special sightseeing bus is driven around the city as a commentary is played to inform the passengers of interesting facts about the city. A relational database system is being developed to store details of the tours.

(*a*) Normalise the attributes listed below.

Attribute	Sample Data
City	Glasgow
Main depot	Buchanan Street
Tour manager ID	1234
Tour manager name	J Smith
Tour manager contact number	01419999991
Bus registration number	AB01RTF
Tour date	15/05/2013
Route number	3
Start point	Buchanan Street
End point	Hampden Park
Driver ID	FT4455
Driver name	P Anderson

You must show all stages of normalisation, from un-normalised form through to third normal form and your solution should take account of the following information.

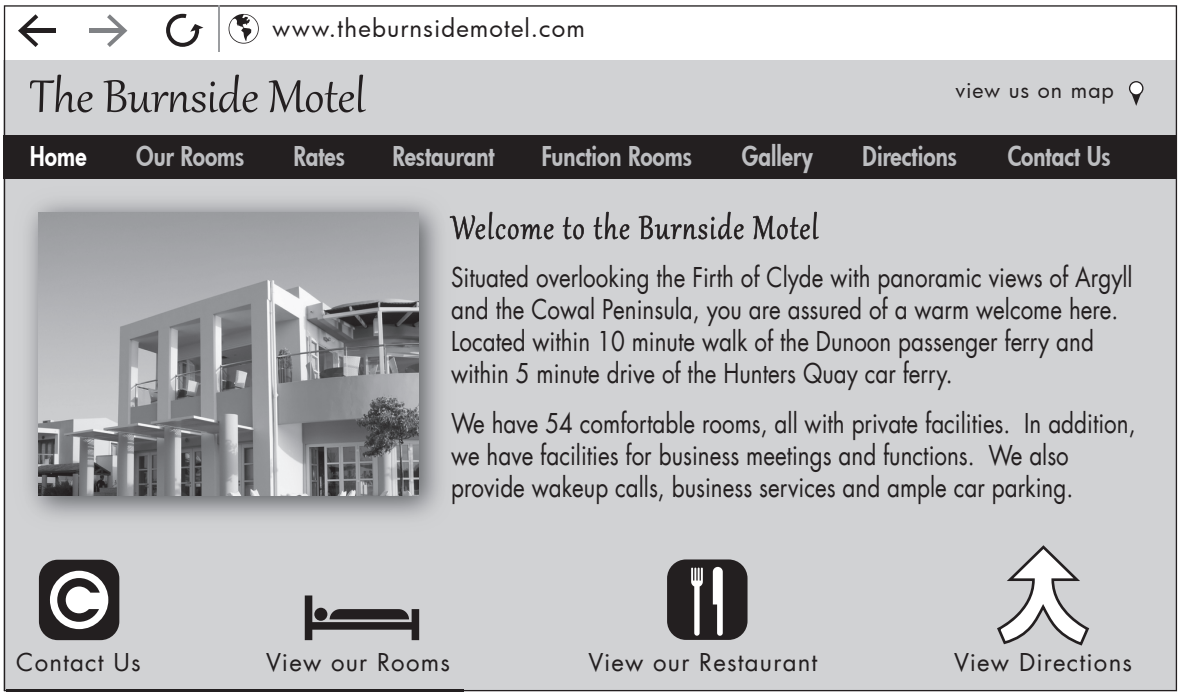
- Each city has at least 5 buses
- Each bus may be used on a number of different routes on the same day
- The registration number of each bus is unique
- Each city has only one tour manager **10**

(*b*) Read the following *structured English* which is used to calculate the total revenue for each tour.

```
total revenue = 0
loop for each passenger
       if passenger is OAP
          apply 20% discount to ticket price
       end if
       add tour price to total revenue
end loop
```

Convert this structured English to a *graphical design notation* with which you are familiar. **3**

13. The Burnside Motel uses its website to provide details of the motel's facilities, rooms and room rates. An application called "quickRes" has been developed to add e-commerce functionality to a hotel or motel website.



(*a*) The e-commerce facilities provided by the "quickRes" application include:

- a reservations system
- a secure booking and payment system.

Describe **two** additional features of an *e-commerce platform* that you would expect to find in the "quickRes" application. **2**

(*b*) Describe **one** advantage of integrating the "quickRes" application within the website for anyone who wants to make a booking for the motel. **1**

(*c*) The "quickRes" application is an example of *commercial* software. Many *open source* alternatives are, however, available.

Explain **one** possible drawback of using an open source alternative to "quickRes" in terms of *security*. **2**

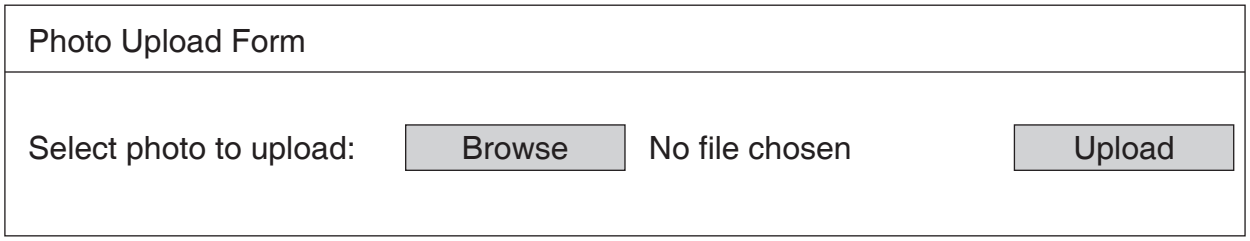
(*d*) A future development of the "quickRes" application will direct guests to other travel and tourist providers and enable them to create personalised travel packages. These other providers would be able to share guest and booking details with the motel using *Electronic Data Interchange* (*EDI*).

Explain **one** *legal restriction* that would apply when EDI is used to share guest and booking details. **2**

Marks

13. (continued)

(*e*) The motel allows guests to upload photographs taken during their stay. An HTML form is used for this purpose.



(i) The HTML *form element* for the Photo Upload Form is provided below.

```
< form action = "guest_photo.asp" method = "get" >
```

Explain the purpose of the *action* attribute. **1**

(ii) The incomplete HTML code used to implement the browse button is provided below.

```
Select photo to upload: < input type = ..... >
```

Complete the *type attribute* of the input element for the button used to browse for the photo to be uploaded. **1**

[Turn over

SECTION II
Part B—Online Database Systems (continued)

Marks

14. ScotEc is a Scottish electronics company. ScotEc wins a contract to supply parts to a washing machine manufacturer. This manufacturer uses Electronic Data Interchange (EDI) for all its business transactions and ScotEc must comply.

(*a*) Part of the EDI process involves the use of *translation software*.

(i) Describe the task carried out by the EDI translation software when ScotEc receives an order from the washing machine manufacturer. **1**

(ii) For the development of the translation software, ScotEc software engineers plan to use open source software rather than commercial software.

Compare the ease of maintaining open source software to the ease of maintaining commercial software in terms of *flexibility and adaptability*. **2**

(*b*) ScotEc uses a specialist company to implement its EDI *communication*.

Describe **one** advantage and **one** disadvantage of using a specialist company rather than using the internet for this purpose. **2**

(*c*) When ScotEc receives an order, data is stored in the ORDER table and made available online so that it can be accessed using a web browser by any of their employees.

For this service to operate, the company will use a database server and a web server with a *scripting language*.

(i) Other than the user's name and password, state **two** additional pieces of data which will be used by the script to access the ORDER table. **2**

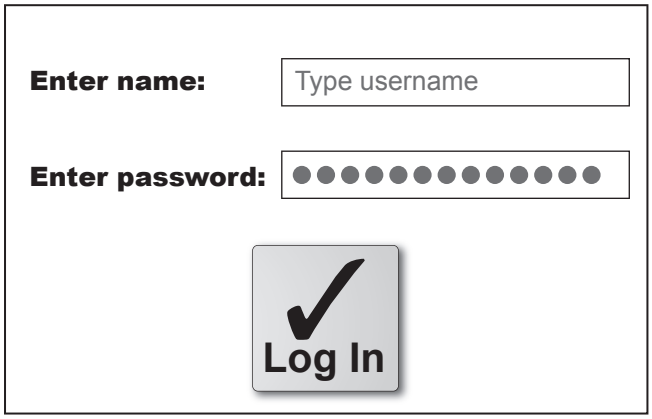
(ii) Describe **three** processes which are carried out by the script used to retrieve the data from the ORDER table. **3**

(*d*) ScotEc's database administrator uses a *server based database management tool*. Describe **two** tasks she could carry out on the ORDER table using this tool. **2**

Marks

14. (continued)

(*e*) The picture shows the part of the form on the webpage used to gain access to ScotEc's database server.



(i) State the *value attribute* of the <*input*> *element* which produces the box where the **name** is to be entered. **1**

(ii) The HTML code for the button to send the login data to ScotEc's webserver is given below

```
<button type = "------">
    <img src = "Login.gif"/>
    Log In
</button>
```

State the button type which has been missed out in the code above. **1**

(iii) State **one** advantage of using a button created by the button element rather than by the input element. **1**

[Turn over

SECTION II
Part B—Online Database Systems (continued)

Marks

15. Finest is an online fashion store. Customers can browse the company website, search for items of clothing and make online purchases.

The company uses a *Customer Relationship Management* system to help better understand customer needs and improve customer satisfaction. The screen shot below shows one page from the Finest website:

(*a*) The website allows customers to leave feedback. Explain how this feature of the company's Customer Relationship Management system is of benefit to:

(i) the company; **1**

(ii) customers. **1**

(*b*) Select **two** additional features of the website that contribute to the company's Customer Relationship Management system. Explain the benefit of the features you select to both the company and its customers. **4**

(*c*) The website was created using a *Content Management System*.

(i) Describe **two** benefits to the company of using a Content Management System to add details of new products to the website. **2**

(ii) Explain how the Content Management System is of benefit when customers leave feedback on items purchased. **2**

Marks

15. (continued)

(*d*) Visitors to the Finest website can submit data using online forms. These forms can be used to insert or amend data stored in the underlying tables of the company's database server.

(i) Give **one** example of when a form would be used to insert data into a table in the underlying database. **1**

(ii) Give **one** example of when a form would be used to amend data in a table in the underlying database. **1**

[Turn over

Marks

16. A new generation of automated cash machines is being developed.

(*a*) Describe the purpose of *system refinement* during the design stage of any development. **1**

(*b*) State **one** reason why it is necessary for any system being developed to undergo *systematic testing*. **1**

(*c*) The cash machine uses *Structured Query Language* (*SQL*) to manipulate the databases used to store customer and account data. Part of each table in the database is shown below.

customer

customerID	lastName	firstName	teleNo
22113211	Smith	Alan	06633121211
22113212	Adams	Peter	06621145122
22113213	Jones	Alison	06612134567

account

accountID	customerID
16784321	22113211
12311221	22113212
12451278	22113213

withdrawal

withdrawalID	accountID	dateOfWithdrawal	amount
236751298	16784321	23/04/13	£60·00
236783471	12451278	23/04/13	£24·00
236814296	16784321	27/04/13	£20·00

card

cardNo	PIN	accountID
1234567	1111	16784321
1212121	1122	12451278

(i) A customer changes their PIN. Copy and complete the SQL statement below which will change the PIN for card number 1234567 to 4491.

```
__________  card

_____________________________

WHERE  _____________________________;
```

3

16. (*c*) (continued)

(ii) The amount of money withdrawn is stored in the attribute "Amount" in the withdrawal table. At the end of each month, these amounts are totalled.

Copy and complete the SQL statement below to total all the withdrawals for account 16784321 for the month of April 2013.

```
SELECT _____________

FROM withdrawal

WHERE dateOfWithdrawal _____________________________;
```

3

(iii) Explain the term *equi-join*. **1**

(iv) The bank wishes to find details of all customers who have not yet withdrawn money from their accounts.

Copy and complete the SQL statement below to find the required information.

```
SELECT * FROM customer, account

WHERE customer.customerID = account.customerID

AND ____________________________________________

(SELECT * from withdrawal WHERE

_____________________________________________________);
```

2

[*END OF SECTION II — PART B*]

[*END OF QUESTION PAPER*]

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