X216/701

NATIONAL QUALIFICATIONS 2010

THURSDAY, 20 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.

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SECTION I

Answer ALL questions in this section.

Marks

1. An information system is being developed to record share prices for companies.

(*a*) The first task of the development process is the *feasibility study*.

Describe **two** aspects of an information system that are considered during a feasibility study. **2**

(*b*) Explain the importance of a *systems specification* in the development of an information system. **2**

(*c*) A *graphical design notation* is used to design a process for the information system.

Describe **one** advantage of using a graphical notation rather than *structured English*. **1**

(*d*) (i) Name **one** suitable *conversion technique* that could be used by the company to implement the upgraded system. **1**

(ii) State **one** implication of your chosen technique for the development of a system. **1**

(*e*) Copy the table below.

Logical Design	Physical Design

Arrange each of the following tasks under the correct heading to indicate whether the task is carried out as part of the *logical design* or as part of the *physical design*:

- Identifying the database product that will be used to build the system
- Producing data flow diagrams
- Defining keys and constraints
- Describing security features and levels of user access **3**

(*f*) Documentation is an important part of any software development. Explain the use made of the following items of documentation:

(i) *user documentation*; **1**

(ii) *system design documentation*. **1**

(*g*) Evaluation of an information system is important for both the client and the development team.

(i) Describe **one** aspect of an information system that would be considered when evaluating the *maintainability* of the system. **1**

(ii) Explain why the *ease of use* of an information system may be of interest to the client during the evaluation stage. **1**

Marks

2. The current information system at Specs4Less is being modelled.

(*a*) An *entity/event matrix* is created.

(i) Explain the purpose of an entity/event matrix. **1**

(ii) **Two** possible events may occur within the customer enitity when a customer makes an appointment for an eye test.

Describe these events and their effect on the customer entity. **2**

When ordering a pair of spectacles or contact lenses for an existing customer, the optician completes an order form. The optician selects the branch, staff, customer and prescription details from drop-down lists. A completed order form is shown below.

Order Number: 123456 Date: 14/05/2010

Branch **Sales Staff Details**

Address: 22 Duck Street	Last Name: Jones
Town: Glasburgh	Initial(s): I
Tel No: 01341871717	

Customer

Last Name: Broad	First Name: Chris
Address: 3 Battle Street	
Town: Newbank	
Postcode: NB1 2YH	
Telephone number: 01122345678	Mobile number: 09876122114
Email: cbonline@vergin.co.uk	

Type: Spectacles [x] Contacts [ ]

Prescription

Left –0·5

Right –1·25

Marks

2. (continued)

(*b*) Copy and complete the following row of the entity/event matrix below to show the effect of this event on each of the entities within the system.

Event/Entity	Branch	Staff	Customer	Order	Appointment	Prescription
Order form completed						

2

(*c*) (i) State **one** difference between an entity/event matrix and an *entity life history diagram*. **1**

(ii) The entry for the supplier entity of the entity/event matrix is shown below. Create an entity life history diagram for the supplier entity based on this part of the entity/event matrix.

Entity / Event	Supplier
New supplier used	C
Supplier changes detail eg address	M
Stop using a supplier	D
Send order to supplier	R
Amend order	R
Receive order from supplier	R
Archive	D

4

(*d*) Testing will be carried out on the implemented system.

Prescription	
Left	−0·5
Right	−1·25

The prescription for left and right can be values in the range −12 to +12 inclusive.

Create a set of *test data values* that will **fully** test the validation procedures on the values entered for left and right. **3**

[Turn over

Marks

3. Sunnyville Social Club organises outings for senior citizens to a number of different destinations. The Club stores information about outings, destinations and members in a relational database system. These details are arranged in third normal form (3NF) as shown below.

Outing Number
Outing Date
Destination Name*
Outing Description

Destination Name
Destination Address
Destination Postcode
Destination Telephone Number
Destination Cost

Outing Number*
Member Number*

Member Number
Member First Name
Member Last Name
Member Telephone Number

Note: in the representation of 3NF shown, primary keys are underlined (Primary) and foreign keys are asterisked (Foreign*).

The following restrictions are applied to the details that are stored by the Club:

- Details of potential destinations for trips are stored by the Club, but not all of these will have outings made to them.
- Each outing goes to only one destination.
- Each member may go on many outings in the course of the year.
- There may be more than one outing to the same destination on different dates.
- The same member may go to the same destination on different dates.
- Not all club members go on outings.
- Outing Number, Destination Name and Member Number are unique identifiers.

Draw an *entity/relationship diagram* to represent the 3NF system above. On your diagram, you should clearly indicate:

- the cardinality of all relationships
- all weak entities and weak relationships
- the mandatory or optional nature of each relationship. **8**

Marks

4. The Sheriff Woods Estate Agency is creating a *data flow diagram* (DFD) to model the flow of data between processes in the agency information system.

(*a*) Describe **two** differences between a *level 0* DFD and a *level 1* DFD. **2**

A description of the processes within the agency information system is provided below.

> The Sheriff Woods Estate Agency is contacted by people who wish to sell their house. The information about the house is stored in a house file and the seller's details are stored in a client file.
>
> When buyers contact the estate agency, their personal details are taken and added to the client file. Information about the type of house that they want to buy is stored in the requirements file.
>
> Every month, the requirements file is used to send buyers a matched list of houses that they may be interested in viewing.
>
> When a buyer decides to purchase a house, details of the offer are forwarded through the estate agency to the seller. The seller responds through the agency with either an acceptance or rejection of the offer which is forwarded to the buyer.
>
> When the offer is concluded, the client file and the house file are updated as necessary.

(*b*) Create a **level 0** DFD for the Sheriff Woods Estate Agency system described above. **6**

(*c*) A *data dictionary* is prepared for the Estate Agency system. The data dictionary indicates whether or not an attribute is to be *indexed*.

(i) Explain when it would be **appropriate** to index an attribute. **1**

(ii) Explain when it would be **inappropriate** to index an attribute. **1**

[Turn over

5. A nationwide supplier of small electrical goods uses a database to store details of the company's branches, their location and the products available within each branch. Sample data stored by the company is shown below.

Branch ID	Location	Product Num.	Description	Make	Warranty	Stock Qty	Price
W15	Greenock	M382	Coffee Maker	HomeSpun	12	24	£23·99
		M117	Bread Maker	MicroGoods	18	5	£45·00
		F663	Digital Camera	Sanyoyo	24	8	£238·95
		D491	Hair Dryer	Murphys	12	15	£35·99
E48	Ballater	M117	Bread Maker	MicroGoods	18	3	£52·05
		R564	Camcorder	Sanyoyo	12	25	£545·95
		F663	Digital Camera	Sanyoyo	24	18	£228·00

Details of company employees are also stored in the database. Sample employee data is shown below.

Employee ID	Name	Job Title	Salary	Branch ID
1453	Nimmo, Peter	Manager	£36,500	W15
1580	Love, Stuart	Asst Manager	£29,750	W15
2218	Singh, Riminjeet	Senior Sales Asst	£21,500	W15
3477	Coxon, David	Sales Asst	£18,500	W15
1995	Cromar, Gary	Sales Asst	£18,500	W15
2811	Alexander, Lesley	Manager	£36,500	E48
3601	Higgins, Mark	Senior Sales Asst	£21,500	E48
4054	Cuthbertson, Craig	Sales Asst	£18,500	E48

5. (continued)

Whenever one or more items are sold in one of the company's branches, a branch sale is created and stored in the company database. Sample branch sales are shown below.

Branch ID	Sale Num.	Date	Time	Product Num.	Sale Qty	Price	Cost
E48	135	13/10/08	14·10	F663	2	£228·00	£456·00
				R564	1	£545·95	£545·95
						Total Cost	**£1001·95**

Branch ID	Sale Num.	Date	Time	Product Num.	Sale Qty	Price	Cost
W15	135	13/10/08	14·00	M117	1	£45·00	£45·00
						Total Cost	**£45·00**

Normalise the data stored in the company database. You should show all stages of your solution, from UNF through to 3NF. You may not introduce any new attributes. The following points should be noted when developing your solution:

- Branch ID, Product Num. and Employee ID are unique identifiers.
- Each Sale Num. is unique within the branch that processed the sale.
- Managers can alter the price of individual products on sale in their branch to take account of competition from other local shops.
- All employees with the same job title earn the same salary.
- Cost and total cost are calculated values. **15**

[*END OF SECTION I*]

[Turn over

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SECTION II

Attempt ONE sub-section of Section II

Part A	**Information Systems Interfaces**	**Page 12**	**Questions 6 to 9**
Part B	**Online Database Systems**	**Page 20**	**Questions 10 to 15**

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

[Turn over

SECTION II

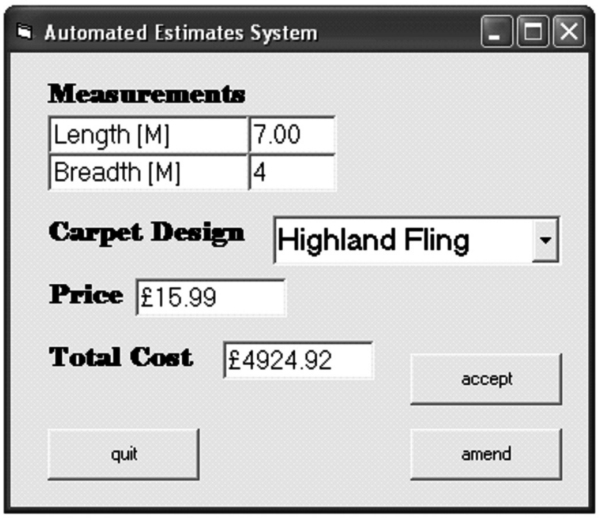
Part A—Information Systems Interfaces

Answer ALL questions in this part.

Marks

6. A carpet sales company is developing a *palm-top device* to measure the dimensions of a room and calculate the total cost of buying carpet for the room. The palm-top devices will be used by salespeople to provide estimates when visiting customers' homes.

(*a*) A completed screen for the palm-top is shown below. When the screen is first used by one of the salespeople, nothing happens when the "amend" button is selected.



(i) Name the stage of the development process at which this error should have been found. **1**

(ii) Name **and** describe the type of *maintenance* that would be needed to fix this error. **2**

(*b*) Whenever the carpet prices are updated on the company's central server, the palm-top devices can be updated automatically. A pop-up dialogue box on the palm-top asks if the update should be performed.

(i) A salesperson can choose whether or not to update the device by tapping either the "Yes" or "No" option and then tapping the "Continue" button.

Name the *interface mode* used by the palm-top device. Justify your answer. **2**

(ii) Name the type of *predictive* and *adaptive user interface* that is exemplified by the automatic updating of prices. **1**

Marks

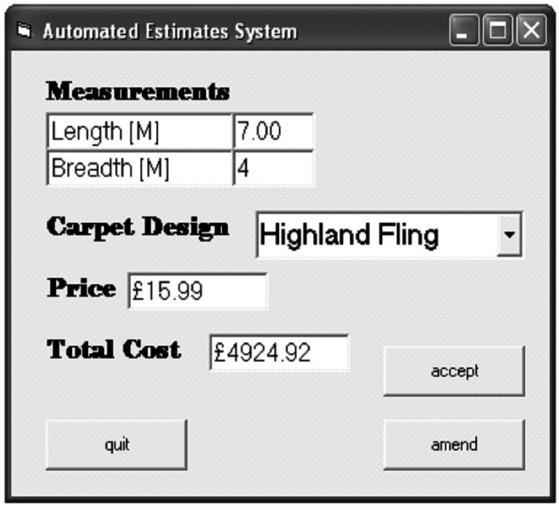
6. (continued)

(*c*) When a customer orders a carpet, the customer and payment details must be entered and stored in a relational database.

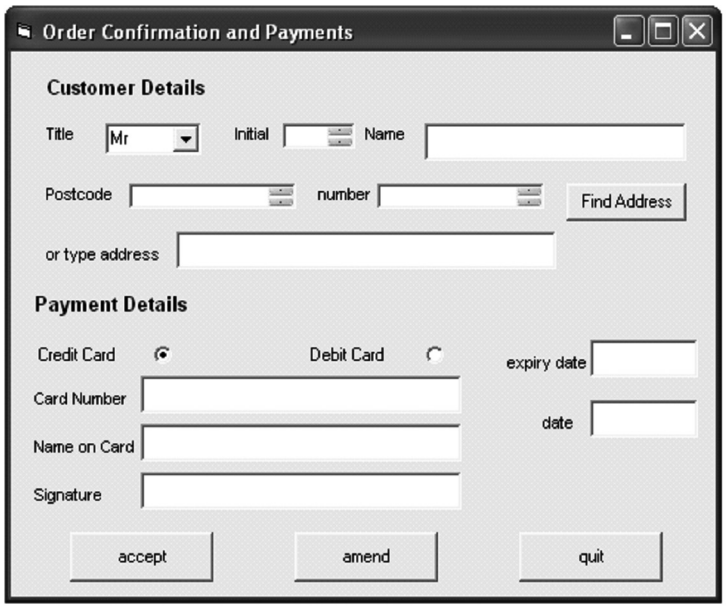
(i) Name the database object that would be used to store customers' details. **1**

(ii) Name the database operation that would be used to retrieve the payment details from any previous orders made by the customer. **1**

(*d*) A *consistency inspection* is carried out on the following two screens that form part of the device's interface.



Screen 1



Screen 2

Describe **two** issues which may be identified from these two screens as a result of the consistency inspection. **2**

(*e*) The company wishes to find out whether or not the new palm-top device has improved the time taken to complete estimates and process orders.

(i) Describe the characteristics of the following **two** *inquiry methods*:

- *user performance data logging*
- *surveys*. **2**

(ii) Explain which inquiry method given in (*e*)(i) would be **more** suitable in this case.

Give **two** reasons to support your choice. **2**

[Turn over

SECTION II
Part A—Information Systems Interfaces (continued)

Marks

7. The interface for a hotel management system is being developed. The design team has created a *paper prototype* of the system.

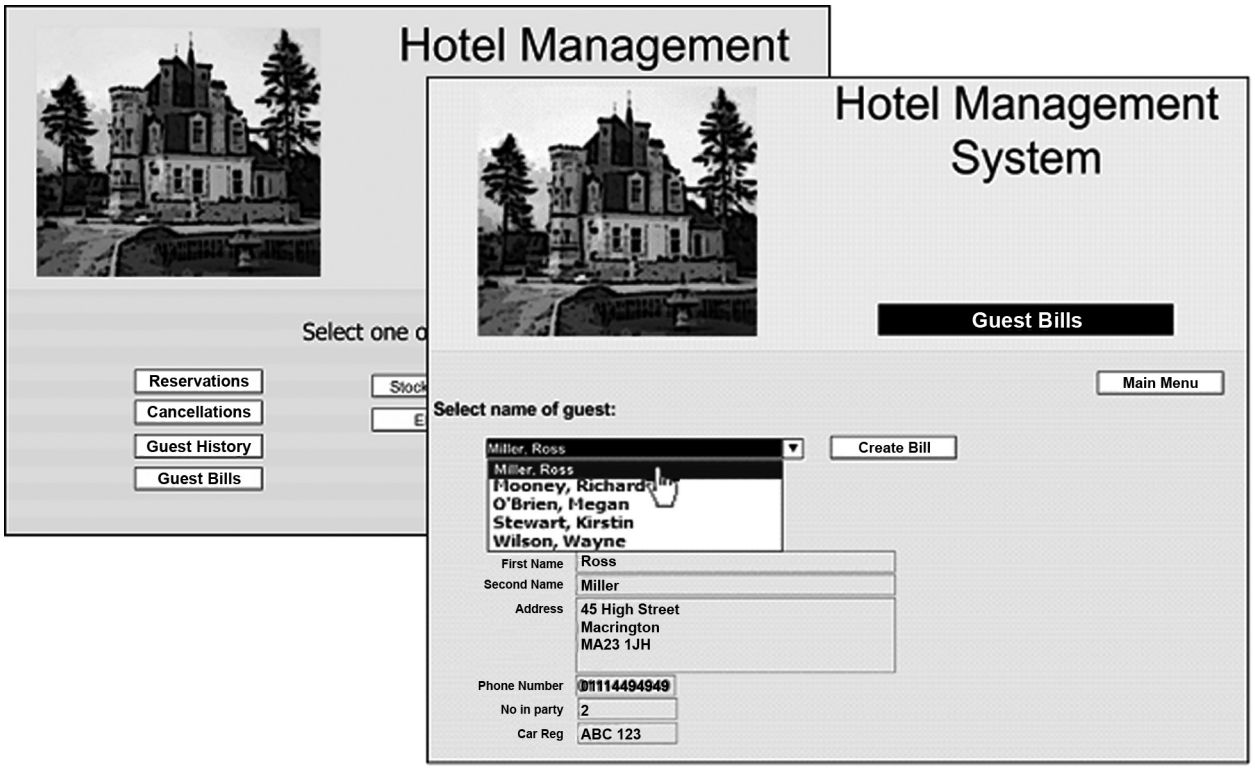
(*a*) Explain what is meant by the term "paper prototype". **1**

(*b*) The paper prototype is used during *usability testing* of the interface.

(i) Explain how *eye tracking* could be used with the paper prototype to improve the user interface. **2**

(ii) Name a *qualitative technique* that could be used to determine the extent to which users approve of the user interface. Explain how the named technique would be used for this purpose. **2**

(*c*) The design team use *rapid application development* (*RAD*) to develop the screens shown below. Once the system has been fully implemented, these screens will be used by hotel receptionists and managers.



(i) Explain what is meant by the term "rapid application development". **1**

(ii) Evaluate the suitability of the interface for its intended users. **2**

(iii) By referring to the screen shots above, explain the difference between *horizontal* and *vertical prototyping*. **2**

Marks

7. (continued)

(*d*) Read the following standard English description of the "Create Bill" process that is part of the hotel management system.

> To produce a customer bill, first set the total nightly cost and total cost of stay to zero. Next, fetch the nightly room rate from the room rate file.
>
> Then display the customer name and address on the bill.
>
> For each night the customer spends in the hotel, fetch the customer's total nightly restaurant spend and display this on the bill. Calculate the total nightly cost by adding the nightly restaurant spend to the nightly room rate. Update the total cost of the stay by adding this total nightly cost to the total cost of stay.
>
> Display the total cost of stay on the bill.
>
> If the customer is a regular guest, calculate a 10% discount of the total cost of stay and print the discount on the bill. Calculate the total due by subtracting the discount from the total cost of stay. For all other customers, the total due is equal to the total cost of stay.
>
> Print the total due on invoice.

Use *structured English* to describe the "Create Bill" process outlined above. **6**

[Turn over

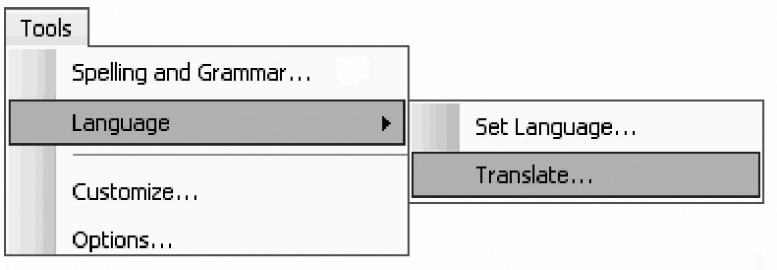
Marks

8. Rory McEwing works for Madeira Software. He is part of a user interface design team that is developing a new word processing package. The new software will include a number of features requested by members of the Madeira Software online users' forum.

(*a*) Rory and his colleagues begin the first stage of the *LUCID methodology*. Name and describe what is involved in the first stage of the LUCID methodology. **2**

(*b*) Forum members have suggested that keyboard shortcuts should be provided for several commonly accessed menu options.

(i) The Translate option is currently available in the Language submenu of the Tools menu as shown in the screen shot below.



Rory has proposed that the keyboard combination ALT+T be added as a keyboard shortcut for the Translation option.

Explain the terms *syntax* and *semantics* using the Translate option described above to exemplify your answer. **2**

(ii) Name a *quantitative technique* that could be used by Rory to measure the increase in operation speed that might result from the suggested addition. **1**

(iii) Name the class of user that would **most** benefit from the suggested addition. Justify your answer in terms of the users' characteristics and the potential benefit to these users. **3**

(*c*) Rory produces a *feature set* that will be used during usability testing of the new word processing package.

(i) Explain the role of a feature set in determining which features of the package are critical and which can be omitted from the final implementation. **2**

(ii) Having identified the critical features of the software, describe **two** ways that Rory can optimise the operation of these features. **2**

(*d*) A *heuristic evaluation* is to be carried out as part of the usability testing.

Suggest **two** heuristics that could be used by the evaluators of the new word processing package. **2**

[Turn over for Question 9 on *Page eighteen*

Marks

9. Vendisoft is a company which creates software to control and operate vending machines.

(*a*) Vendisoft sometimes analyses older systems in order to improve the design of new ones. Name and describe **one** *investigative technique* that could be used for this purpose. **2**

(*b*) To develop initial ideas quickly and to make them accessible to customers, Vendisoft uses *storyboards*.

Name **two** components that might be included in an interface design storyboard. **2**

(*c*) Vendisoft plans to carry out *acceptance testing* of a ticket vending machine in the concourse of a busy railway station. Actual passengers will be asked to test the system.

(i) Recommend **one** *qualitative technique* that could be used to carry out this acceptance testing. Justify your choice by giving **two** reasons why this technique would be appropriate. **2**

(ii) Explain, by giving **two** reasons, why *command and control systems* would be inappropriate in this situation. **2**

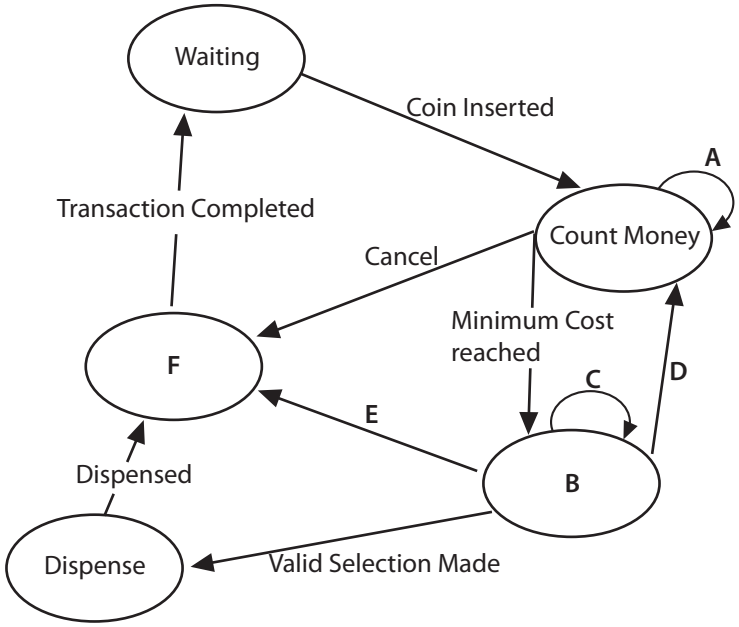
Marks

9. (continued)

(*d*) Vendisoft has been developing a drinks vending system. The operation of the system is described below.

> The machine waits until the first coin is entered. It continues to count coins until the minimum cost of any item in the machine is reached. When the customer selects a drink, if the drink is available it is dispensed and any necessary change given. If the chosen drink is out of stock the machine continues to wait for a valid selection. If a valid selection is made but insufficient money has been entered, the system waits for further coins to be entered. The transaction can be cancelled at any stage before a valid selection has been made.

A *state transition diagram* is produced to represent the operation of the drinks vending machine. An incomplete version of this state transition diagram is shown below.



By referring to the system description and the incomplete state transition diagram above, suggest suitable labels for items A, B, C, D, E and F. **6**

(*e*) With reference to the drinks vending machine described above, explain why **both** *component testing* and *integrative testing* are required. **2**

[*END OF SECTION II—PART A*]

SECTION II

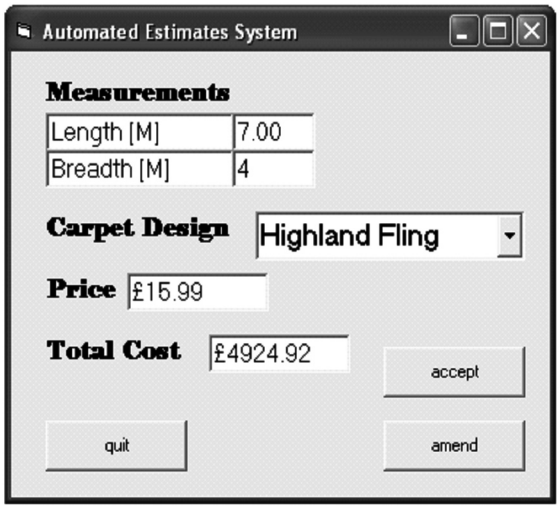
Part B—Online Database Systems

Answer ALL questions in this part.

Marks

10. A carpet sales company is developing a *palm-top device* to measure the dimensions of a room and calculate the total cost of buying carpet for the room. The palm-top devices will be used by salespeople to provide estimates when visiting customers' homes.

(*a*) A completed screen for the palm-top is shown below. When the screen is first used by one of the salespeople, nothing happens when the "amend" button is selected.



(i) Name the stage of the development process at which this error should have been found. **1**

(ii) Name **and** describe the type of *maintenance* that would now need to be carried out to fix this error. **2**

(*b*) When a customer orders a carpet, the customer and payment details must be entered and stored in a relational database.

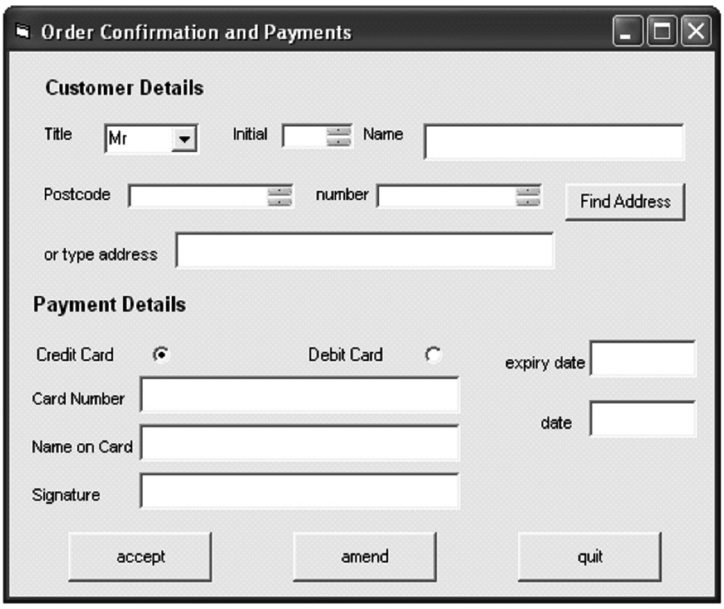
(i) Name the database object that would be used to store customers' details. **1**

(ii) Name the database object that would be used to retrieve the payment details from any previous orders made by the customer. **1**

Marks

10. (continued)

(*c*) When the "accept" button is selected, the payment screen below is displayed.



Using the form *input element* and its attributes *type, name* and *value*, write the HTML code used to create the Credit Card and Debit Card payment labels and option buttons shown in the screen shot above. **5**

[Turn over

SECTION II
Part B—Online Database Systems (continued)

Marks

11. An increasing number of companies use *Customer Relationship Management* (CRM) systems.

(*a*) Describe what is meant by the term "Customer Relationship Management". **1**

(*b*) Many online shops will use CRM systems to generate additional sales by suggesting a personalised list of items that may be of interest to the customer. This is illustrated in the screenshot below.

Describe what information the CRM system needs to store in order to make these personalised suggestions. **2**

(*c*) Companies with an online presence often combine CRM systems with *e-commerce platforms*.

Describe **two** components of an e-commerce platform. **2**

Marks

12. For many years doctors have used computer systems to store patients' records. They often need to share this data with organisations such as hospitals, the local health service and insurance companies. Due to the incompatibility of their computer systems, some doctors still have to exchange paper records with the local health service. To solve this problem, the local health service has introduced *electronic data interchange* (*EDI*).

(*a*) *Transaction standardisation, translation software* and *communication* are **three** features of an EDI system. Explain how **each** of these features of EDI is used in transferring patient data from doctors to the local health service. **3**

(*b*) The introduction of EDI means that doctors no longer need to exchange paper records with the local health service. State **two** additional reasons why the introduction of EDI would be an advantage to doctors. **2**

(*c*) State **two** legal restrictions that apply when using EDI to exchange patient data. **2**

[Turn over

Marks

13. David Young is a professional photographer. He intends to use a content management system to develop a website for his business.

(*a*) State what is meant by the term *content management system* in relation to websites. **1**

David summarises his requirements for the website as follows:

- Photographs should be available to view via the website.
- Photographs should be arranged in topics such as Landscapes, Castles, Wildlife, Seasons and Holidays.
- Members of the public should be able to search the site for a particular topic and thumbnails of relevant images should be displayed.
- When a thumbnail is selected, the image should be enlarged so that the detail can be viewed.
- Enlarged images should be protected so that my copyright wouldn't be infringed.
- I need to be able to update the site content, add new images, remove older images and reorganise the image topics.
- I also need to update the site layout regularly to keep it fresh and up-to-date.

Lenz is a content management system that specialises in photo galleries. The homepage of the Lenz website is shown below.

Marks

13. (continued)

(*b*) By referring to David's requirements and the facilities offered by the Lenz content management system in your answer, explain how the system would be of benefit to David when:

(i) creating the website; **2**

(ii) maintaining and updating the website content. **2**

(*c*) The Lenz content management system would store David's images on one server and use a separate web server to process requests from members of the public.

Describe the processing that takes place at the web server in order to display relevant photographs when a member of the public searches for Castles. **2**

(*d*) The Lenz content management system is an example of *open source software*.

(i) State **one** benefit of using open source software in terms of *security*. **1**

(ii) State **one** drawback of using open source software in terms of *ongoing support*. **1**

(*e*) The website allows members of the public to search for photographs arranged by a particular topic. The following HTML code is used to create a submit button.

```
<input type= "submit" name="submit_button" value="click to search">
```

(i) Write the HTML code for a *button element* that could replace the *input element* shown above. **3**

(ii) State **one** advantage of using the button element rather than the input element to create a submit button. **1**

(*f*) The structure of tables in an online database can be modified using *server-based database management tools*.

Explain how the use of server-based database management tools would be beneficial to owners of an online database. **2**

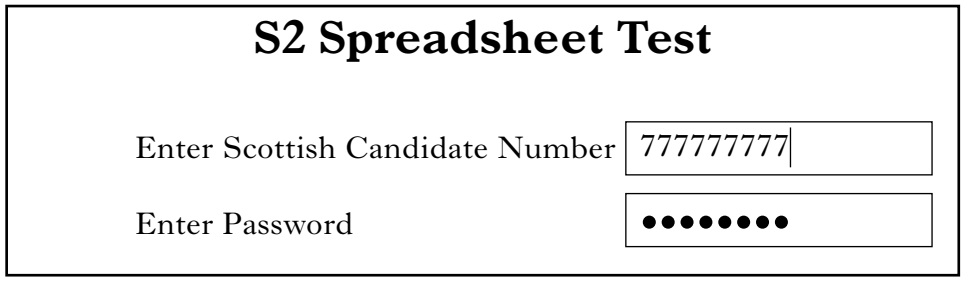
[Turn over

Marks

14. A school wishes to introduce an online testing system. The pupils will sit online tests which would be automatically marked by the system and the results stored in a database.

(*a*) Name and describe **one** *information gathering technique* which the developer could use to investigate the user requirements. **2**

(*b*) The start of one test is shown below.



(i) Write the HTML code for the *form element* and its attributes which will be used to send the data shown to the web server file S2ssmarks.asp. **3**

(ii) Explain your choice of *method* for sending the form data. **1**

(*c*) A script is used to add a user's answers and scores to a table held in a database server.

Read the following standard English description of the process that marks a user's answers and enters data into the database.

> Set total score to 0.
>
> Make a connection to the database server and connect to the correct table.
>
> For each question, get the user's answer and compare it to the correct answer, awarding 1 mark if answer is correct and 0 marks if answer is wrong. Add the marks to the total score. Then execute the SQL command to update the table with the user's answer and the marks awarded for the question.
>
> When all questions have been answered, execute the SQL command to update the table with the user's total score.
>
> Close the connection.

Use *structured English* to describe the process outlined above. **6**

(*d*) Explain why **both** *integrative testing* and *component testing* are needed in this situation. **2**

[Turn over for Question 15 on *Page twenty-eight*

Marks

15. In an effort to cut down traffic congestion and pollution, the town of Orwellton has decided to implement a congestion charging system.

Any vehicle detected in the Congestion Charge Zone will have to pay a daily charge based on the vehicle's ChargeCategory. Details of each vehicle's ChargeCategory are stored in a table of Charges.

This table is shown below.

Table: Charge

ChargeCategory	*ChargeAmount*
A	5·00
B	8·00
C	12·00

(*a*) A new ChargeCategory is to be added to the system. The new ChargeCategory is D and the associated ChargeAmount is 25·00.

(i) Write the SQL code to add this new category. **2**

(ii) State whether the SQL statement required in (*a*)(i) is an example of *Data Query Language* or an example of *Data Manipulation Language*. **1**

The congestion charging system consists of the four tables and three relationships shown below.

Table: ZoneEntry

DateOfEntry	*VehicleRegNo*	*DatePaid*
2010-03-23	ED05 KLM	2010-03-23
2010-03-23	DU04 DRW	
2010-03-23	DU59 AJP	2010-03-24

Table: Vehicle

VehicleRegNo	*ChargeCategory*	*OwnerID*
ED05 KLM	A	CRAIJ2053
DU04 DRW	B	DOBBI1234
DU59 AJP	D	FOSTD4723

Table: Charge

ChargeCategory	*ChargeAmount*
A	5·00
B	8·00
C	12·00
D	25·00

Table: Owner

OwnerID	*FirstName*	*LastName*	*HouseNo*	*Postcode*	*PhoneNo*
CRAIJ2053	Joseph	Craig	24	EH42 6XY	01425 567890
FOSTD4723	David	Foster	253	DD81 4AP	01327 444444
DOBBI1234	Ian	Dobbin	73	PA16 7XE	01475 715050

Relationships:
ZoneEntry.VehicleRegNo : Vehicle.VehicleRegNo
Vehicle.ChargeCategory : Charge.ChargeCategory
Vehicle.OwnerID : Owner.OwnerID

15. (continued)

(*b*) Read the following SQL code.

```
SELECT Owner.FirstName, Owner.LastName, Owner.Postcode
FROM Owner, ZoneEntry, Vehicle
WHERE ZoneEntry.VehicleRegNo = Vehicle.VehicleRegNo
AND Vehicle.OwnerID = Owner.OwnerID
AND (ZoneEntry.DatePaid > ZoneEntry.DateOfEntry
OR ZoneEntry.DatePaid IS NULL)
```

By referring to the data provided in the table opposite, write down the output produced by the SQL code above. **3**

(*c*) Details of any vehicles which used the congestion zone in December 2009 are required. The details must be arranged in reverse alphabetical order of ChargeCategory.

Read the SQL code below.

```
SELECT DateOfEntry, Vehicle.VehicleRegNo, ChargeCategory
FROM ZoneEntry, Vehicle
WHERE ZoneEntry.VehicleRegNo = Vehicle.VehicleRegNo
AND DateOfEntry BETWEEN 2009-12-01 AND 2009-12-31
...
```

Write the missing SQL code that is needed to complete this query. **2**

(*d*) State the purpose of the SQL `SUM` function. **1**

[*END OF SECTION II—PART B*]

[*END OF QUESTION PAPER*]

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