X216/701

NATIONAL QUALIFICATIONS 2008

MONDAY, 19 MAY
1.00 PM – 3.30 PM

INFORMATION SYSTEMS
ADVANCED HIGHER

Attempt **all** questions in Section I.

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

Part A	Information Systems Interfaces	Page 10	Questions 6 to 10
Part B	On-line Database Systems	Page 19	Questions 11 to 15

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

Answer ALL questions in this section.

Marks

1. ScotJob is an agency that offers careers advice to secondary school pupils. Information about jobs, apprenticeships and work-based training courses is held on individual career cards. Pupils must complete a paper-based questionnaire giving details of their qualifications and career preferences. The pupils' details are then manually matched with possible jobs, apprenticeships or training courses.

Peter Henderson is a systems analyst. He has been asked by ScotJob to determine whether or not it would be feasible to develop a computerised information system to replace the current manual systems in use by the ScotJob agency.

(*a*) Explain why it would be important to carry out a *feasibility study* before embarking on the full development of the new information system. **2**

(*b*) Having completed the feasibility study and determined that the development is indeed feasible, Peter is asked to begin the necessary analysis and design work.

Peter starts by investigating the current card-based system that is used by the agency to record details of jobs, apprenticeships and training courses. He also investigates the manual system that is used to match pupil preferences to possible careers.

What information would Peter hope to gain by investigating the systems currently in use by the ScotJob agency? **2**

(*c*) State **two** issues that would be taken into account when creating the *physical design* of the system that would **not** have been considered when creating the *logical design*. **2**

(*d*) Once the new information system for the ScotJob agency has been fully implemented, testing of the system is performed.

Explain the need to carry out *integrative testing* in addition to *component testing*. **2**

Marks

2. The management committee of the Smash&Lob Tennis Club would like to develop an information system to process club membership applications, store personal details of club members, process details of club matches and competitions and update member positions in the club league. Once developed, the system will be used:

- by the club secretary to process details of members and memberships
- by the match secretary to arrange match fixtures and competitions, process match results and update positions of members in the club's league
- by club members to view up-to-date positions in the club's league and details of forthcoming matches

(*a*) The following is an interview with the club secretary about the method of processing the results from a tennis competition.

> "When we have a competition, I first of all check that all players already exist in our players list. Any players not already registered with the club are entered into our players list and recorded as guests.
>
> Next, I make up matches for the first round by deciding which players are playing against each other, when the match will be played and which court will be used. I store details of the matches in the match file. Before each match, I print out the score card that will be used by the match umpire. This score card shows the match details and player details. After each match, I record the scores for each match in the match file. After each round is finished, I make up the matches for the next round."

Create an entity event matrix based on this interview. Your entity event matrix should list the events that are described and indicate the effect that these events have on the PLAYER entity and the MATCH entity. **4**

(*b*) The information system will require a number of processes, including an `update_league` process that will be required to update the position of a club member in the club's league as soon as the results of a match have been entered into the system.

The analyst produces a description of the `update_league` process using *Structured English*. The Structured English is shown below.

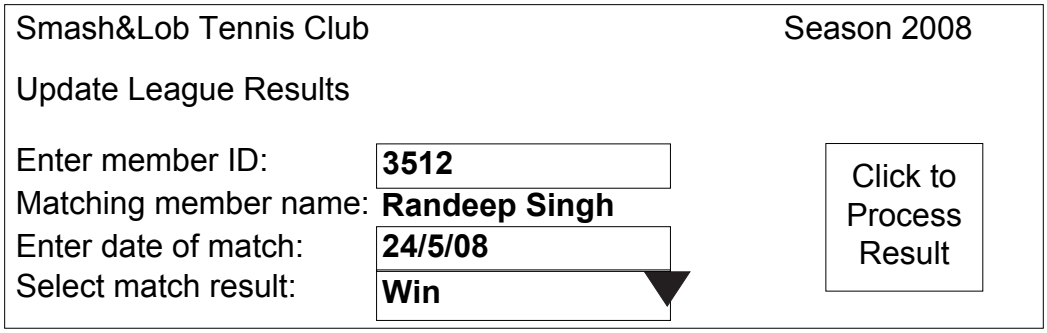
```
Process: update_league

loop
     enter match result for member
     if match result = win then
         add 3 points to member points
     end if
end loop when match results of all members entered
sort league into descending order of member points
```

Using a *graphical design notation* with which you are familiar, produce a description of the `update_league` process that is equivalent to the Structured English given above. **3**

Marks

2. (continued)

(*c*) The `update_league` process described in part (*b*) above includes the statement `enter match result for member`. During implementation, this statement is implemented using a form. A screen shot of this form is shown below:



Explain the use made of **three** other elements of a database system that would be needed to implement the `update_league` process described in part (*b*). **3**

(*d*) The new information system has been successfully implemented. The management committee of the tennis club request that the developers undertake *perfective maintenance* of the system.

(i) Explain how the contents of the *post implementation review* would be used to carry out this maintenance. **2**

(ii) Describe any **three** tasks that would be involved in carrying out maintenance of the system. **3**

Marks

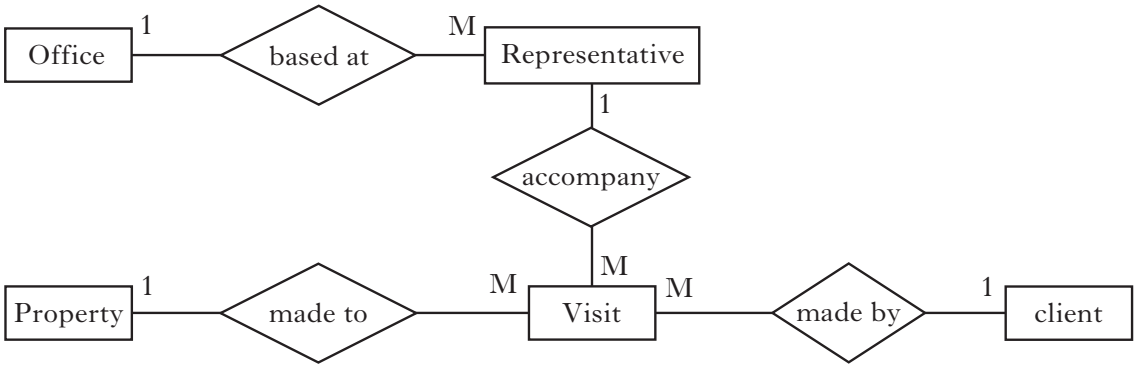
3. A sales office at a housing development is looking to develop a computerised solution to keep records of all clients who visit a property that is being sold. A relational database management system is implemented based on the design produced. As part of the design, an *entity-relationship diagram* is created.

(*a*) Explain the importance of an entity-relationship diagram in the implementation of a relational database management system. **2**

(*b*) The sales offices have at most 5 sales representatives. Each representative is assigned to one office. Each office has at least one representative and all representatives carry out visits. The sales representatives are responsible for giving information and showing clients around any properties that the client is interested in buying. Clients may visit certain properties unaccompanied. Client and property details may be recorded without any visits taking place.

The third normal form (3NF) for the relational database management system results in the following:

- Office [office id, address, town, postcode]
- Representative [office id*, sales rep code, name, total sales]
- Property [property ref number, type, rooms, price]
- Client [client ID, name, address, town, postcode]
- Visit [property ref number*, client ID*, date, time, sales rep code*, comment]



Copy the entity-relationship diagram.

Based on the information given, add suitable notation to show:

- Entities (strong/weak)
- Relationships (optional/mandatory, strong/weak) **4**

(*c*) A *data dictionary* is developed as part of the design. The data dictionary is based on the earlier design work. The data dictionary indicates that one particular attribute requires a lookup to be implemented. When the lookup is implemented, it displays an incorrect list of values.

Correction of this problem involves *iteration*. Explain the iterative nature of the development cycle. **2**

Marks

4. Mosco is a sandwich and smoothie bar that supplies take-away orders to offices and work places. Customers can place orders for sandwiches and smoothies by telephone. Once an order has been prepared by the kitchen, it is then delivered to the customer's place of work.

(*a*) The manager of Mosco decides that a computerised ordering system would bring several efficiency savings and asks an analyst to carry out an initial investigation of the system. The analyst begins the investigation by interviewing the manager and the take-away assistant. Having completed the interviews, the analyst realises that further investigative techniques will be necessary.

Explain why interviewing, on its own, would provide the analyst with insufficient detail. **3**

(*b*) Having completed a full investigation of the order processing system at the sandwich bar, the analyst produces a description of each process in the sandwich bar's order processing system. These descriptions are provided below. Produce a level 1 data flow diagram (DFD) to represent the order processing system described.

TAKE ORDER
Customers provide details of sandwiches, smoothies and quantities to an order assistant who records the order details on a paper notepad.

WORK OUT COST
To work out the total cost of the order, the order assistant looks up the price of each item in the sandwich bar chalkboard menu and adds individual prices and total order cost to the notepad.

CONFIRM ORDER
Before an order can be prepared, the order assistant checks the final order details and costs with the customer. If the customer gives the go-ahead, the order assistant asks the customer to provide a delivery address which is added to the order details on the notepad. The order assistant then photocopies the order details on the notepad and sends the copy order to the kitchen so that the sandwiches and smoothies can be prepared.

DELIVER ORDER
Once the kitchen has prepared the sandwiches and smoothies for an order, the completed order is passed to the order assistant along with the copy order. The order assistant then gives the copy order and completed order to the delivery driver. The delivery driver delivers the order to the customer and requests payment. When payment is received, the customer is asked to sign the copy order to indicate the payment has been made to the driver. When the driver returns to the restaurant, the signed copy order and payment are given to the order assistant. The order assistant places the signed copy order in a ring binder that is used to store all completed orders.

UPDATE SALES INFORMATION
At the end of each day, the order assistant uses the original orders in the notepad and the completed orders in the ring binder to update the sales information for the day. The order assistant records sales details in the sales book and provides summary information for the restaurant manager on a daily basis. **12**

Marks

5. Music4All is an agency whose members act as agents to music bands worldwide. Each member agent may be responsible for several bands. Individual bands may have different agents representing them in each worldwide region. The agency stores details of each member agent together with details of all bands that the agent represents. Music4All also keep a file of band details. This second file includes details of all albums released by the band.

AGENT DETAILS

Agent ID	5698
Firstname	Robert
Surname	Smith
Mobile No	0777 555 9875
Region	Europe

Band ID	Band Name	Year Formed	Date Signed	Record Company	Record Company Address	Record Company Town
975	The Chefs	2004	14/06/05	Sunny Records	Unit 4a Carewell Ind Estate	Ayr
276	Polar Chimps	2002	07/12/02	GoldStar Recordings	38 Rose Ave Bearsden	Glasgow
646	BoyzAllowed	2007	28/02/07	—	—	—
183	The Prime Numbers	2005	04/10/06	Sunny Records	Unit 4a Carewell Ind Estate	Ayr

BAND DETAILS

Band ID	Band Name	Album	Date Released	Producer	Studio
276	Polar Chimps	Minimum	14/06/03	Justin Casey	Moon Studios
		What I Say	23/05/04	Pete Bell	Moon Studios
		Greatest Hits	05/11/06	Katy Pippin	Cocoon Studio
646	BoyzAllowed	Welcome to Mainstream	30/03/07	Katy Pippin	Cocoon Studio
975	The Chefs	Upside down	03/12/05	Justin Casey	Moon Studios
		Back To Front	04/10/06	Marsha Mathers	Cocoon Studio
		Greatest Hits	10/12/06	Justin Casey	Moon Studios
		Back To Basics	01/04/07	Al Dente	Penne Tunes
183	The Prime Numbers	Indivisible	31/10/06	Al Dente	Penne Tunes
		Those They Fixed	18/05/07	Pete Bell	Moon Studios
		Unplugged	07/08/07	Katy Pippin	Cocoon Studio

Marks

5. (continued)

Using the two source documents above and taking the following points into consideration, produce a fully normalised set of entities to represent this system. You must show your working at each stage and may not introduce any new attributes.

- Album names are not unique (eg several bands have an album called "Greatest Hits")
- Bands may have more than one agent to represent them in different worldwide regions
- The "Date Signed" attribute refers to when the band signed with the agent, not a Record Company
- A producer only works at one studio, but each studio may have several producers.

14

(60)

[*END OF SECTION I*]

SECTION II

Attempt ONE sub-section of Section II

Part A	**Information Systems Interfaces**	**Page 10**	**Questions 6 to 10**
Part B	**On-line Database Systems**	**Page 19**	**Questions 11 to 15**

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

[Turn over

SECTION II

Part A—Information Systems Interfaces

Answer ALL of the questions in this part.

Marks

6. Glasburgh airport is developing a new information system. The new system will replace the existing information system at the airport which is based on out-dated technology, is frequently unreliable and is prone to regular software failures.

Once developed, the new information system will provide passengers and visitors with up-to-date arrival and departure information on large display screens throughout the airport. Passengers will also be able to access the new information system using kiosks that are located in the departure lounge.

Authorised airport staff will be able to update the screen displays from desktop PCs in the main administrative office of the airport.

(*a*) Describe **both** the kiosk and PC interfaces described above in terms of:
- *mode*
- *typical users* **4**

(*b*) The PCs in the main administrative office will have an *agent-based interface*.

Explain the benefit of an agent-based interface for *novice users* of the system. **1**

(*c*) The airport management decides to evaluate the success of the passenger information kiosks. The management would like to know user opinions of the kiosks.

Suggest **one** *method of inquiry* that would be appropriate to use in this situation. **1**

 Marks

7. Perfect Holidays is looking to extend its company website. At present, the Perfect Holidays website sells package holidays to customers. The company now wishes to extend the service to enable customers to purchase flights, accommodation and transfers separately and so build holidays that meet the customers' individual needs. The Perfect Holidays company also wishes to include virtual tours of apartments and, where appropriate, movie footage of the local villages and towns in the redeveloped website.

The company is aware that many people have additional devices that allow access to the Internet. Such devices include mobile phones, personal digital assistants (PDAs) and portable games consoles.

(*a*) Describe the *technological* and *social* factors that have contributed to the development of human computer interfaces such as those on the devices mentioned above. **4**

(*b*) Perfect Holidays wishes to expand the website to allow customers in other countries to make use of the services provided by the company. One requirement of this expansion is that the website must be displayed in the native language of the customer.

(i) State the area of natural language processing that enables the text of a website to be converted into a customer's native language. **1**

(ii) The website has to cater for the needs of disabled customers. Describe **one** natural language technique that may be used to allow customers with no arm movement to use the website developed for Perfect Holidays. **1**

(*c*) A *heuristic evaluation* of the website is carried out by the interface design team for the Perfect Holidays website development.

During which stage of the *LUCID design methodology* would the heuristic evaluation be carried out? Justify your answer. **2**

[Turn over

8. Taste of Tuscany is a chain of restaurants that serves pizza and pasta. Customers place their orders at an order station near the entrance to the restaurant. They can choose to eat in the restaurant or take the food away. Customers ordering pizza can choose from a range of toppings.

The management of the restaurant chain has decided to upgrade the software used by staff to take customer orders. A development team has been asked to design an interface for the software that will reduce the time needed to take order details from customers.

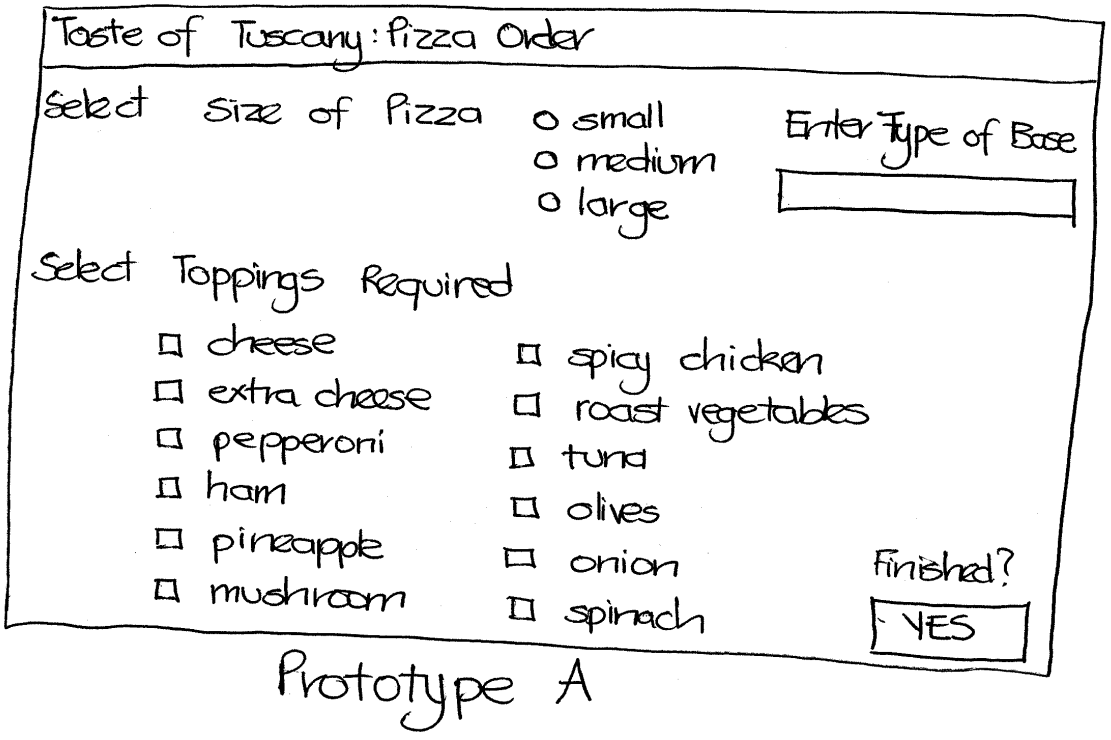
(*a*) The developers use a *storyboard* to plan the layout of the proposed interface.

(i) Name **one** component of an interface, other than the proposed layout, that is indicated on a storyboard. **1**

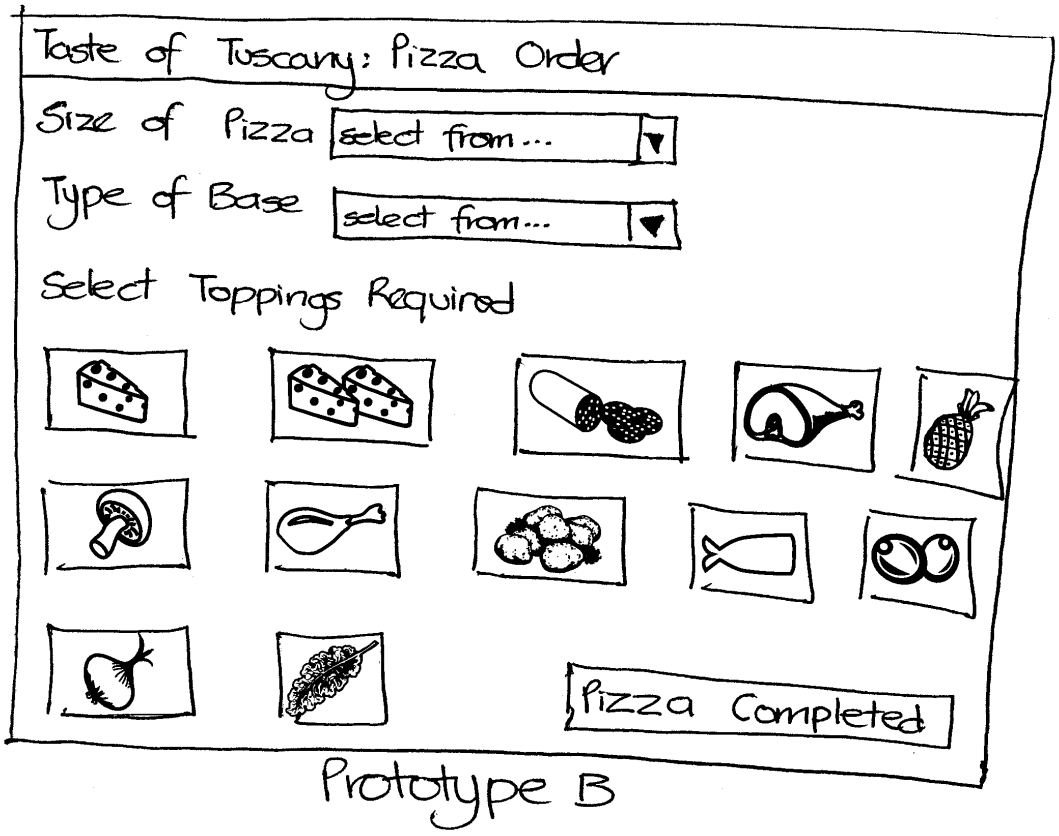
(ii) Describe one benefit of using a storyboard for this purpose. **1**

(*b*) The developers decide to create several *low fidelity prototypes* of the proposed interface for the software.

Two low fidelity prototypes of the pizza ordering interface section of the software are shown below.



8. (continued)



(i) Explain how the *thinking aloud protocol* would be of benefit to the design team when comparing the usability of the two low-fidelity prototypes shown above. **2**

(ii) Explain how the *co-discovery method* would be of benefit to the design team when evaluating the usability of the two low-fidelity prototypes shown above. **2**

(iii) Explain how *eye tracking* could be used to evaluate the usability of the low-fidelity prototypes shown above in terms of *time to learn*. **2**

(*c*) Are the prototypes above examples of *horizontal* or *vertical* prototyping? Explain your answer. **2**

(*d*) Once the new software has been fully developed, *conversion* from the existing system must be planned. Explain why a *pilot* conversion may be appropriate in this situation. **2**

[Turn over

SECTION II

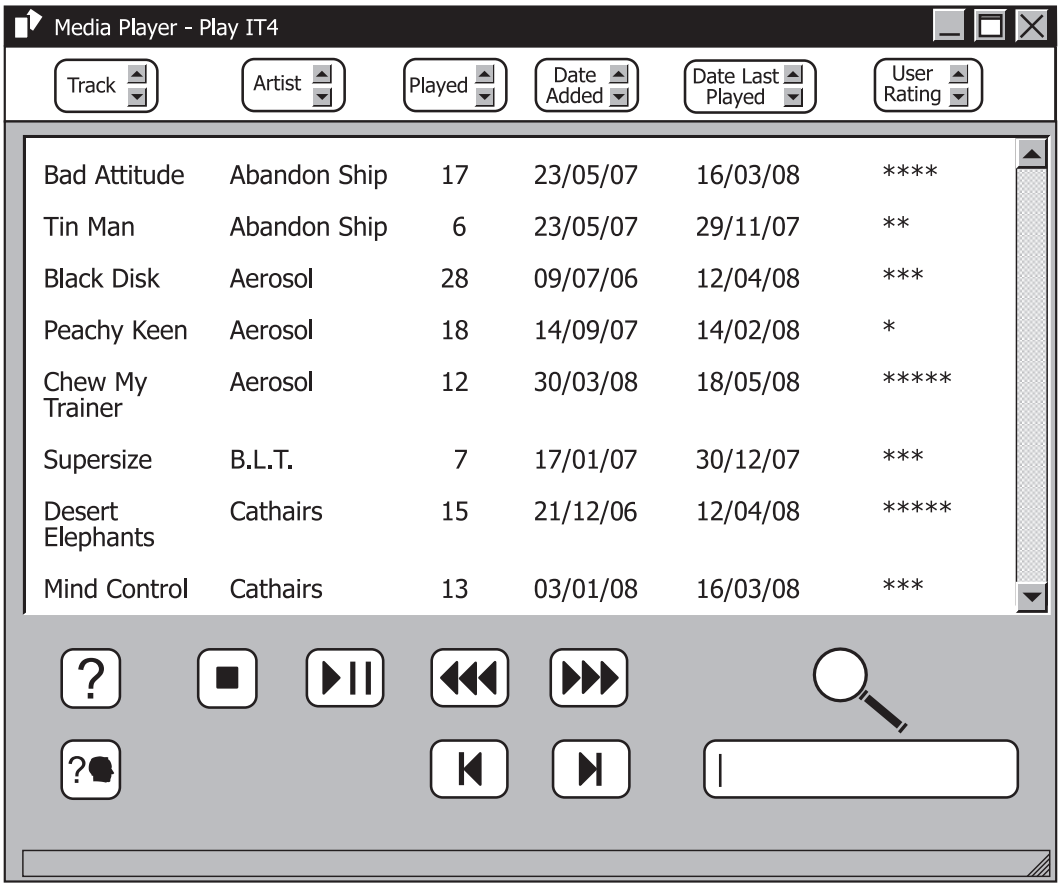
Part A—Information Systems Interfaces (continued)

Marks

9. PlayIT is a software company that develops media players for music and video. The company's media players are often packaged as software extras on new home computer systems, mobile phones, PDAs etc. The company is currently developing its latest media player, PlayIT4.

(*a*) Explain why *adherence to standards* is an important consideration for PlayIT in the design of any media player. **2**

(*b*) The PlayIT4 interface is shown below:



A *feature set* for the PlayIT4 has been generated and the controls have been categorised under 4 different headings. The complete feature set is provided below.

Feature Set			
Play Controls	**Track Listing Controls**	**Random Select Controls**	**Search Facility**
Stop Play Pause Rewind Fast-Forward Next Track Previous Track	Sort By (toggle between ascending & descending on field chosen) - Track - Artist - Played - Date Added - Date Last Played - User Rating	Random Track Intelligent Select (selects tracks based on number of plays)	Search Box

9. (continued)

A user interface may be evaluated in terms of the following criteria:

- speed of task performance
- user error rates
- user retention of commands over time

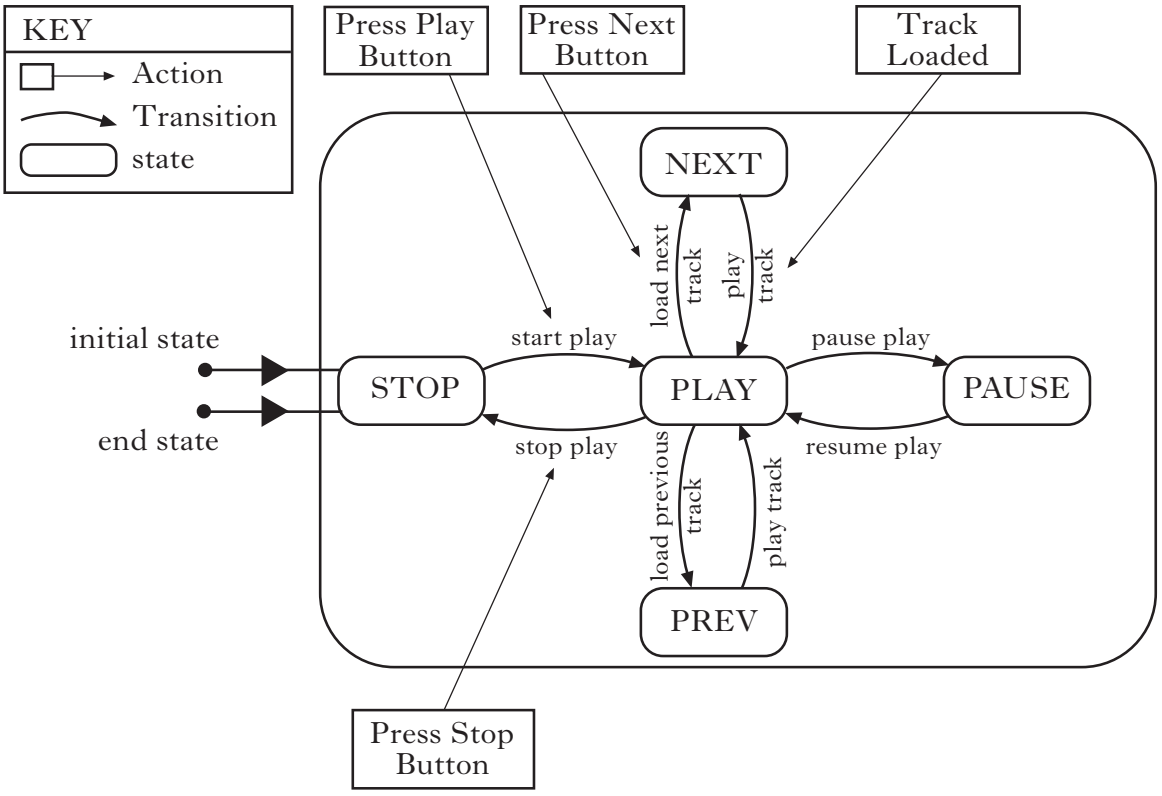
Evaluate each of the following aspects of the feature set using the stated criteria:

(i) Play Controls using user retention of commands over time
(ii) Track Listing Controls using user error rates
(iii) Random Select Controls using user error rates
(iv) Search Facility using speed of task performance **4**

(*c*) (i) Explain how the Intelligent Select feature uses data logging to identify which track to play next. **1**

(ii) Explain how the search facility of the media player could make use of *predictive text* as Artist or Track details are entered into the search box. **2**

(*d*) A *state transition* diagram for some basic functions of the media player is shown below.



(i) Using the state transition diagram as the basis of your answer, is it possible **in one transition** to STOP a track that has been PAUSED? Explain your answer. **2**

(ii) Copy the state transition diagram above and complete the annotations for PREV and PAUSE. **4**

10. GamesStore is a computer games retailer that requires an information system to manage the sale of computer games and other items in their stores.

The following advertisement illustrates a typical game available from the store.

Price: £29·99
Number in Stock: 12

The developers have created a data dictionary to indicate how details will be stored in the information system. The partial data dictionary below shows how details of each game will be stored in the GAME entity.

GAME ENTITY

Name	Type	Size	Validation	Index /Key
Game ID	Integer		Unique	Yes (PK)
Title	Text	250		Yes
Rating	Text	3	Choose from ("3+", "7+", "12+", "16+", "18+")	Yes
Number in Stock	Real			Yes
Price	Text	10		Yes

(*a*) Examine the partial data dictionary above.

(i) Comment on the efficiency of the data storage. **2**

(ii) State the purpose of an index. **1**

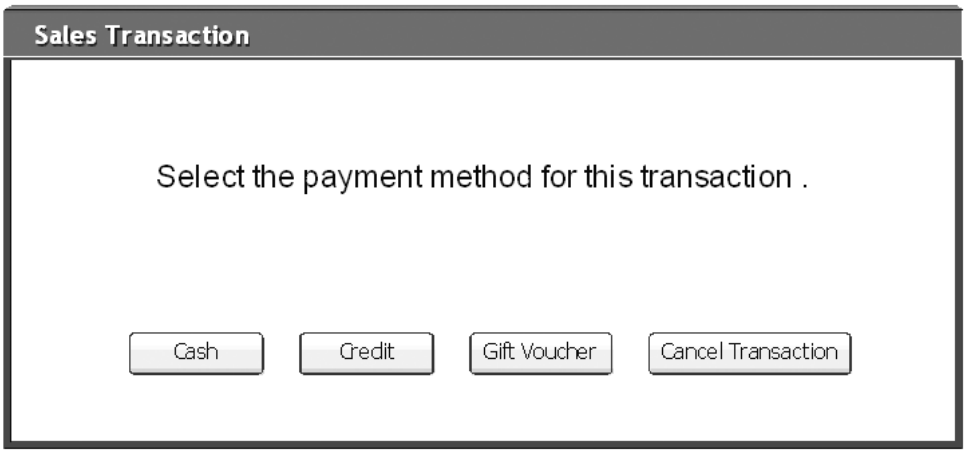
(iii) All of the fields in this partial data dictionary are indexed. Give **one** reason for this. **1**

10. (continued)

(*b*) Using a storyboard technique, generate a *multimodal* user interface that allows the viewing and editing of game details shown in the partial data dictionary above. The user interface should meet the needs of both experienced and inexperienced users.

You may wish to annotate your storyboard(s) to indicate functionality. **6**

(*c*) The developers of the information system decide to produce a *high fidelity prototype* of the system. The prototype includes several forms. The form shown below is used to indicate the method of payment for any game that is purchased:



(i) As new forms are added to the prototype, the developers will be increasingly aware of the need for *consistency*. Describe **two** techniques that could be used by the developers to achieve consistency across all components of the user interface. **2**

(ii) Explain how *eye tracking* has influenced the placement of the buttons on this form. **2**

(*d*) Once the new system has been fully developed, it must be submitted to GameStore so that *acceptance testing* can take place.

Explain how GameStore should approach this acceptance testing. Your answer should indicate who should test the software and how it should be tested. **2**

[Turn over

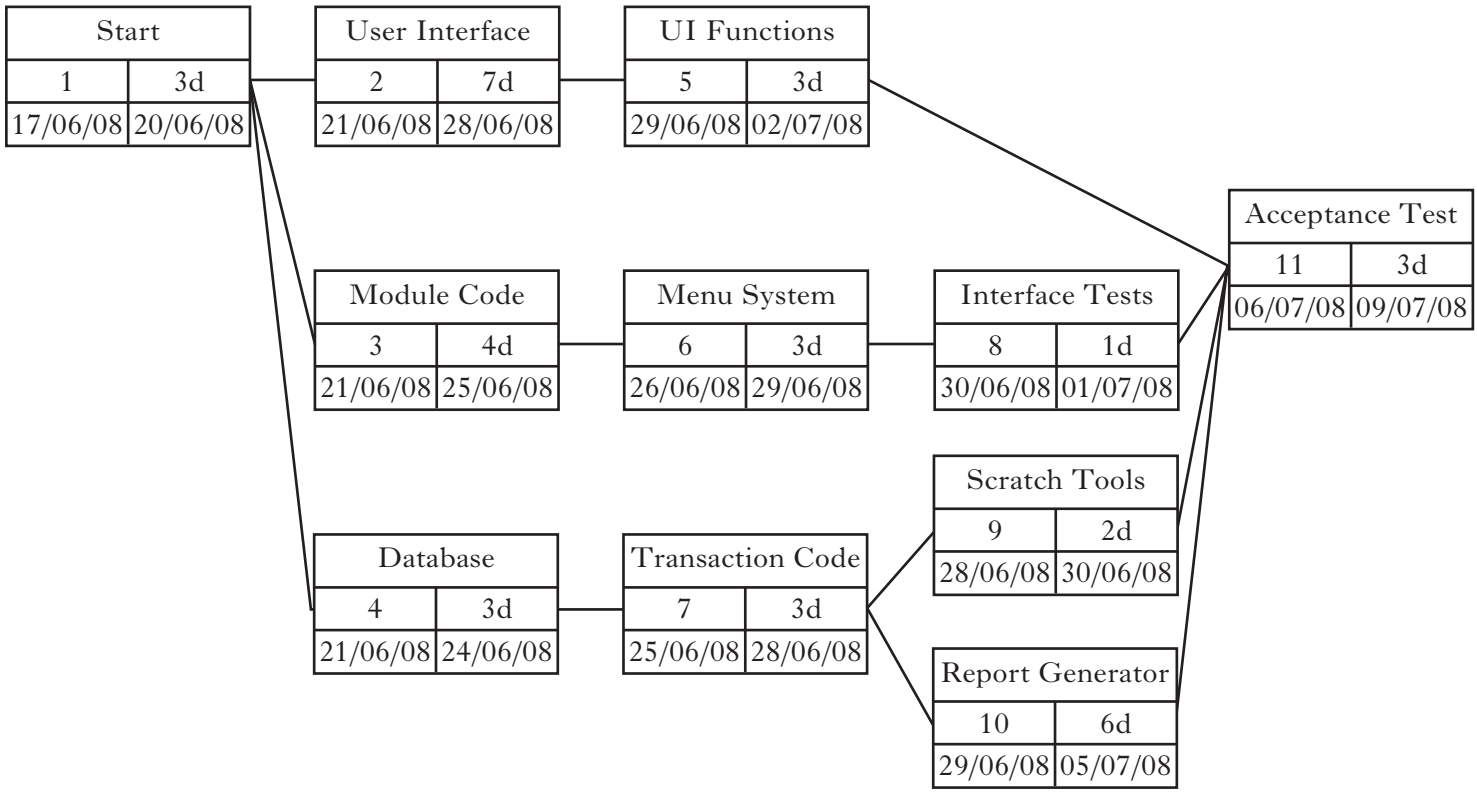
SECTION II

Part A—Information Systems Interfaces (continued)

Marks

10. (continued)

(*e*) Examine the diagram below which shows a subsection of the original project plan for development of the information system.



(i) Write down the sequence of tasks which make up the critical path. **1**

(ii) During the implementation of the project it is discovered that additional staff are required to complete the "Transaction Code" task of the plan on time.

Describe how the project manager would use the project plan to allocate additional staff to this task. You should also describe the impact that this would have on the overall project. **2**

[*END OF SECTION II—PART A*]

SECTION II

Part B—On-line Database Systems

Marks

Answer ALL questions in this part.

11. "Football Fantasy League" is a website that allows users to pick a team from players in the Scottish Premier League. The site stores the name of every player in the Scottish Premier League along with the player's position in their team.

(*a*) (i) A content management system is used to help maintain the website. Explain the purpose of a content management system in this situation. **2**

(ii) Content management systems may be *open-source* or *commercial*.

Explain whether an open source or commercial content management system would be more appropriate for use when developing the fantasy football website.

You should consider the following in your answer:

- Cost effectiveness
- Security **4**
- Flexibility and adaptability
- Ongoing support and development.

(*b*) Each user of the website must provide an e-mail address and a suitable password of six letters or more when they first register with the website.

Other than user name and password, state **two** additional requirements that are necessary to allow a log-on script to connect to the Web server hosting the fantasy football website. **2**

[Turn over

SECTION II

Part B—On-line Database Systems (continued)

Marks

12. www.scotpcwatch.org.uk is the website of an organisation that provides users of the site with up-to-date information about a range of desktop PCs.

(*a*) To provide users of the website with details that they require, a number of software tools are needed. These include:

- *structured query language (SQL)*
- *HTML*
- *Server side scripting language*

Explain the role of **each** of these software tools in providing users with details that match their requirements. **6**

(*b*) Each of the PC manufacturers has its own website that makes use of an *e-commerce platform* to provide users of the site with an on-line shopping facility. Each manufacturer is aware of the need to maintain good relationships with its customers.

(i) Describe **two** features of an e-commerce platform that would be useful to the PC manufacturers. You should justify the features you describe by explaining how each would be of value to the PC manufacturers. **2**

(ii) Describe **two** features of a *customer relationship management* system that would be useful to the PC manufacturers. You should justify the features you describe by explaining how each would be of value to the PC manufacturers. **2**

13. BeatTheRush.co.uk is an on-line shopping site which specialises in unusual gift items. Before placing an order, customers must first register by supplying their contact details (including an e-mail address). Once registered, they are sent a user name and password. Customers can then log-in to the site and browse an on-line catalogue, search for specific items or select from a range of gift categories (eg Gifts For Him, Gifts For Her, Gifts for Christmas, Gifts for Kids).

Customers add items to their on-line shopping basket and then pay for their order using a credit or debit card.

(*a*) BeatTheRush uses *EDI* to process orders and payments.

(i) EDI systems often make use of flat-files prior to translation.

Explain why flat files are often required by *translation software*. **2**

(ii) EDI systems can make use of one of two different systems of *communication* — EDI VAN or EDI INT.

Compare **both** of these systems of communication by describing **one** benefit of **each** system over the other. **2**

(iii) Explain the importance of *standards* in EDI systems. **2**

(*b*) A customer uses the search facility of the website to find a gift suitable for a birthday present. He enters his search criteria and clicks 'submit' to run an SQL query. The SQL query extracts data from a table called PRODUCT and produces an answer table that is held in an array called MYSQL_PRODLIST.

Using a server side scripting language with which you are familiar, write the script to fetch and display the Product_Name, Product_Description and Product_Price of the selected items from MYSQL_PRODLIST. **4**

[Turn over

14. The National Library Service is constructing a database to hold details of all the famous Scottish authors and books that they have written. The proposed data structure is shown below:

author

Field	Type	Null	Key	Default	Extra
id	INT		Yes		
last_name	VARCHAR(15)				
first_name	VARCHAR(15)				
city	CARCHAR(15)				
county	VARCHAR(20)				
birth	DATE			0000-00-00	
death	DATE	YES		NULL	

book

Field	Type	Null	Key	Default	Extra
id	INT		Yes		
author_id	INT				
title	VARCHAR(30)				
publicationdate	DATE			0000-00-00	
sales	VARCHAR(20)			0	

Relationship: author.id = book.author_id

Given this structure and assuming that each book has only one author, construct the following SQL queries:

(*a*) A query to show the titles and publication dates of books written by authors who are still alive. **4**

(*b*) A query to find the number of books written by authors born in the 1920s. The query should show the full name of each author along with the number of books they have written. **5**

(*c*) Construct a query to insert a new record in the author table using the following values:

id: 2387
last_name: Stevenson
first_name: Robert Louis
city: Edinburgh
county: Midlothian
birth: 1850-11-13
death: 1894-12-03 **3**

15. GamesStore is a computer games retailer that requires an information system to manage the sale of computer games and other items in their stores.

The following advertisement illustrates a typical game available from the store.

Price: £29·99
Number in Stock: 12

The developers have created a data dictionary to indicate how details will be stored in the information system. The partial data dictionary below shows how details of each game will be stored in the GAME entity.

GAME ENTITY

Name	Type	Size	Validation	Index /Key
Game ID	Integer		Unique	Yes (PK)
Title	Text	250		Yes
Rating	Text	3	Choose from (“3+”, “7+”, “12+”, “16+”, “18+”)	Yes
Number in Stock	Real			Yes
Price	Text	10		Yes

(*a*) Examine the partial data dictionary above.

(i) Comment on the efficiency of the data storage. **2**

(ii) State the purpose of an index. **1**

(iii) All of the fields in this partial data dictionary are indexed. Give **one** reason for this. **1**

15. (continued)

(*b*) As part of the implementation of the new system, an HTML form is required to submit values to a script. This script will be used to create a new record containing details based on the partial data dictionary above.

(i) Due to the restrictions of HTML, some aspects of the form may not be as robust as the developer would wish. Describe **one** potential problem and explain how this problem could be resolved by the developer. **2**

(ii) Create the HTML form code that will submit the necessary data to a script called "newrecord.php". **4**

(*c*) An alternative to coding by hand is to use *Rapid Application Development tools* (RAD tools) to generate the code.

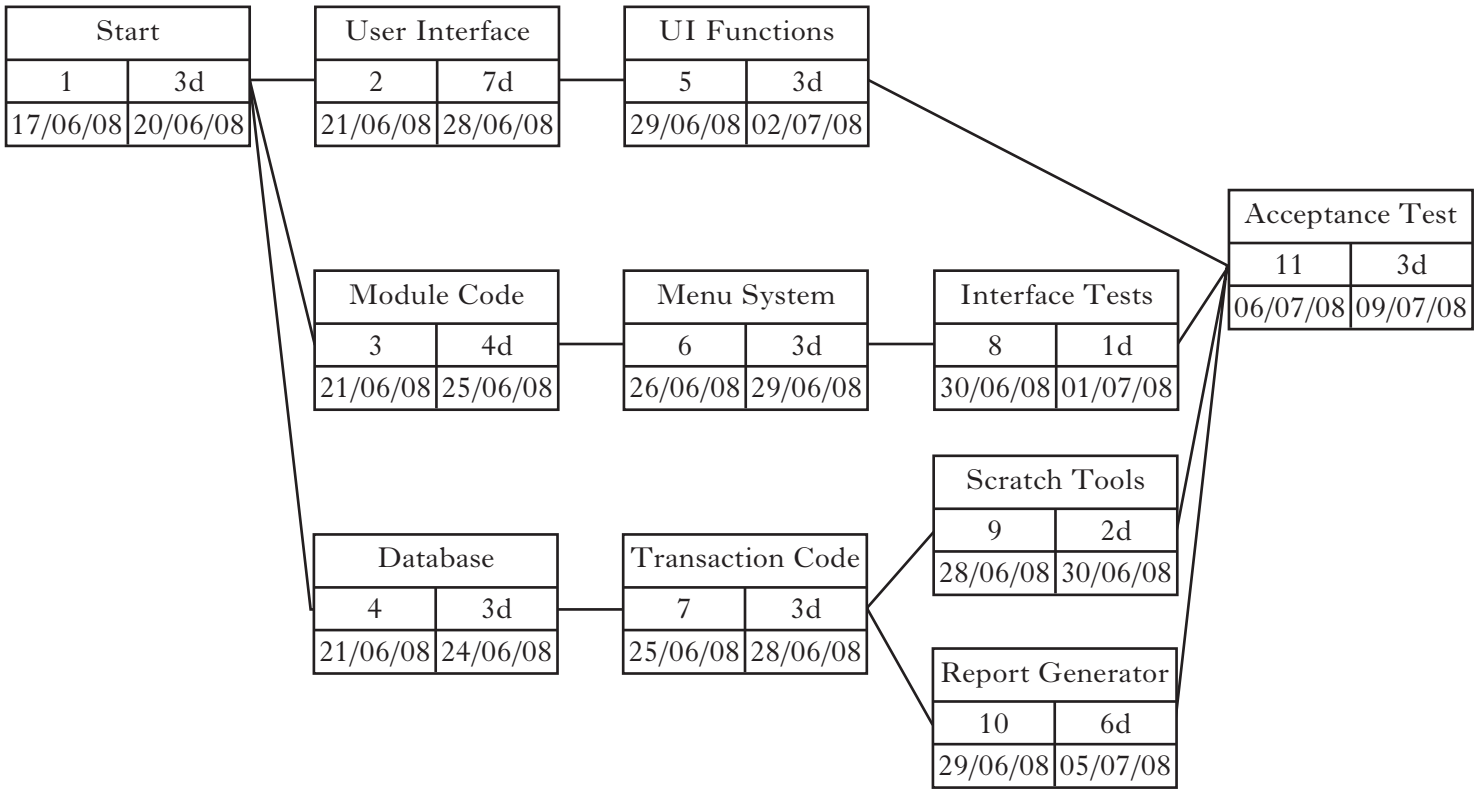
Describe **two** drawbacks of using RAD tools to automatically generate code. **2**

(*d*) Once the new system has been fully developed, it must be submitted to GameStore so that *acceptance testing* can take place.

Explain how GameStore should approach this acceptance testing. Your answer should indicate who should test the software and how it should be tested. **2**

15. (continued)

(*e*) Examine the diagram below which shows a subsection of the original project plan for development of the information system.



(i) Write down the sequence of tasks which make up the critical path. **1**

(ii) During the implementation of the project it is discovered that additional staff are required to complete the "Transaction Code" task of the plan on time.

Describe how the project manager would use the project plan to allocate additional staff to this task. You should also describe the impact that this would have on the overall project. **2**

(*f*) A query is required to join the "Game" table with a related table called "Review". The related foreign key value in "Review" is called GameID (GameID is the primary key of "Game").

Construct a query using a *join* to select all the records from these two related tables. **3**

[*END OF SECTION II—PART B*]

[*END OF QUESTION PAPER*]

ACKNOWLEDGEMENTS

Question 10 and Question 15—Picture *Need for Speed Carbon computer game front and back cover* taken from needforspeed.com. Permission is being sought from Electronic Arts Limited.

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