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General Certificate of Education
 Summer 2003
 Advanced Subsidiary Examination



COMPUTING

CPT2

Unit 2 Principles of Hardware, Software and Applications

Thursday 5 June 2003 Afternoon Session

<p>In addition to this paper you will require: a calculator.</p>
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For Examiner's Use			
Number	Mark	Number	Mark
1			
2			
3			
4			
5			
6			
7			
8			
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

Time allowed: 1 hour 30 minutes

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

Information

- The maximum mark for this paper is 65.
- Mark allocations are shown in brackets.
- You are expected to use a calculator where appropriate.
- You will be assessed on your ability to use an appropriate form and style of writing, to organise relevant information clearly and coherently, and to use specialist vocabulary, where appropriate.
- The degree of legibility of your handwriting and the level of accuracy of your spelling, punctuation and grammar will also be taken into account.

Answer **all** questions in the spaces provided.

1 (a) Give **one** example of a typical validation control used in a database system.

..... (1 mark)

(b) State **one** advantage of the database approach over a separate, independent file approach.

.....
..... (1 mark)

2 A desktop PC has access to a *local disk drive*, C: and a *networked disk drive*, N:

(a) What is meant by:

(i) local disk drive?
.....
..... (1 mark)

(ii) networked disk drive?
.....
..... (1 mark)

(b) The command “Type” lists the contents of a specified file on the desktop PC’s VDU screen as shown in **Figure 1**.

```

C:\> Type C:\Project\Source\MyFirst.Pas

Program MyFirst;
Begin
  Writeln('Hello World');
End;

C:\> Type C:\Project\Build\MyFirst.Arc

MZP ☺   ◆   ♀   ♠   ♣   +
z   ☺   ◆
      ♀   ♣   ♠   +
☺   ♀   Hello World   ♣   +
      ♀   □

```

Figure 1



Using **only** the information contained in **Figure 1**, give **one** example of each of the following:

- (i) a logical drive
(1 mark)

 - (ii) a file pathname.....
(1 mark)

 - (iii) a sub-directory.....
(1 mark)

 - (iv) the filename of a text file.....
(1 mark)

 - (v) the filename of a non-text file
(1 mark)
- (c) Using the information contained within **Figure 1** complete the directory structure diagram shown in **Figure 2** for the desktop PC's local drive, C:

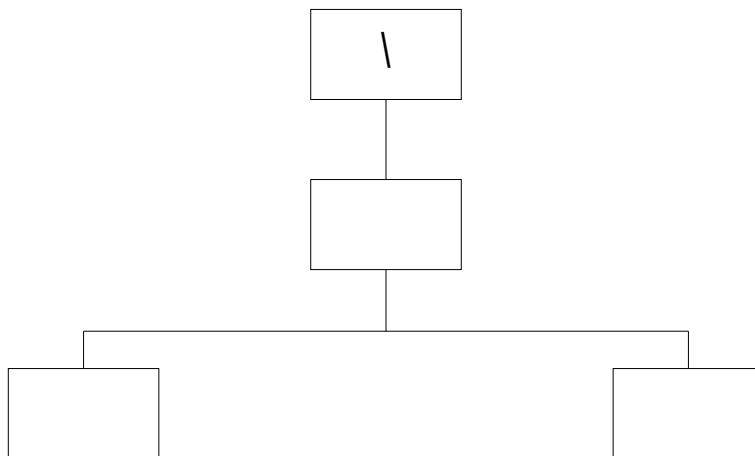


Figure 2

(1 mark)

8

TURN OVER FOR THE NEXT QUESTION

Turn over ►

3 A well-known software company has constructed a media player to query an on-line database at the company's headquarters. It retrieves the titles of tracks on audio CDs for display in the media player's window. In the process it assigns a unique identifying digital fingerprint to the computer playing the audio track.

In a separate transaction, the company can then link this digital fingerprint to an e-mail sent from the same computer. This links the user's e-mail address to the music interests of the user for marketing purposes.

(a) Explain one benefit to

(i) the user

.....
.....
.....

(1 mark)

(ii) the software company.

.....
.....
.....

(1 mark)

(b) Why might the use of the link be considered unethical?

.....
.....
.....

(1 mark)



4 The file, **CurrentUserIds**, has the following record structure.

UserId, Password, NoOfDaysSincePasswordLastChanged

UserId is a seventeen byte fixed length string, **Password** is a two-byte integer, **NoOfDaysSincePasswordLastChanged** is a single byte integer.

(a) What is the size of this file, in bytes, when the file **CurrentUserIds** contains 1500 records?

.....
.....
(1 mark)

(b) The file **CurrentUserIds** is used by a computer system to authenticate (check) a user's **UserId** and password typed at a keyboard when the user logs onto the system. The logon program collects a user's password as an alphanumeric string, e.g. 'AQA5511CPT2' and converts it to a two-byte integer using a one-way hashing function or algorithm before sending it across a network for authentication (checking).

(i) Give **two** reasons why the system converts passwords to two-byte integers.

1
.....
.....
2
.....
.....
(2 marks)

QUESTION 4 CONTINUES ON THE NEXT PAGE

Turn over ►

(ii) Outline **three** major steps that a typical hashing function/algorithm would use to convert an alphanumeric string to a two-byte integer.

.....
.....
.....
.....
.....
.....

(3 marks)

(iii) Why is the hashing function used for the passwords a one-way (irreversible) function?

.....
.....

(1 mark)

Figure 3 shows the steps that are followed to update the file of records of **UserIds** and **passwords**.

- Each **UserId** in this file is different.
- The transaction file, **UserIdsToBeUpdated**, contains the **UsersIds** that are to be used in the update process.
- The file **CurrentUserIds** and the transaction file **UserIdsToBeUpdated** are organised sequentially on **UserId** in ascending order.
- Every **UserId** in the transaction file is different but each matches a **UserId** in the **CurrentUserIds** file.

```

Open Transaction File (UserIdsToBeUpdated) for reading
Open Old UserIds File (CurrentUserIds) for reading
Open New UserIds File (NewUserIds) for writing
While Not End of File Transaction File Do
  Read Next Transaction File Record
  Read Next Old UserIds File Record
  If Next Transaction File Record.UserId <> Next Old UserIds File Record.UserId
    Then Write Next Old UserIds File Record to New UserIds File
EndWhile
Copy remainder of Old UserIds File to New UserIds File
Close all Files
Archive Old UserIds File
Rename New UserIds File as CurrentUserIds File

```

Figure 3

<> means not equal to.

(c) Explain the purpose of this update process

.....

.....

(1 mark)

QUESTION 4 CONTINUES ON THE NEXT PAGE

Turn over ►

- (d) In the box below, list the missing steps that will insert UserId, password records from a transaction file, **UserIdsToBeInserted**, into the file **CurrentUserIds** in one pass through this file whilst preserving its sequential order.

You may assume that:

- No **CurrentUserIds** file record will exist with the same UserId as a transaction record
- The last record in the CurrentUserIds file will be a dummy record with UserId *'ZZZZZZZZZZZZZZZZZZZZ'*
- All UserIds will be stored in uppercase.

Open Transaction File (**UserIdsToBeInserted**) for reading

Open Old UserIds File (**CurrentUserIds**) for reading

Open New UserIds File (**NewUserIds**) for writing

Close all files

Archive Old UserIds file

Rename New UserIds File as **CurrentUserIds** File

(6 marks)

5 Name the legislation that applies in the following cases.

- (a) An Examination Board allows a software reseller access to its database of centre names and addresses so that the reseller can market its products directly to centres that teach AS Computing.

.....
(1 mark)

- (b) A company using an encryption algorithm in one of its software products receives a demand for royalties from another software company that claims that it invented the encryption algorithm.

.....
(1 mark)

- (c) A user sends an attachment to an e-mail which when opened infects the recipient's computer with a virus.

.....
(1 mark)

- (d) A company has its computing equipment seized by the police for using unlicensed commercial software.

.....
(1 mark)



TURN OVER FOR THE NEXT QUESTION

Turn over ►

6 A multi-storey car park is controlled by a computer system as follows.

For a vehicle arriving at the barrier-controlled *entrance*:

- the computer system generates an integer number at random from a set of unused numbers which identifies the vehicle to the system
- the vehicle's driver collects a ticket containing this number from a machine at the barrier
- after a short interval a barrier is raised to enable the car to enter the car park
- the computer system remembers the current date, the arrival time and the randomly generated number.

If the car park is full a sign is lit to indicate the situation and no vehicle is allowed to enter the car park.

For a vehicle arriving at the barrier-controlled *exit*:

- the ticket is presented to a machine which reads the number on the ticket
- the computer system determines the length of time the vehicle has been parked in the car park and calculates the amount to pay
- the amount to pay is displayed on the machine
- the driver inserts the correct money into the machine
- the computer system records the length of time in minutes and the amount to pay in pence
- after a short interval the barrier is raised to enable the vehicle to exit.

(a) Taking account of the technology that could be used for ticket production at the entrance barrier, describe **two** different ways for the number assigned to the ticket to be submitted to the computer system at the exit barrier. Your answer should include a reference to the relevant input/output hardware used.

1

.....

.....

.....

2

.....

.....

.....

(4 marks)

- (b) Using the table below, construct an appropriate record structure for the computer system to use to record the relevant car parking details for one vehicle. Data types should be given that would be available in a third generation programming language.

Field Name	Data Type

(5 marks)

- (c) At any one time the car park can accommodate up to 1000 vehicles. The records for vehicles currently parked in the car park are stored in a file using *direct access*. After a vehicle has left the car park the computer system copies the corresponding record to a *serially organised file* for audit purposes before erasing the contents of the direct access file record and releasing the random number for reuse.

- (i) What is meant by direct access in a file context?

.....

(1 mark)

- (ii) What is meant by serially organised file?

.....

(1 mark)

- (iii) How many records should the direct access file store at any one time?

.....

(1 mark)

QUESTION 6 CONTINUES ON THE NEXT PAGE

Turn over ►

(iv) Explain how a number selected randomly from the set of one thousand available numbers can be used to locate the corresponding record in the direct access file.

.....
.....
.....

(1 mark)

7 (a) One common business application package is the *spreadsheet*. Give **two** different reasons why a spreadsheet package is particularly useful as a decision making tool.

1

2

(2 marks)

A spreadsheet is used to record examination scores and grades as follows:

	A	B	C	D
1	Surname	Percentage	Grade	
2				
3	Bloggs	65	P	
4	Boon	39		
5	Deedes	70		
6				
7				40
8				70

(b) The formula in C3, IF(\$B3<\$D\$7, "F",IF(\$B3<\$D\$8, "P","M")) is copied to cells C4 to C5. The symbol \$ indicates absolute addressing.

(i) Write the format of the formula in

Cell C4

(1 mark)

(ii) After the formula is copied, what is displayed in the following cells

Cell C4?.....

(1 mark)

Cell C5?

(1 mark)

(c) The value in cell D7 is changed to 30. What effect, if any, will this change have on any other cell?

.....

(1 mark)

8 Mobile phone systems rely upon a *smart card* called a Subscriber Identity Module or SIM in a mobile phone to identify a subscriber to the mobile phone network. Each SIM is allocated a unique number that is stored in the SIM and which is continually sent to the nearest base station in the mobile phone network whilst the mobile phone is switched on. Each base station is able to access a central relational database consisting of several relations (tables) two of which **LocationRegister** and **CallRegister** are constructed as follows

LocationRegister (SIMCardNo, MobileTelephoneNo, MobilePhoneSerialNo, ActivationDate, ServiceType, CurrentBaseStationID)

CallRegister (CallID, SIMCardNo, Date, Time, Duration, CalledTelephoneNo, Charge)

Each mobile telephone call is assigned a unique CallID.

(a) What is a smart card?

.....
.....
(1 mark)

(b) State a suitable primary key for the **CallRegister** relation.

.....
(1 mark)

(c) (i) Explain what is meant by foreign key.

.....
.....
(1 mark)

(ii) Name the attribute which is the foreign key in the relation **CallRegister**.

.....
(1 mark)

QUESTION 8 CONTINUES ON THE NEXT PAGE

Turn over ►

- (d) Relation **LocationRegister** is *updated in real time* whereas relation **CallRegister** is updated in a *batch processing* system which uses records collected from the network's base stations every 24 hours.

What is meant by:

- (i) Updated in real time?

.....
.....
(1 mark)

- (ii) Batch processing?

.....
.....
(1 mark)

- (iii) Give **one** reason why relation **LocationRegister** should be updated in real time.

.....
.....
(1 mark)

- (e) Indexes are created on **CallID** and **SIMCardNo** attributes in relation **CallRegister**.

- (i) Why is an index used?

.....
.....
(1 mark)

- (ii) Which of the two attribute indexes is a secondary index?

.....
(1 mark)

Figure 4 shows a sample of the **CallRegister** table (4A) and a sample of the **LocationRegister** table (4B).

CallID	SIMCardNo	Date	Time	Duration	Called Telephone No	Charge
:	:	:	:	:	:	:
:	:	:	:	:	:	:
1204200227	310-68-4451003	12/04/2002	8:01:00	360	07713411927	300
1204200228	310-68-4451005	12/04/2002	8:02:00	420	01296552341	210
1204200229	310-68-4451003	12/04/2002	8:08:10	120	07713631281	100
1204200230	310-68-4451008	12/04/2002	8:02:20	240	0793433016	80
1204201200	310-68-4451003	13/04/2002	9:32:35	120	0793433016	40
1204201201	310-68-4451008	13/04/2002	9:35:35	240	0235670023	160
:	:	:	:	:	:	:
:	:	:	:	:	:	:

Figure 4A: CallRegister table

SIMCardNo	Mobile TelephoneNo	Mobile Phone SerialNo	Activation Date	Service Type	Current BaseStationID
310-68-4451000	07713631281	4990600	10/02/2001	A	10211
310-68-4451001	07713421224	4990613	07/10/2001	A	20231
310-68-4451002	07713411927	4990628	13/07/2001	B	11367
310-68-4451003	07718491221	4990632	12/09/2001	B	–
310-68-4451004	07714621289	4990644	23/11/2001	A	–
310-68-4451005	07713421123	4990656	24/12/2001	C	34111
310-68-4451006	07713482414	4990661	01/02/2002	C	32178
310-68-4451007	07713421582	4990673	10/03/2002	C	22987
310-68-4451008	07715621276	4990689	29/04/2002	D	10345

Figure 4B: LocationRegister table

(f) The following shows a Query By Example (QBE) applied to the **LocationRegister** and **CallRegister** tables.

MobileTelephoneNo	Date	Time
07718491221	12/04/2002	> 8:00:00

QBE

(i) What will be the minimum number of records returned by this QBE?

.....
(1 mark)

(ii) Complete the following QBE to extract the **SIMCardNo** and **ServiceType** of all mobile phone accounts activated before 01/03/2002.

(3 marks)
Turn over ►

(g) The last digit of the **MobilePhoneSerialNo** is a check digit.

(i) What is a check digit?

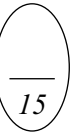
.....
.....
.....

(1 mark)

(ii) What is its purpose?

.....
.....
.....

(1 mark)



END OF QUESTIONS