

Total Marks — 60

Attempt ALL questions

1. The owners of a monthly magazine decide to update the company website. The current website allows users to access online versions of articles printed in the monthly magazines.

- (a) Requirements for the updated website are listed below.

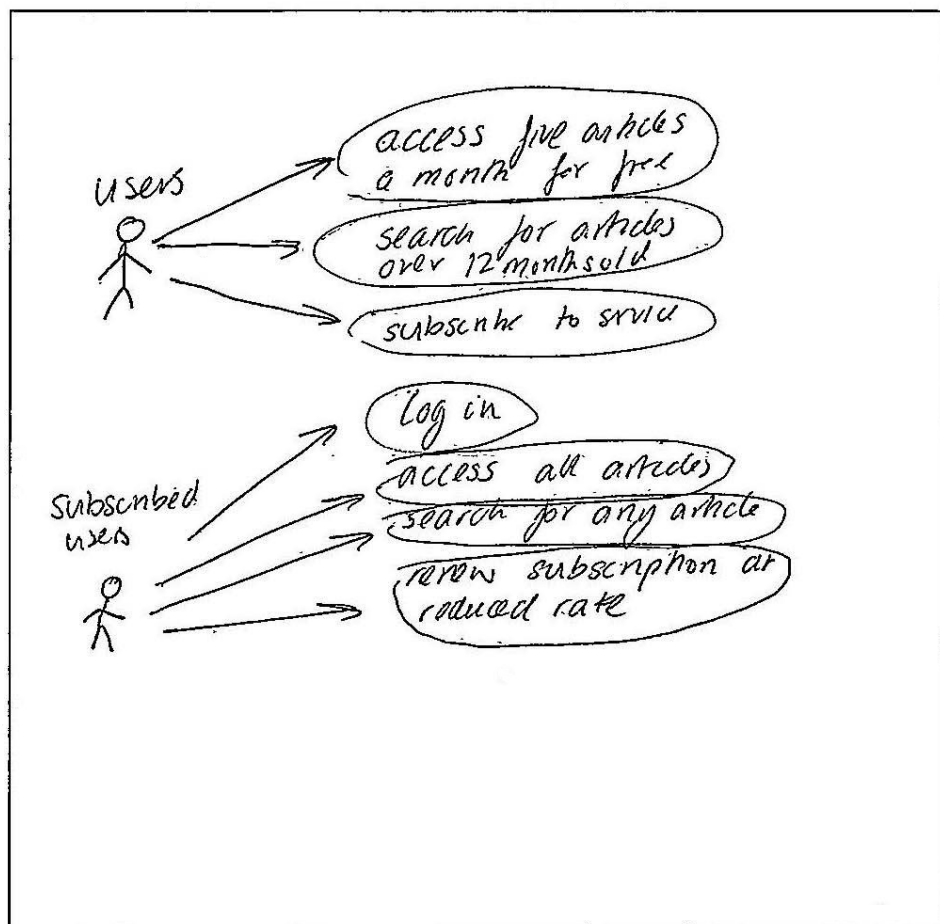
The updated website will allow all users to:

- access a maximum of five free articles every month
- search for articles over 12 months old
- subscribe to the full service using a secure payment system

The updated website will allow **subscribed** users to:

- log-in to gain access to the full service
- access any number of articles
- search for articles without restriction
- renew their subscription at a reduced rate using a secure payment system

Draw a use case diagram to represent these requirements.



1. (continued)

- (b) Two designs for the human computer interface (HCI) of the search facility for the updated website are produced.

The two designs are shown.

Design 1

Article Search	
TOPIC	<input style="width: 100%;" type="text"/>
DATE FROM	<input style="width: 80%;" type="text" value="dd/mm/yyyy"/>
DATE TO	<input style="width: 80%;" type="text" value="dd/mm/yyyy"/>

Users must type the topic and then either type the date in the required format or select the date from the calendar.

Design 2

Article Search	
TOPIC	<input style="width: 100%;" type="text"/>
YEAR	<input style="width: 80%;" type="text" value="2014"/>
MONTH	<input style="width: 80%;" type="text" value="MAY"/>

Users must type the topic and then select the year and month by using the spinners.

- (i) Discuss the suitability of each design for use with a smartphone or tablet device.

2

Design 1 means the ~~is much~~ data will be entered much more slowly than design 2. + harder to search for in calendar

Design 2's scroll wheel completes the action with minimum consumer input, therefore is more important for smartphone - also used to scrolling on phone.

- (ii) During testing of the search facility, the following list of articles is produced.

Article Title	Summary	Date	Issue
Processors	Recent processor development	06/05/2016	214
Printers	Inkjet or Laser?	25/03/2016	208
Smartphones	Control your phone by thought	13/05/2016	215

Describe how an insertion sort would reorder the three articles above, listing the articles in chronological order with the most recent article first.

2

The insertion sort would take an item and compare it to the item above it, if the taken item is bigger than the above item it compares it with the next item, until it is sorted. The number above it is bigger than it.

1. (c) (continued)

(ii) Having received the HTML form data, the server-side script "subscription.php" then executes a number of processes. The script

1. assigns the HTML username and password to server-side variables
2. creates a connection with the database server
3. adds data to "member" table of the "subscribedata" database
4. closes the connection

The name of the database server is "magserver" and the username is "subscribe" with the corresponding password "subpass".

Using pseudocode or a server-side scripting language with which you are familiar, write code for processes 1, 2, 3 and 4 described above.

```

<?php
$member = $_POST("member");
$query = "INSERT INTO
$password = $_POST("password");
$username = $_POST("username");
$query = "INSERT INTO member,
$password, $username INTO
TABLE member");
$link = mysql_ ("magserver", "subscribe",
"subpass");
mysql_db_ ("subscribedata", $link)
mysql_query (" $query").

?>

```

2. Radio Lowden plays songs from the years 1990 to 1999 inclusive. The songs played by the radio station must have featured in the official UK top 40 singles chart from these years.

(a) Using the above example, explain the terms scope and constraints.

The scope is what the app should contain
and all features (from 1990-1999 and in top 40)
whereas the constraints are limitations that stop
the scope being achieved

(b) The management of Radio Lowden has commissioned a developer to create a new website for the radio station. One of the pages of the new website will give access to playlists from recent radio programmes.

(i) The developer suggests that the layout and interface of the website belonging to a rival radio station could be copied and used by Radio Lowden.

Discuss whether this is acceptable practice.

This is not an acceptable practice as
the copyright designs and patterns are
an intellectual property law forbids this.
If the radio station decides to sue the
Lowden could be in financial trouble.
The radio station might hate since
the layout is intellectual property
then copying it is a breach

2. (continued)

- (c) A PlayList table is used to store details of all playlists created by Radio Lowden and details of each song are stored in a separate table called Song. These tables are part of a relational database.

Sample data for the PlayList and Song tables are shown.

Attribute	Sample
ProgrammID	1
SongID	A34213
DatePlayed	27/05/15
TimePlayed	09:00

PlayList Table

Attribute	Sample
SongID	A34213
Title	Jack & Dee
Artist	Soozie - L
Year	1997

Song Table

- (i) Write the SQL statement which will create the structure of the PlayList table.

4

```

CREATE TABLE playlist (Programme ID, Song ID,
Date Played, Time Played)
INSERT INTO playlist
VALUES (1,

```



```

CREATE TABLE playlist (Programme ID, Song ID,
Date Played, Time Played)
INSERT INTO playlist (Programme ID, Song ID,
Date Played, Time Played)
VALUES (1, A34213, 27/05/15, 09:00)

```

- (ii) Write the SQL query which will list the title of each song played on 26 May 2016.

2

```

SELECT SongID FROM Songtable
WHERE Dateplayed = 27/05/15

```



```

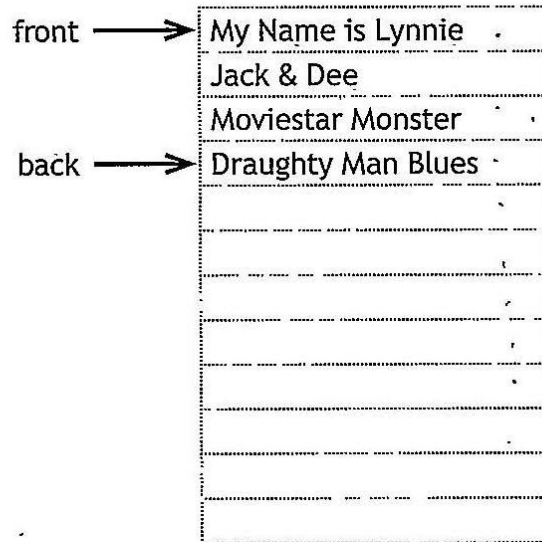
SELECT title
FROM Songtable
WHERE Song ID = Playlisttable and Song ID = Songtable
WHERE Dateplayed = 27/05/15

```

2. (continued)

(d) The titles of the songs in one of the playlists are exported to a program for processing using a queue structure. The queue has been implemented as a 1-D array.

The contents of the queue are shown.



Use pseudocode to write an algorithm to remove a played song from the top of the playlist queue.

```

define front as integer
define array(11) as string
define back as integer

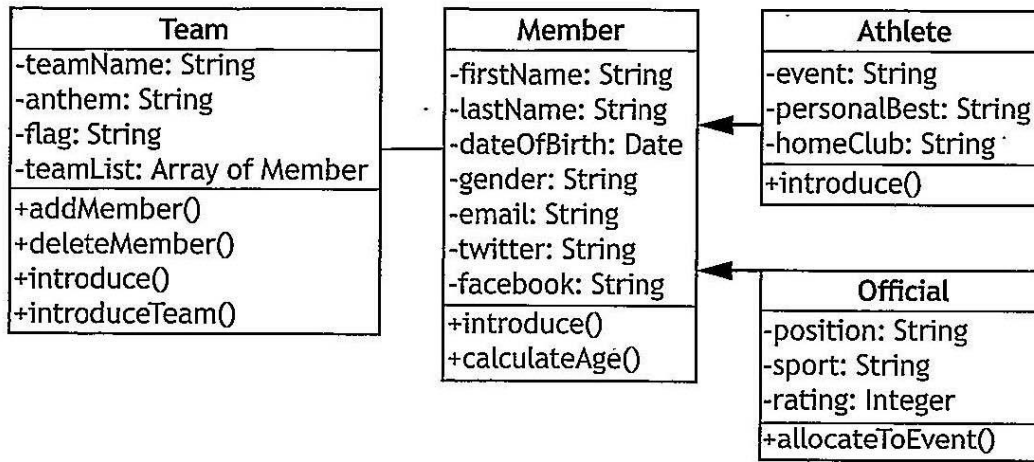
front = 0    back = 11

array(0) front = front - 1
if front = 0 then
    front = end of list
else
    front = front - 1

array(front) = 0
if front = end of list
    front = 0
else
    front = front + 1
    
```

3. A program is to be written to process the results of different events in the 2016 Olympic Games.

(a) A simplified version of the UML class diagram for the program is shown.



(i) By referring to the class diagram above, explain:

- the difference between a class and an object
- encapsulation
- inheritance

4

• A class is a blueprint for an object,
 whereas an object is an instance of a class.
 Object = Usain Bolt Class = Athlete

• Encapsulation means code inside a class is
 protected and can only be changed by
 an associated method (subclass - athlete)

• Inheritance is when a class inherits
 contents of class above it. (superclass - member)

- (b) The details of the athletes taking part in individual events will be stored in separate arrays of objects. For example, the longjumpM array will store the details of all 32 male athletes taking part in the long jump event..

Using a programming language with which you are familiar, write the code used to create the array of objects used to store details of the 32 male athletes in the long jump event.

2

~~maleAthletes(32) = longjumpM~~
longjumpM(32) = String

3. (continued)

- (c) Two introduce methods have been written for the Member and Athlete classes respectively.

```
# Version in Member class
PROCEDURE introduce()
    SEND "Hello, my name is " & THIS.firstName TO DISPLAY
END PROCEDURE
```

```
# Version in Athlete class
OVERRIDE PROCEDURE introduce()
    SEND "Hello, my name is " & THIS.firstName TO DISPLAY
    SEND "I'm an athlete on the team" TO DISPLAY
END PROCEDURE
```

A new Team object called myTeam has been created. The following calls have been made to add Ali, Omar and Nour to the team.

```
myTeam.addMember( Athlete("Ali", <only firstName needed here> ) )
myTeam.addMember( Member("Omar", <only firstName needed here> ) )
myTeam.addMember( Official("Nour", <only firstName needed here> ) )
```

- (i) Write down the output displayed by the following procedure call:

```
myTeam.introduceTeam
```

1

```
" Hello, my name is Omar "
" Hello, my name is Ali "
" I'm an athlete on the team "
```

3. (continued)

- (e) The Olympic Games generate a large amount of data. Sources of this big data will include ticket sales, competition and performance data, information gathered from retail and catering outlets and details of sponsorship deals and merchandising. Data analytics will be used to analyse the big data.

Using one of the sources of big data listed above, describe one benefit to the Olympic Games Management Committee of using analytics when preparing for the 2020 Olympic Games.

By measuring ticket sales, the committee can establish how many large stadium capacities should be for the next games. If they consistently sold out then the next games Olympics should have larger stadiums etc.

4. Dawid Mahyne is studying Advanced Higher Computing Science. His teacher has asked him to compare the computational constructs provided by a procedural programming language with those provided by a database.

Dawid starts by creating a database file called "pupils.db". The file contains one table called "pupildata" which stores the pupil data shown.

PupilID	FirstName	LastName	DateOfBirth	RegClass
112211	Joan	Simpson	23/02/1999	6A
112212	John	Adam	12/04/1998	6B
112213	Alison	Brown	30/10/1998	6A
112214	Brian	Morgan	18/11/1998	6C
112215	Bilal	Ali	12/09/1998	6C
112216	Lian	Wong	27/05/1998	6A
112217	Charles	West	23/06/1998	6B
112218	Janet	Smith	18/02/1999	6B
112219	Raymond	Thomas	07/12/1998	6B
112220	Theresa	Cameron	29/01/1999	6A

Dawid writes a program to import the pupil data from the database file and store it in an array of records called "details". His program then applies a binary search to the array of records to display the details of the pupil with PupilID 112213.

- (a) (i) Use pseudocode to create the top level design for the program. Your top level design should define the required data structure and call all necessary modules.

3

```

Structure pupil_data
  pupil_data.pupilID = Integer
  pupil_data.FirstName = String
  pupil_data.LastName = String
  pupil_data.DOB = date
  pupil_data.RegClass = String.
End Structure
define pupils as pupil_data.
binary search (pupil_data)
binary search (pupils(a)).

```

4. (a) (continued)

- (ii) Use pseudocode to refine the binary search used to display the details of the pupil with PupillID 112213.

5

```

found = false
min = 0
max = 9
DO mid = (min + max) / 2
  IF search > mid THEN
    min = mid + 1
  ELSE
    max = mid - 1
  END IF
  IF search = mid THEN
    found = true
  END IF
UNTIL found = true OR min > max

Display (pupils[mid]) First
display pupils[mid]. pupil ID, pupils[mid]. first name,
pupils[mid]. lastname, pupils[mid]. DOB,
pupils[mid]. RegClass.

```

4. (continued)

- (b) During testing of the program, Dawid changes the registration class of the pupil with PupilID 112213 from 6A to 6B.

Using pseudocode or a language you are familiar with, write the code needed to edit the required details in the external database file called "pupil.db".

```
UPDATE pupil d.b.  
WHERE PupilID = 112213 and RegClass = 6A  
SET Regclass to 6B,
```

4. (continued)

- (c) Dawid decides to add a new module to his program. This module sorts the data in the array of records into ascending order of registration class. Part of Dawid's code is shown.

```

Line 1  # Name of Sort Algorithm Used: _____
Line 2  REPEAT
Line 3    SET swapped TO false
Line 4    FOR counter FROM 1 TO 9
Line 5      IF _____
Line 6        SET swapped TO true
Line 7        < swap data >
Line 8      END IF
Line 9    END FOR
Line 10  UNTIL swapped = false

```

Line 1 and Line 5 of the code are incomplete.

Provide the missing details by rewriting both lines of code.

2

Line 1 = false bubble sort
 Line 5 = registration(counter) < registration(counter-1)

- (d) Dawid's school has 2000 pupils.

Explain why it may be more appropriate to use a quick sort rather than the sort algorithm used in part (c) above.

2

Quick sorts divide and conquer, and use less memory than bubble sort. Also, quicksorts are more appropriate due to likelihood of repeating data.