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.

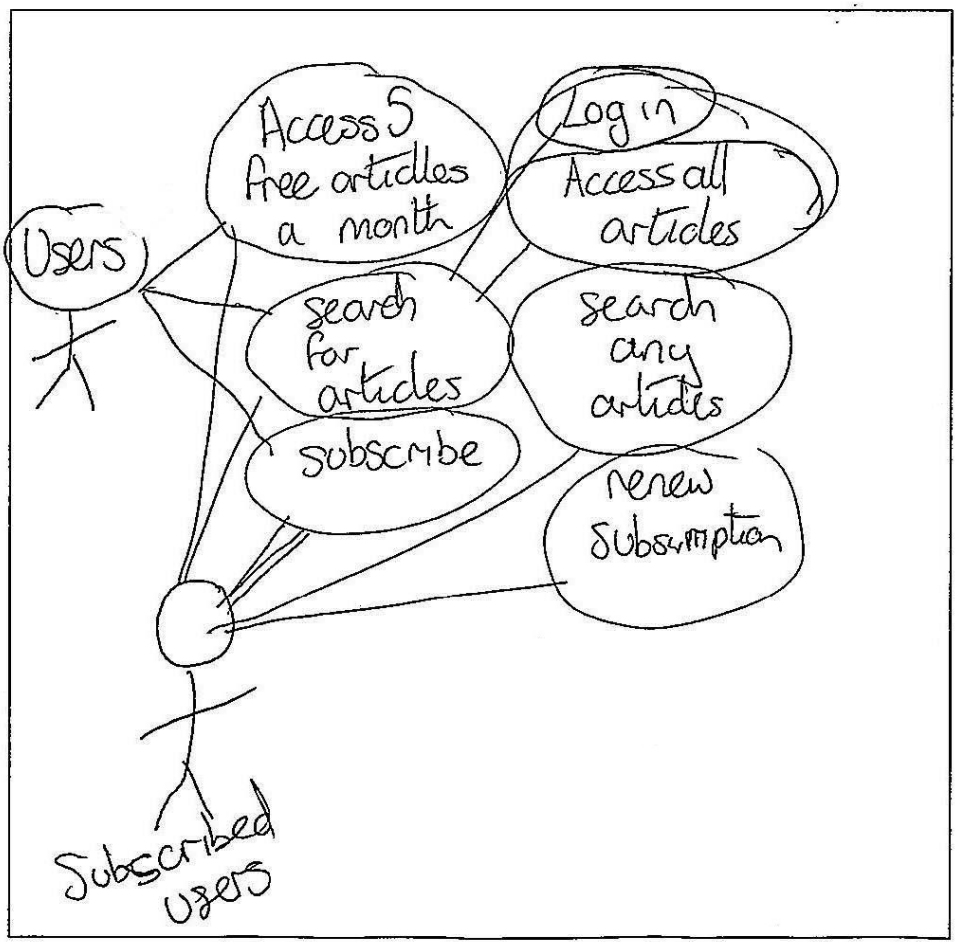
   The updated website will allow **all** users to:

   - 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.



(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

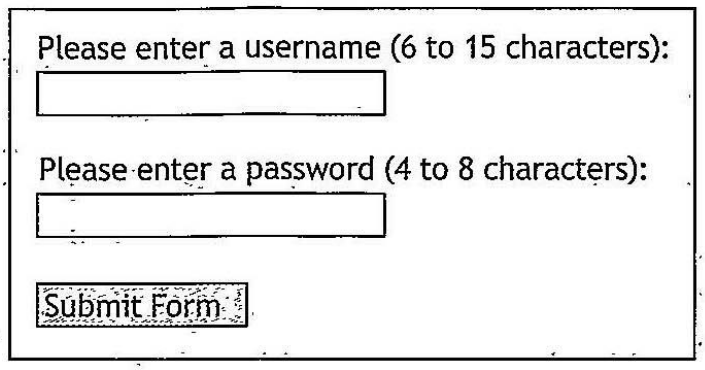
Describe how an insertion sort would reorder the three articles above, listing the articles in chronological order with the most recent article first.

Compare processors and printers (titles)
-no swap needed
Compare Printers and smartphones
- swap needed
Compare smartphones and processors
- swap needed
New order - Smartphones, processors, printers

MA

1. (continued)

(c) An HTML form is used to subscribe to the full service. Part of this form is shown.



(i) The server-side script called "subscription.php" will receive data from the HTML form.

Write the HTML tags used to generate the subscription form shown above.

```
<form method = "POST" action = "subscription.php">
Please enter a username (6 to 15 characters):
<input type = "text" name = "username" />
Please enter a password (4 to 8 characters):
<input type = "password" name = "pass" />
<input type = "submit" name = "submit" />
</form>
```

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.

```
$user = $_POST('Username');
$pass = $_Post('Pass');

$server = "magserver";
$username = "subscribe";
$password = "subpass";
$link = mysql_connect($server, $username,
                      $password);
mysql_select_db("subscribedata", $link);
$query = "INSERT into member VALUES($user,
                      '$pass')";
mysql_query($query);
mysql_close_dbconnection($link);
```

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.

Scope would be the songs featured in Official UK top 40
Constraints would be from years 1990 to 1999 inclusively.

(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.

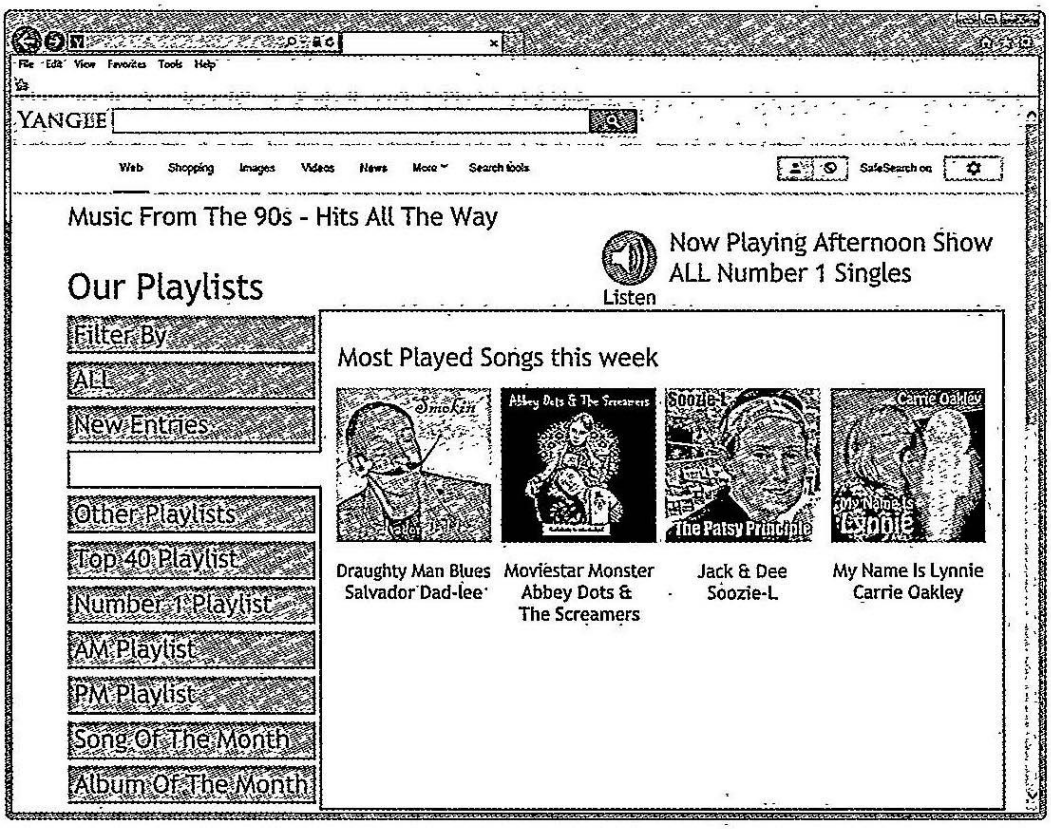
(i) The developer suggests that the layout and interface of the website belonging to a rival radio station could be copied and used by Radio Lowden.

Discuss whether this is acceptable practice.

This may be an issue due to intellectual property rights, However, There would be no copyright infringement if the layout and interface were copied but not any original artwork or anything owned by the rival company.

2. (b) (continued)

(ii) An initial build of the playlist page of Radio Lowden's website is created. The layout of this page is shown.



Usability testing of the interface of the playlist page is carried out. The developer provides the test group with the following test case.

> *Jackie has injured her wrist and is unable to use a mouse. Earlier today, she heard Radio Lowden's AM programme and would like to listen to the 3rd song on its playlist again.*

Explain how the test case would help the developer evaluate the accessibility of the playlist page of the Radio Lowden website. 2

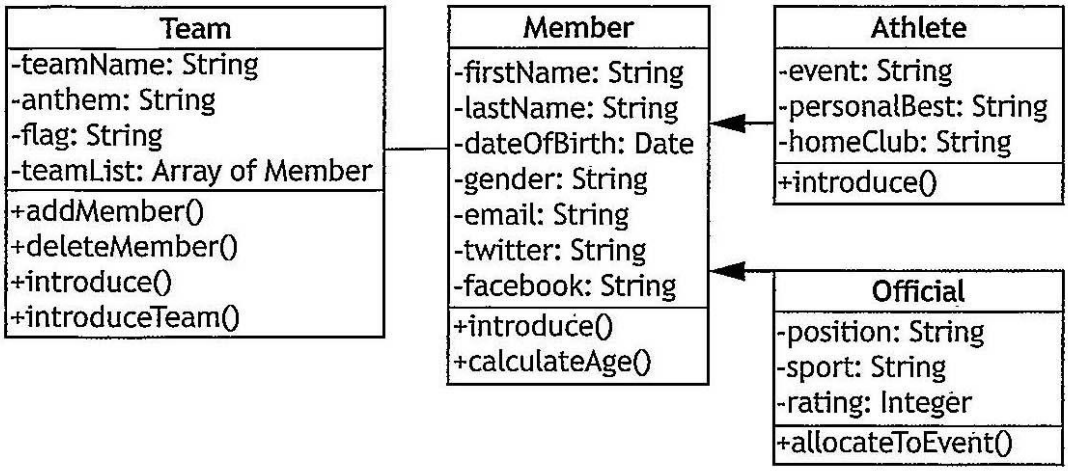
It provides a scenario in which the website must be used in a different way and therefor evaluate how accessible it would be for all users of all abilities, and in all cases.

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

```
SELECT Title from Song, Playlist
WHERE DatePlayed = 26/05/16
```

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 (Team) contains private variables and public ~~class~~ methods - which are the only way to update/use those variables. An object has those variables and can interact with the methods to change them. Encapsulation ~~is~~ is the encasing of these variables and methods inside the class and not allowing anything outside the class to interact with the variables. Inheritance is when one class is created and has all the variables and methods from another class plus any additional (Member inherits Team).

3. (a) (continued)

(ii) Some of the code used to define the class Team is provided below.

```
CLASS Team IS       { STRING teamName,
                      STRING anthem,
                      STRING flag,
                      ARRAY OF Member teamList  }

METHODS

    CONSTRUCTOR (  STRING teamName, STRING anthem, STRING flag )
        DECLARE THIS.teamName INITIALLY teamName
        DECLARE THIS.anthem INITIALLY anthem
        DECLARE THIS.flag INITIALLY flag
        DECLARE THIS.teamList INITIALLY []
    END CONSTRUCTOR

    PROCEDURE addMember( Member newMember )
        SET THIS.teamList TO THIS.teamList & [newMember]
    END PROCEDURE

END CLASS
```

An instance of the Team class is to be created using the following values.

Team Name	Brazil
Anthem	Hino Nacional Brasileiro
Flag	Bandeira do Brasil

Using the data provided and a programming language with which you are familiar, write the code used to instantiate a Team object. Your code should make use of each of the values provided. 1

```
Declare team1 initially Team("Brazil",
"Hino Nacional Brasileiro", "Bandeira do
Brasil")
```

(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

```
Declare longjumpM as array of Athlete *32
```

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 Ali
Im an athlete on the team
Hello, my name is Omar
Hello, my name is Nour

(ii) Use object oriented terminology to explain the operation of the procedure call in (c) part (i) above. 2

Calls the introduceTeam method from the Team class and sends instance variables Ali, Omar and Nour to the formal parameter firstName.

MARKS

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

```
Declare details as array of records
1. Import from database
2. Binary search
```

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4. (a) (continued)

(ii) Use pseudocode to refine the binary search used to display the details of the pupil with PupilID 112213. 5

```
2.1  Set searchItem to 112213
2.2  Set found to false
2.3  Set lower to 0
2.4  Set upper to 9.
2.5  Repeat until found = true or lower > upper
2.6      Set midpoint to (lower + upper)/2
2.7  If details[counter]["PupilID"] = searchItem then
         set found to true and set location to counter
2.8  If details[counter]["PupilID"] > searchItem then
         Set upper to midpoint-1
2.9  If details[counter]["pupilID"] < searchItem then
         Set lower to midpoint + 1
2.10 End loop.
```

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".

```
Assumption that pupil.db is a different file than pupils.db *
-From binary search
1. Set details[location]["RegClass"] to 6B
2. Open file "pupil.db" for write
3. loop with counter2 from 0 to 9
4. write details[counter] to file
5. end loop
6. close file "pupil.db"
```

```
If pupil.db is the same as pupils.db
-From Binary Search
1. Set details[location]["RegClass"] to 6B
2. Open file "pupil.db" for amend
3. Set Line(location) of file to details[location]
4. Close file "pupil.db"
```

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: Bubble sort
Line 2    REPEAT
Line 3      SET swapped TO false
Line 4      FOR counter FROM 1 TO 9
Line 5        IF details[counter]["RegClass"] > details[counter+1]["RegClass"] THEN
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

1. # Name of Sort Algorithm Used: Bubble Sort

5. IF details[counter]["RegClass"] < details[counter+1]["RegClass"] THEN

(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

A bubble sort would have to pass through the array many more times than a quicksort would and therefore take a lot more time with such a large array.