X7167701

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day   Month   Year   Scottish candidate number

Total marks — 60

Attempt ALL questions.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting.

Use **blue** or **black** ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

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SQA
©

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. **3**

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	
DATE FROM	dd/mm/yyyy 📅
DATE TO	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	
YEAR	2014 ⬍
MONTH	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**

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(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**

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1. (continued)

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

> Please enter a username (6 to 15 characters):
>
> Please enter a password (4 to 8 characters):
>
> Submit Form

(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. **3**

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.

5

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. **2**

   _____

   _____

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   _____

   (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. **2**

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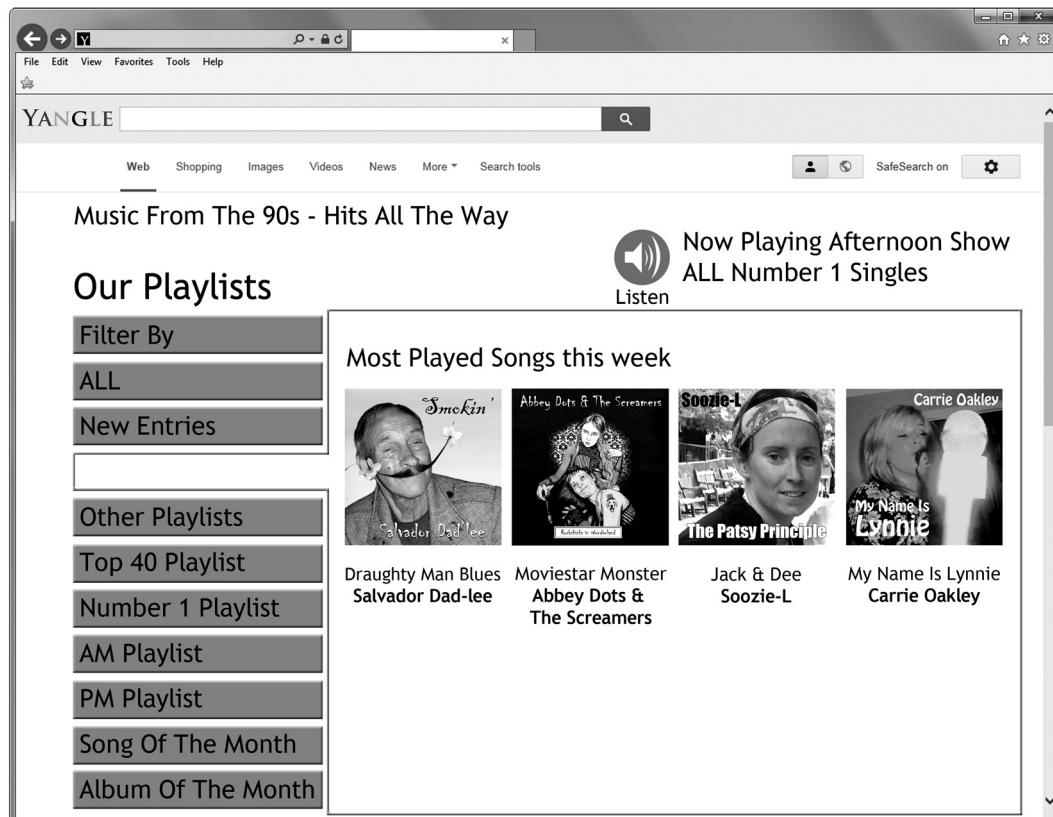
2. **(b)** **(continued)**

(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

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
ProgrammeID	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**

(ii) Write the SQL query which will list the title of each song played on 26 May 2016. **2**
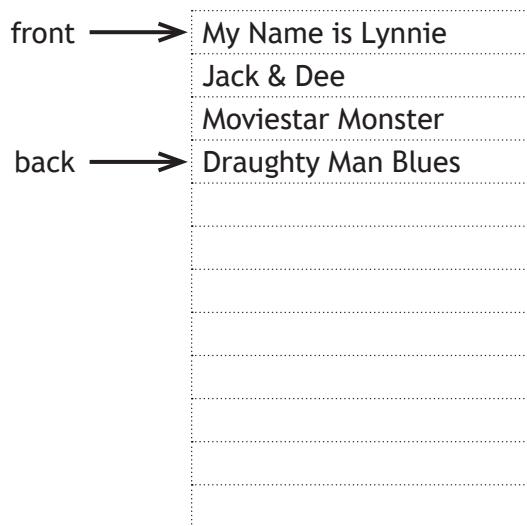
2. (continued)
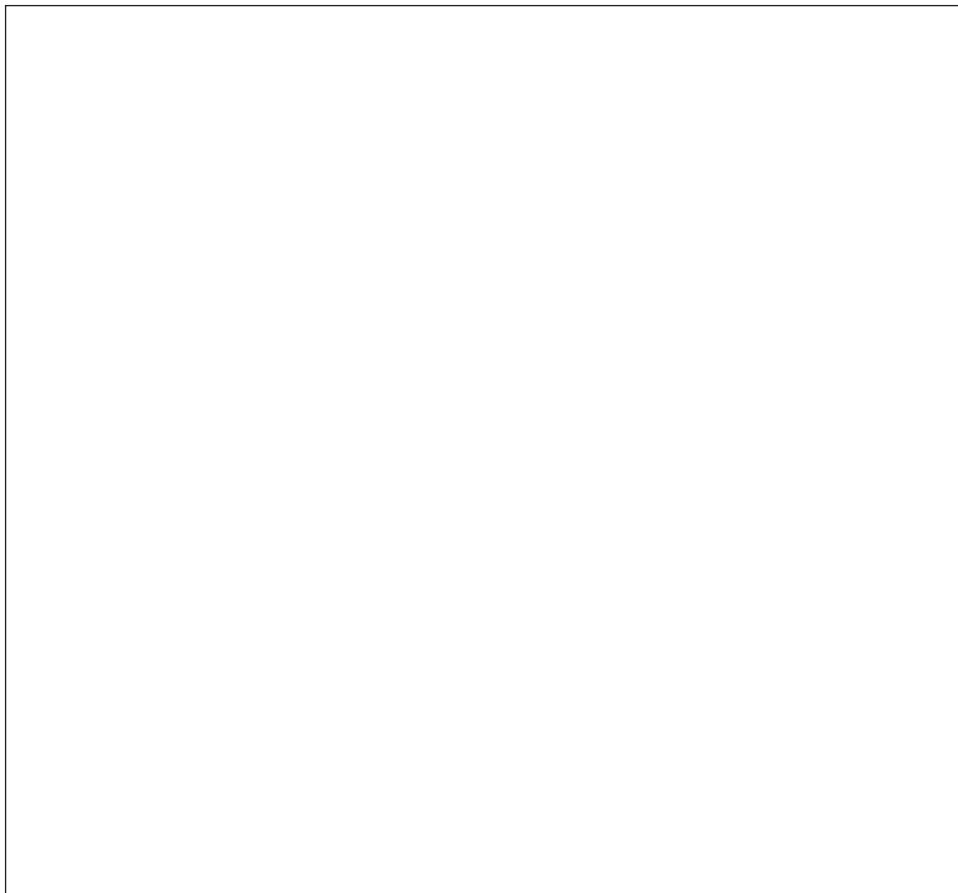
(d) The titles of the songs in one of the playlists are exported to a program for processing using a queue structure. The queue has been implemented as a 1-D array.

The contents of the queue are shown.

front ——→ | My Name is Lynnie
| Jack & Dee
| Moviestar Monster
back ——→ | Draughty Man Blues

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

3
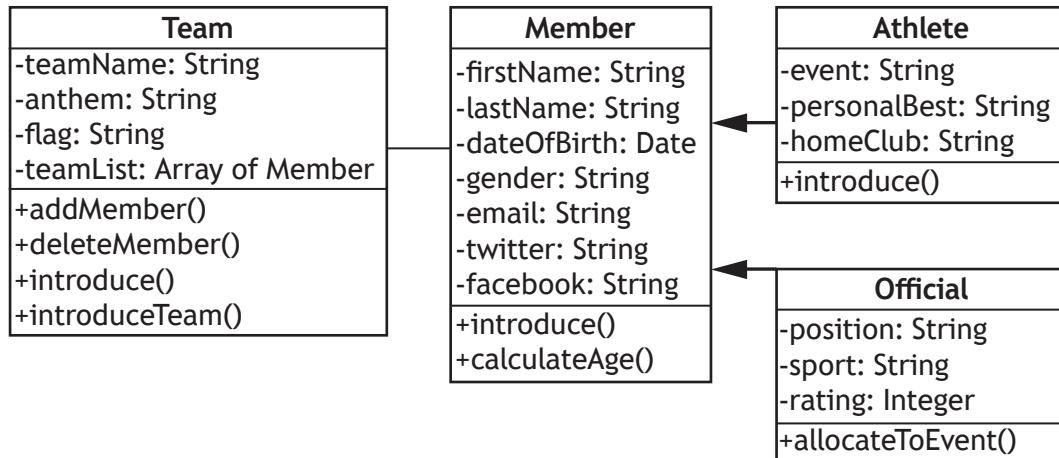
[Turn over

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.

Team
-teamName: String
-anthem: String
-flag: String
-teamList: Array of Member
+addMember()
+deleteMember()
+introduce()
+introduceTeam()

Member
-firstName: String
-lastName: String
-dateOfBirth: Date
-gender: String
-email: String
-twitter: String
-facebook: String
+introduce()
+calculateAge()

Athlete
-event: String
-personalBest: String
-homeClub: String
+introduce()

Official
-position: String
-sport: String
-rating: Integer
+allocateToEvent()

(i) By referring to the class diagram above, explain:
- the difference between a class and an object
- encapsulation
- inheritance   **4**

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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**

(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**

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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.introduce()   **1**

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

3. (continued)

(d) The names of the top 10 medal winning teams are held in a stack. Part of the stack is shown.

	1	Brazil
	2	United Kingdom
	3	Germany
	4	France
→	5	Australia
	6	
	7	
	8	
	9	
	10	

(i) The USA wins enough medals to be fourth on the table. Write down the sequence of stack operations required to produce the new table.　　**2**

|	1	Brazil
	2	United Kingdom
	3	Germany
	4	USA
	5	France
→	6	Australia
	7	
	8	
	9	
	10	

[Turn over
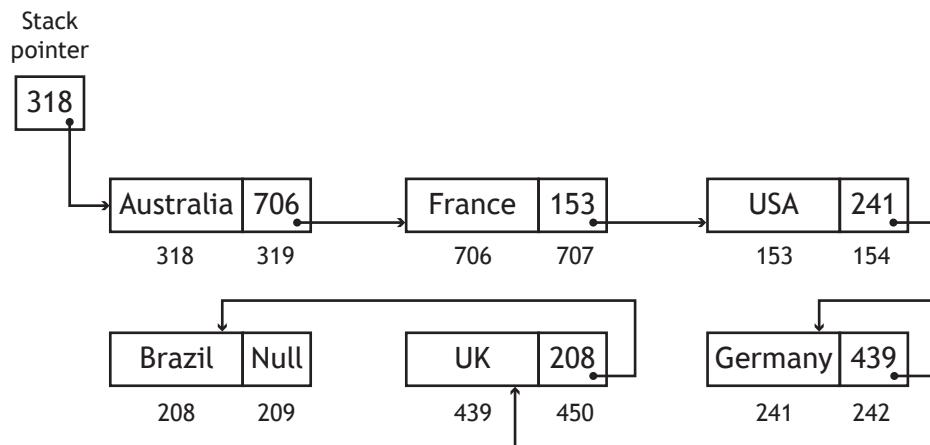
3. (d) (continued)

(ii) The stack storing the medal winning teams could be implemented using a linked list.

The diagram below represents a linked list after the first six teams have been added to the medal table.

Stack pointer

| 318 |

| Australia | 706 | → | France | 153 | → | USA | 241 |
| 318 | 319 | | 706 | 707 | | 153 | 154 |

| Brazil | Null | | UK | 208 | | Germany | 439 |
| 208 | 209 | | 439 | 450 | | 241 | 242 |

Team Russia is to be added to the medal table between Germany and the USA.

Describe how team Russia would be added to the correct place in the linked list.

2

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.

1

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[Turn over

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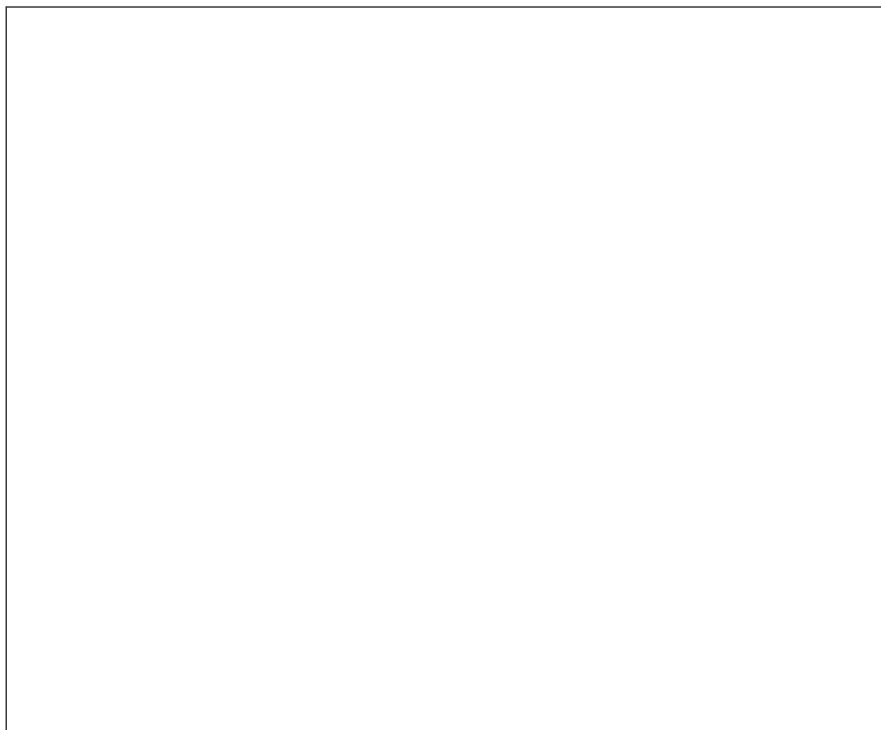
Dawid starts by creating a database file called "pupils.db". The file contains one table called "pupildata" which stores the pupil data shown.

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**

4. (a) (continued)

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

[Turn over

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 "pupils.db".

3

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**

(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**

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