FOR OFFICIAL USE

N5

National Qualifications 2023 MODIFIED

Mark

X816/75/01 Computing Science

THURSDAY, 25 MAY
12:30 PM – 2:00 PM

X8167501

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 — 80

SECTION 1 — Software design and development, and Computer systems — 55 marks
Attempt ALL questions.

Attempt EITHER Section 2 OR Section 3

SECTION 2 — Database design and development — 25 marks

SECTION 3 — Web design and development — 25 marks

You may use a calculator.
Show all workings.

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.

SQA ©

X816750101

SECTION 1 — SOFTWARE DESIGN AND DEVELOPMENT, AND COMPUTER SYSTEMS — 55 marks

Attempt ALL questions

1. The logo below is stored as a vector graphic.

A polygon is one object used in this logo.

(a) State two attributes of this object. **2**

Attribute 1 _____

Attribute 2 _____

(b) State the name of one other object used in this logo. **1**

_____

2. An email has been intercepted by a hacker whilst being sent across a network. Part of the contents of the email are shown below.

A!e% #e 7y zX$s _£

Describe what has been done to the email to avoid it being understood by the hacker. **1**

_____

3. A school wants to reduce the energy consumption of the computing department.

Pupils are already encouraged to put the computers into standby mode when not in use.

Describe two other methods to reduce the energy consumption of the computers. **2**

Method 1 _____

_____

Method 2 _____

_____

4. Snooker uses seven different coloured balls, each worth a different number of points.

Colour of ball	Points
Red	1
Yellow	2
Green	3
Brown	4
Blue	5
Pink	6
Black	7

A program has been written to record the number of points scored as each ball is potted.

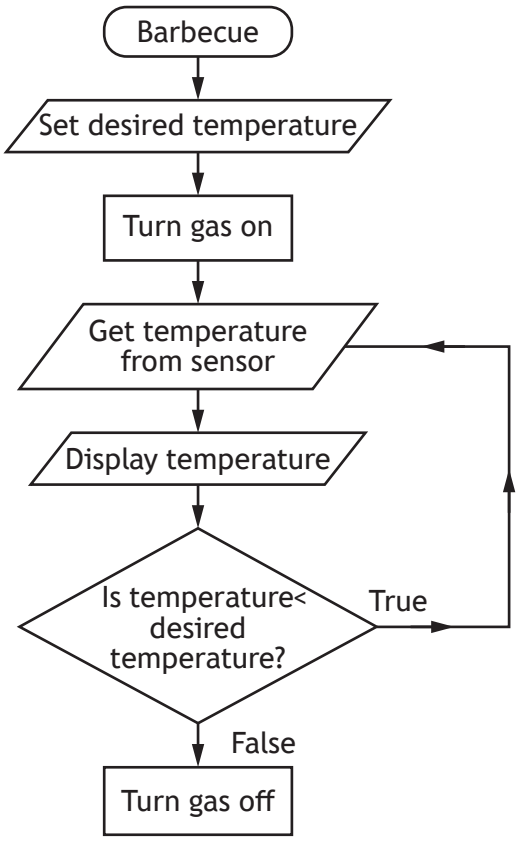
State one example of extreme and exceptional test data that can be used for the input of points. **2**

Extreme _____

Exceptional _____

[Turn over

5. A program is being designed to control the gas burner on a barbecue.

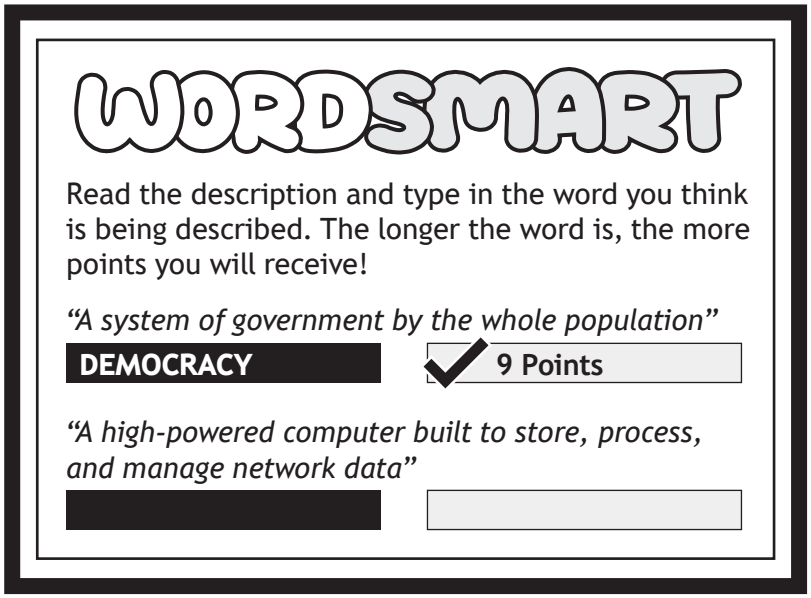


State the design technique shown above. **1**

_____

MARKS DO NOT WRITE IN THIS MARGIN

6. WordSmart is a computer game where players are shown a definition of a word and are asked to enter the word being described.



(a) A player enters the answer:

SERVER

(i) State how many bits would be required to store the player's answer using extended ASCII code. **1**

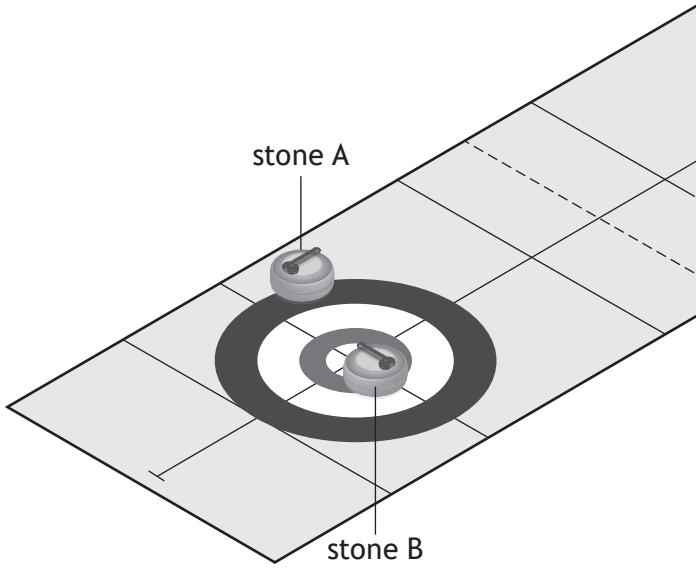
(ii) State the part of the processor used to temporarily store the answer. **1**

(b) If the correct word is entered, a point is awarded for each letter of the word as shown below.

Word	Points
DEMOCRACY	9
SERVER	6

State the predefined function used to count the number of characters in the player's correct answer. **1**

7. Curling is a sport where stones are thrown down a lane of ice towards a target. In the example below, stone B is closest to the middle of the target and is the winner.



A computer program calculates the distance of each stone from the middle of the target. The code below has been written to identify the winning stone but produces the wrong output.

```
...
Line 20   IF stone_A_distance < stone_B_distance THEN
Line 21     SEND "Stone B is the winner." TO DISPLAY
Line 22   ELSE
Line 23     SEND "Stone A is the winner." TO DISPLAY
Line 24   END IF
...
```

(a) State the type of error in the code above and how it can be corrected. **2**

Type of error _____

Correction _____

(b) State the part of the processor used to compare `stone_A_distance` to `stone_B_distance`. **1**

_____

8. A window replacement company employs a programmer to write a program that calculates how much it will cost to fit triple glazed windows.

Small windows cost £299.99 and large windows cost £499.99 to replace.

The algorithm to calculate the cost is shown below.

1. Set totalCost to 0
2. Ask for number of rooms
3. Loop through the number of rooms
4. Ask for the number of small windows
5. Ask for the number of large windows
6. Calculate and update totalCost
7. End loop
8. Display totalCost

(a) Step 6 in the algorithm calculates and updates the total cost.

Using a programming language of your choice, write the code for step 6. **4**

8. (continued)

MARKS DO NOT WRITE IN THIS MARGIN

(b) The total cost should be output as shown below.

The cost is £14999.50 for the windows

Using a programming language of your choice and the variable name `totalCost`, write the code to produce the output above. **2**

(c) A hotel wants to replace 114 windows.

Convert this denary number to 8-bit binary. **1**

9. A 9-hole golf course is introducing an app to replace paper scorecards. The total score is the number of times the player hits the ball to complete all 9 holes.

Below is an example of a paper scorecard that a player has filled in.

Name: *Sanya Abioye* Date: *25/5/2023*	
Hole	Score
1	*3*
2	*4*
3	*9*
4	*4*
5	*6*
6	*6*
7	*4*
8	*5*
9	*5*
Total score	*46*

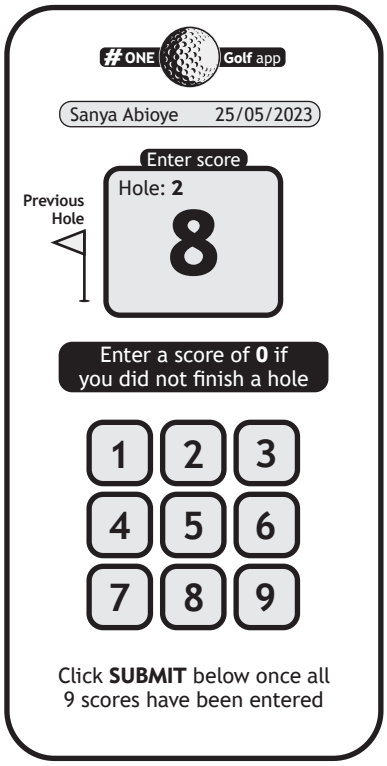
(a) Complete the analysis for the app by identifying the inputs and the output. **2**

Inputs	
Process	Add up the scores
Output	

[Turn over

9. (continued)

(b) The following user interface is designed for the player to enter their score for each hole.



Give two reasons why this user interface design is not fit for purpose. **2**

Reason 1 _____

_____

Reason 2 _____

_____

9. (continued)

(c) Each hole has a target score known as the par value.

If a score entered is three or more above the par value for that hole it is adjusted to the par value plus two. This is shown below for holes 3 and 6.

Hole	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total Score**
Par	3	4	4	4	4	3	4	4	5	
Score	3	4	~~9~~	4	6	~~6~~	4	5	5	~~46~~
Final score	3	4	**6**	4	6	**5**	4	5	5	42

Part of the code for the app is shown below.

```
...
Line 10   REPEAT 9 TIMES
Line 11     RECEIVE par FROM (INTEGER) KEYBOARD
Line 12     RECEIVE score FROM (INTEGER) KEYBOARD
Line 13     < calculate final score for each hole >
Line 14     < update totalScore >
Line 15   END REPEAT
Line 16   SEND totalScore TO DISPLAY
...
```

Using a programming language of your choice, write the code for line 13. **3**

(d) The final scores are stored within the app.

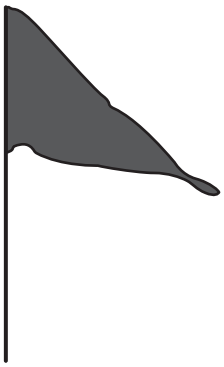
State the most suitable data structure and data type for storing the final score for each hole. **2**

Data structure _____

Data type _____

9. (continued)

(e) The app uses the following bit-mapped graphic.



Describe how a bit-mapped graphic is represented in a computer system's memory. **2**

10. A communications company uses a program to calculate a customer's average data usage over a 12-month period.

An example of a customer's monthly data usage in gigabytes (GB) is shown below.

...	Feb	March	April	May	June	July	Aug	...
	50	41	30.8	35.7	32.7	23	19	

(a) The data usage for the customer in May is 35.7 GB. This value would be stored in a computer system using floating-point representation as shown below.

$$0.357 \times 10^2$$

Identify the mantissa and exponent in the above floating-point representation. **2**

Mantissa _____

Exponent _____

(b) The design below shows how a customer's average monthly data usage is calculated and displayed.

Algorithm

1. Store each month's data usage
2. Calculate the average monthly data usage
3. Display the average monthly data usage

The data structure `month` is used to store the data usage.

The variable `aveData` is used to store a customer's average monthly data usage.

Using a design technique of your choice, refine step 2. **4**

10. (continued)

(c) A customer's average monthly data usage is displayed using the following code.

```
SEND aveData TO DISPLAY
```

The above code displays the following value to a customer.

23.3123

Using a programming language of your choice, re-write this code so the customer's average monthly data usage will display as the following. **2**

23.3

(d) The following code checks if the customer receives both their mobile data and broadband from the company before offering them a discount.

```
...
Line 44   SET custDiscount TO 0.0
Line 45   < Repeat for each customer >
Line 46      IF mobileData = TRUE AND broadband = TRUE THEN
Line 47         SEND "You are due a 20% discount." TO DISPLAY
Line 48         SET cust Discount TO bill * 0.2
Line 49      END IF
Line 50   < End repeat>
...
```

(i) Identify the logical operator in the above code. **1**

(ii) During translation the program stops and produces an error at line 48.

State the type of error that the programmer has made and how the error can be corrected. **2**

Type of error _____

Correction _____

11. Tarvit High School is trialling a voting system to decide their representative for the pupil council. A programmer creates a voting app to allow pupils to cast their vote. The winner is displayed once voting is closed.

2023 Tarvit High School Pupil Council Representative Online Vote

A Jade Hendry
B Lisa Murphy
C Lukasz Kowalski
D Robert Green

Enter your vote using your keyboard: A, B, C or D **C**

2023 Tarvit High School Pupil Council Representative Current Votes

Jade Hendry	**22**
Lisa Murphy	**13**
Lukasz Kowalski	**19**
Robert Green	**21**

(a) Identify one process carried out by the voting app. **1**

(b) A pupil must enter A, B, C or D to cast their vote.

(i) State the most suitable data type for storing the vote. **1**

(ii) Using a design technique of your choice, design a solution that will allow only these values to be entered. **4**

11. (continued)

(c) The following code displays the number of votes for each candidate.

```
...
Line 22  REPEAT 4 TIMES
Line 23    < display candidate name and number of votes >
Line 24  END REPEAT
...
```

Before the code is run it must be translated.

Complete the table below to identify the type of translator that should be used for each effect. **2**

Type of translator	Effect
	Loop will be translated once and converted into machine code
	Loop will be translated four times as the program is run

(d) After voting is closed three candidates have received the same number of votes. Their names are stored in a data structure called `winners`.

The app uses a predefined function to pick one candidate from `winners`.

Using a programming language of your choice, write the code that will display the name of the winning candidate. **3**

[END OF SECTION 1]

SECTION 2 — DATABASE DESIGN AND DEVELOPMENT — 25 marks

Attempt ALL questions

12. A database table stores data about balloon orders.

Order					
orderID	**type**	**personalise**	**price**	**colour**	**collection**
NS254	Number	No	5.29	Silver	11/09/2023
SM892	Star	Yes	3.99	Red	25/08/2023
CM762	Circle	Yes	2.99	Red	25/08/2023
CM766	Circle	Yes	4.99	Blue	05/06/2023
NG982	No1 Friend	No	3.49	Gold	01/08/2023
NB118	No1 Teacher	No	3.49	Blue	20/06/2023

(a) Balloons are available in a limited number of colours.
State the type of validation that should be implemented to achieve this. **1**

_____

(b) State the attribute type required for the following attributes. **2**

Attribute	**Attribute Type**
personalise	
collection	

[Turn over

13. The sorted output below was produced by running a query in a database.

contractCode	contractLength	phoneType	storage
IP24128	24 months	iPhone14	128 GB
IP18128	18 months	iPhone14	128 GB
GA18128	18 months	Galaxy S22	128 GB
GA24256	24 months	Galaxy Z	256 GB
PI18256	18 months	Pixel 6a	256 GB
IP18256	18 months	iPhone 14	256 GB
XP12256	12 months	Xperia 5	256 GB
IP24512	24 months	iPhone 14	512 GB
GA24512	18 months	Galaxy Z	512 GB

Complete the SQL statement used to produce this sorted output. **2**

```
SELECT contractCode, contractLength, phoneType, storage
FROM contract

ORDER BY _____
```

14. A window cleaning company wishes to create a database to store information about staff and the houses they clean. The company provides examples of information they would like to include.

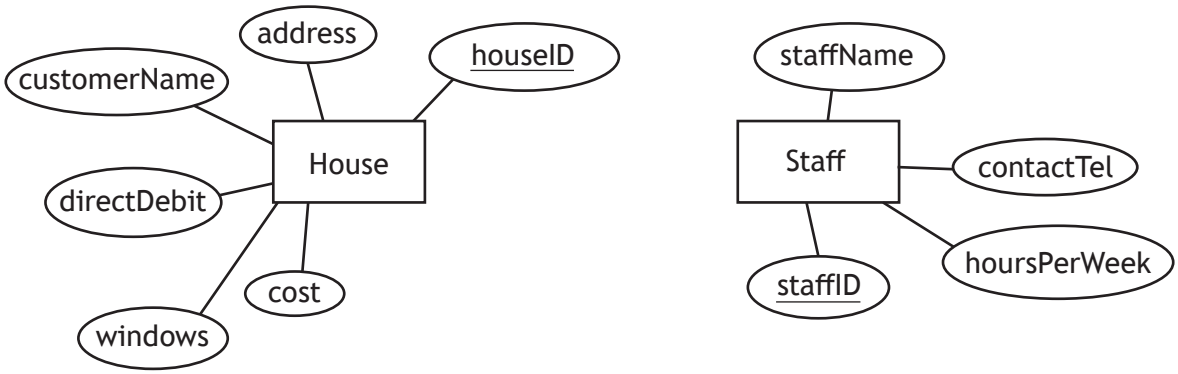
House
houseID: DAL7233
Customer Name: Jacob Brown
Address: 8 Wishaw Place
Direct debit: No
Windows: 8
Cost: 15

Staff
staffID: 6290
Staff Name: Noah Canavan
Contact Telephone: 07387259004
Hours Per Week: 25

(a) Each staff member is allocated a number of houses to clean. They clean the windows of the same houses each month.

Use the information provided to complete the entity relationship diagram below by:

- adding the missing key attribute
- drawing the relationship between the entities
- naming the relationship between the entities. **4**



[Turn over

MARKS

DO NOT WRITE IN THIS MARGIN

(b) The relational database is implemented. Sample data from both tables is shown below.

House						
houseID	**customerName**	**address**	**directDebit**	**windows**	**cost**	**staffID**
BON4523	Claire Banks	168 Ferry Place	Yes	6	13	1613
DAL8001	Stephen Jones	7F Millbank	No	3	7	1752
EDI3189	Ian Collins	15 Robin Ave	Yes	8	12	1613
...	...	...	...	...	...	...

Staff			
staffID	**staffName**	**contactTel**	**hoursPerWeek**
2160	Daniel Buchan	07721454187	35
1613	Jessie Tait	07378565190	15
1752	Nick Haig	07745176623	27.5
1617	Dagmara Dyner	07178251143	35
...	...	...	...

(i) The database is used to identify all customer names and addresses that have 5 or more windows and are allocated to staff member Fatima Khan.

Complete the SQL statement below that would produce this output. **5**

```
SELECT _____

FROM _____

WHERE _____

_____

_____
```

(ii) The owner at 15 Robin Avenue has moved house. The new owner's name is Sue Horaz. They will still pay via direct debit.

Complete the SQL statement below to update this record. **1**

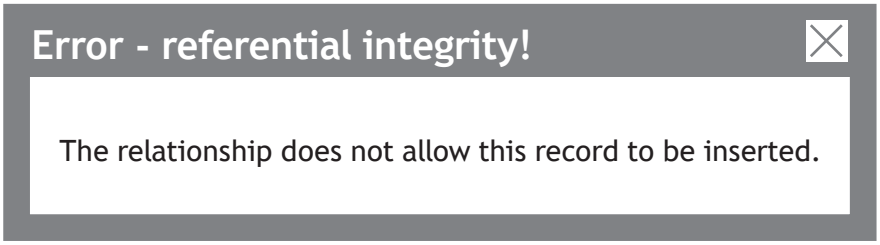
```
UPDATE House

SET _____

WHERE houseID = "EDI3189" ;
```

14. (continued)

(c) The following details are to be added into the `House` table.

houseID	customerName	address	directDebit	windows	cost	staffID
BON9070	Tia Neil	77B Park Close	No	5	9	3630

When attempting to add this data, the following error message is displayed.



Explain the reason for this. **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

15. Bright Stars organise and run classes for children. Classes are organised into blocks, each running for 8 weeks.

The table `Class` stores data about the classes available.

The table `Booking` stores data about the children and their parents/guardians.

Sample data from each table is shown below.

Class						
classID	**leaderName**	**day**	**time**	**location**	**sessionBlock**	**classAge**
S1-141	Suzanne	Mon	10:45	Grange	Summer	1-2 Years
S2-228	Claire	Tue	11:50	Lothianburn	Autumn	3-4 Years
S2-871	Jo	Mon	13:00	Gorebridge	Spring	3-4 Years
B1-121	David	Thur	15:30	Biggar	Winter	Babies
S1-333	Alexander	Wed	13:00	Coldingham	Summer	1-2 Years
S2-519	Claire	Fri	10:45	Lothianburn	Autumn	3-4 Years
B3-435	Jose	Wed	09:30	Gorebridge	Spring	Babies
...	...	...	...	...	...	...

Booking						
bookingID	**parentName**	**email**	**childName**	**childDOB**	**paid**	**classID**
EF220731	Esme Faulds	EFaulds22@mail.com	Quinn	25/09/2022	No	S1-333
TR238270	Tim Roberts	TRoberts2@mail.com	Lucas	05/02/2023	Yes	B1-121
ZA200836	Zoe Archer	ArcherLTD@mail.com	Blake	11/01/2020	Yes	S2-288
FY229853	Fen Yang	FYang131@mail.com	Freya	06/06/2022	No	S1-333
...	...	...	...	...	...	...

15. (continued)

(a) Spring classes for babies are ending soon. An email needs to be sent to all parents to offer them a place in the Summer classes.

Design a query that could be used to generate a list of names and email addresses of parents with a child who attends a Spring class for babies. **4**

Field(s)	
Table(s)	
Search Criteria	

(b) A new class is going to be added for Autumn which will be run by Adam. This is added by executing the following SQL statement.

```
INSERT INTO Class (classID, leaderName, day, time,
location, sessionBlock, classAge)
VALUES ("B1-497", "Adam", "Mon", 15:30, "Grange","Autumn",
"Babies");
```

Tim Roberts, who made booking TR238270, would like to book their child Lucas onto this new class. He has not yet paid for the class.

Write an SQL statement that will add this booking to the `Booking` table, using the bookingID TR653726. **2**

15. (continued)

MARKS DO NOT WRITE IN THIS MARGIN

(c) Some data needs to be removed from this table.

Class						
classID	**leaderName**	**day**	**time**	**location**	**sessionBlock**	**classAge**
S1-141	Suzanne	Mon	10:45	Grange	Summer	1-2 Years
S2-228	Claire	Tue	11:50	Lothianburn	Autumn	3-4 Years
S2-871	Jo	Mon	13:00	Gorebridge	Spring	3-4 Years
B1-121	David	Thur	15:30	Biggar	Winter	Babies
S1-333	Alexander	Wed	13:00	Coldingham	Summer	1-2 Years
S2-519	Claire	Fri	10:45	Lothianburn	Autumn	3-4 Years
B3-435	Jose	Wed	09:30	Gorebridge	Spring	Babies
...	...	...	...	...	...	...

(i) Claire is no longer able to run the 3-4 Years class on a Tuesday in the Autumn block.

The SQL statement below is written to make the change.

```
DELETE FROM Class
WHERE leaderName = "Claire"
AND classAge = "3-4 Years";
```

Give one reason why this SQL statement is not fit for purpose. **1**

(ii) The Gorebridge classes are no longer running.

Write the SQL statement to remove all the Gorebridge classes. **2**

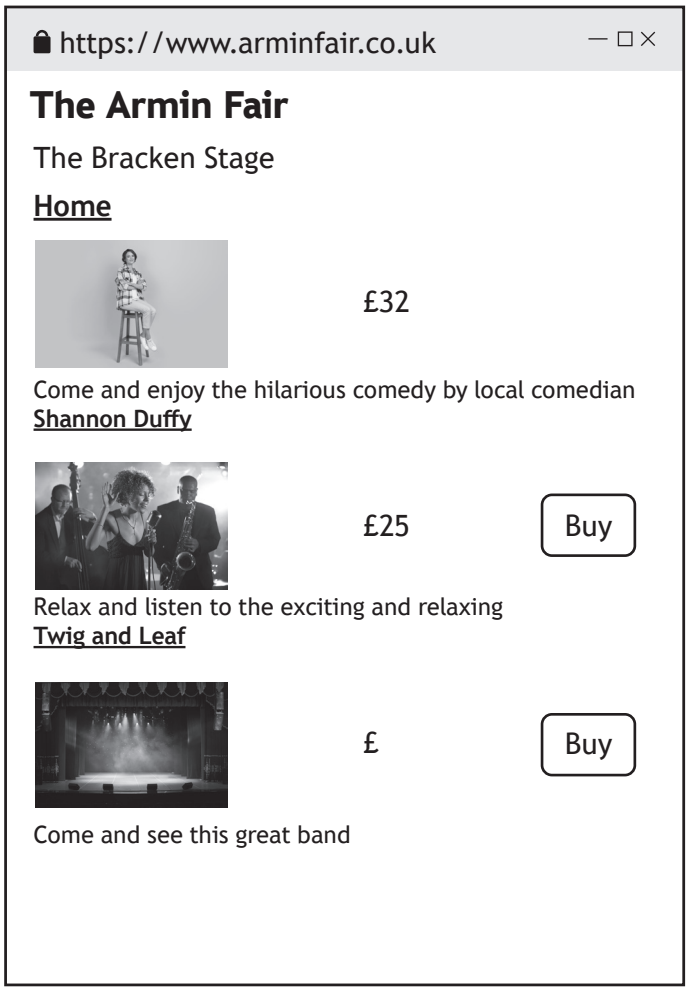
[END OF SECTION 2]

SECTION 3 — WEBSITE DESIGN AND DEVELOPMENT — 25 marks

Attempt ALL questions

16. The Armin Fair website allows customers to buy tickets for shows taking place during the fair.

The web page for the Bracken Stage is shown below.



(a) State two reasons why the above web page is not fit for purpose. **2**

Reason 1 _____

_____

Reason 2 _____

_____

[Turn over

16. (continued)

(b) The web page contains internal hyperlinks.

Describe what is meant by an internal hyperlink. **1**

17. A website has been created to help users play video games. The website makes use of animated images.

(a) State a suitable standard file format for these animated images. **1**

(b) The animated images were taken from another website.

Describe how the Copyright, Designs and Patents Act protects the rights of the original creator of the images. **1**

18. Describe one benefit of using an external CSS file. **1**

19. The Vulpes fox charity would like a website to increase public knowledge of foxes.

(a) The following content is required.

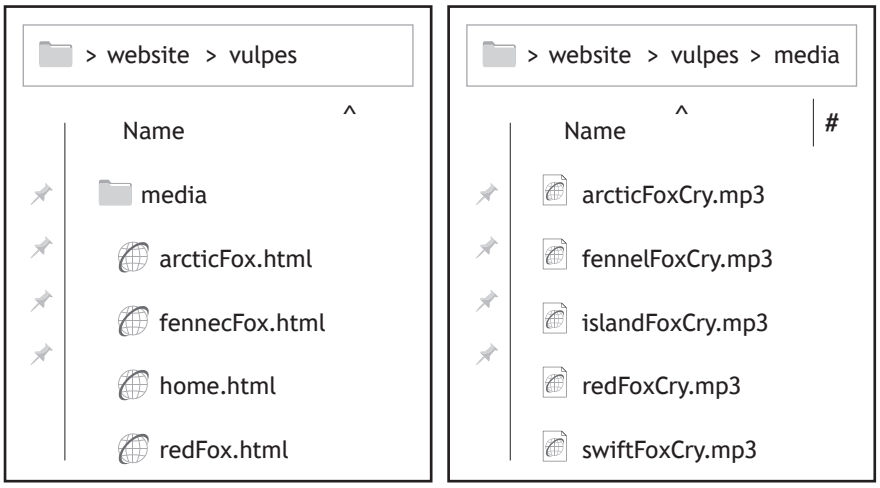
> The website will have pages about different types of foxes where users can view pictures and listen to the sounds made by each fox. The charity logo needs to be visible at the top of each page.

Identify a functional requirement of the above website. **1**

_____

_____

(b) All the sounds used on the website are stored in a folder called 'media' in the following locations.



(i) Using this structure, complete the following code to play the sound 'redFoxCry.mp3' when the play button is pressed on the redFox web page. **3**

```
<_____ controls>

<source src = "_____"

type= "audio/mpeg" >

</_____ >
```

[Turn over

19. (b) (continued)

(ii) Upon testing, the fox sounds were found to take too long to download.

Describe how the file size can be reduced without altering the length of the sound. **1**

_____

_____

(c) When the cursor moves over an image of the fox it changes the picture from one of a fox in a sitting down position to one of the fox lying down.

Identify the language and the event used to implement this. **2**

Language _____

Event _____

(d) Part of the HTML and CSS for the 'Contact us' page for the Vulpes website is shown below.

contactUs.html

```
<html>
<head>
<link rel="stylesheet" type="text/css"
href="Styles.css">
</head>
<body>
<img src="logo.png">
<a href="home.html">Back to home page</a>
<div id="titleSection">
<h1 style="text-align:center">Vulpes</h1>
<p>Contact us</p>
</div>
<div>
<p>We're here to help, whether to answer
a fox question or assist you to find more
information about foxes. Contact us using
one of the methods below</p>
</div>
<div>
<h1>Methods</h1>
<ol>
<li>Phone Number – 07700900833</li>
<li>Email – info@vulpes.uk</li>
<li>Address – Currently our offices are
closed</li>
</ol>
</div>
…
```

Styles.css

```
body{background-color:violet;}

#titleSection{text-align: right;
background-color:yellow;
}

div{text-align:left;}

h1{text-align:right; }
```

19. (d) (continued)

Draw how the web page will look when viewed in a browser. Some of the content has already been added. **3**

Back to home page

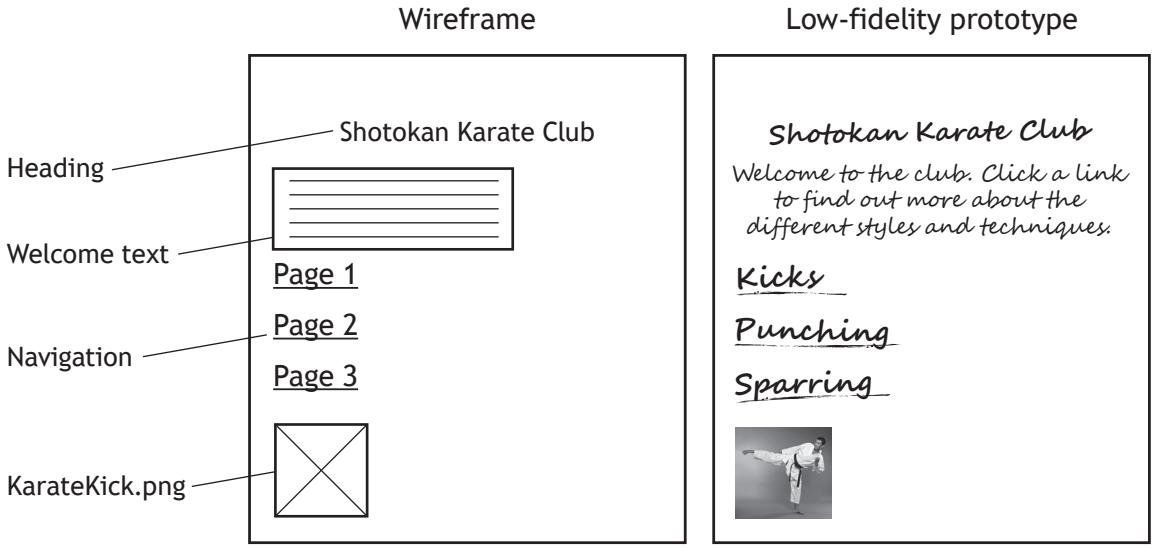
We're here to help, whether to answer a fox question or assist you to find more information about foxes. Contact us using one of the methods below.

1. Phone Number - 07700900833
2. Email - info@vulpes.uk
3. Address - Currently our offices are closed

[Turn over

20. The Shotokan Karate Club wants to create a website so members can view techniques and find information about the club.

(a) During website design both a wireframe and a low-fidelity prototype are created.



Explain why wireframes and low-fidelity prototypes are used when designing a website. **2**

Wireframe _____

_____

_____

Low-fidelity prototype _____

_____

_____

20. (continued)

MARKS DO NOT WRITE IN THIS MARGIN

(b) Four pages for the website are shown below.

https://www.shotokanclub.co.uk

Shotokan

Shotokan Karate Club

Welcome to the club. Click a link to find out more about the different styles and techniques

Kicks

Punches

Sparring

https://www.shotokanclub.co.uk/kicks

Shotokan

back to home page

Kicks

This page is about all the different types of kicks being taught at the Shotokan Club. Learn them all and become a master!

Foot sweep

This kick is used to trip an opponent. Click the link to go to the Karate Association for a demo

Foot sweep demo

https://www.shotokanclub.co.uk/sparring

Shotokan

back to home page

Sparring

What is sparring?

Sparring is karate in action! This allows you to put all your techniques in use within a spontaneous situation.

Skill development

Sparring builds mobility, control and distance. It is also used to build endurance.

https://www.shotokanclub.co.uk/punches

Shotokan

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Punches

Snap punch

This can be described as a punch that instantly connects to the target and returns immediately.

Lunge punch

This punch involves taking a step. It is the most powerful punch in karate.

Hook punch

This punch starts at your hip and moves towards the opponent's temple.

Draw the navigational structure for this website. **4**

20. (continued)

MARKS DO NOT WRITE IN THIS MARGIN

(c) Part of the code from the 'Punches' page is shown below.

punches.html

```
…
<body>
<h1>Shotokan</h1>
<a href="shotokanclub.co.
uk">back to home page</a>
<h2>Punches</h2>

<div>
<h3>Snap punch</h3>
<p>This can be described as a
punch that instantly connects
to the target and returns
immediately.<p>
</div>

<div>
<h3>Lunge punch</h3>
<p>This punch involves taking
a step. It is the most
powerful punch in karate.</p>
</div>

<div>
<h3>Hook punch</h3>
<p>This punch starts at your
hip and moves towards the
opponent's temple.</p>
…
```

styles.css

```
body{ background-color :
lightBlue;
}

h2{ font-family: Arial;
font-size : 24px;
text-align: center;
}

h3{font-family: Arial;
color: yellow;
}
```

The club have decided to make the lunge punch their training focus. To show this they want the heading below to be red.

```
<h3>Lunge punch</h3>
```

Write an external CSS class to style the text and edit the HTML above to implement this change. **3**

CSS rule

Edited HTML

[END OF SECTION 3]

[END OF QUESTION PAPER]

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ADDITIONAL SPACE FOR ANSWERS

MARKS | DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS

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