FOR OFFICIAL USE

N5

National Qualifications 2022 MODIFIED

Mark

X816/75/01 Computing Science

MONDAY, 30 MAY

1:30 PM – 3:00 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 ©

X8167501 01

MARKS DO NOT WRITE IN THIS MARGIN

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

Attempt ALL questions

1. Convert the decimal number 60 into 8-bit binary. **1**

2. The following code is used to input and display the points in a game.

```
...
Line 5  RECEIVE teamName FROM KEYBOARD
Line 6  RECEIVE totalPoints FROM KEYBOARD
Line 7  <display output>
...
```

When 'Scotland' and '27' are input the following output is produced by the program.

```
Scotland scored 27 points
```

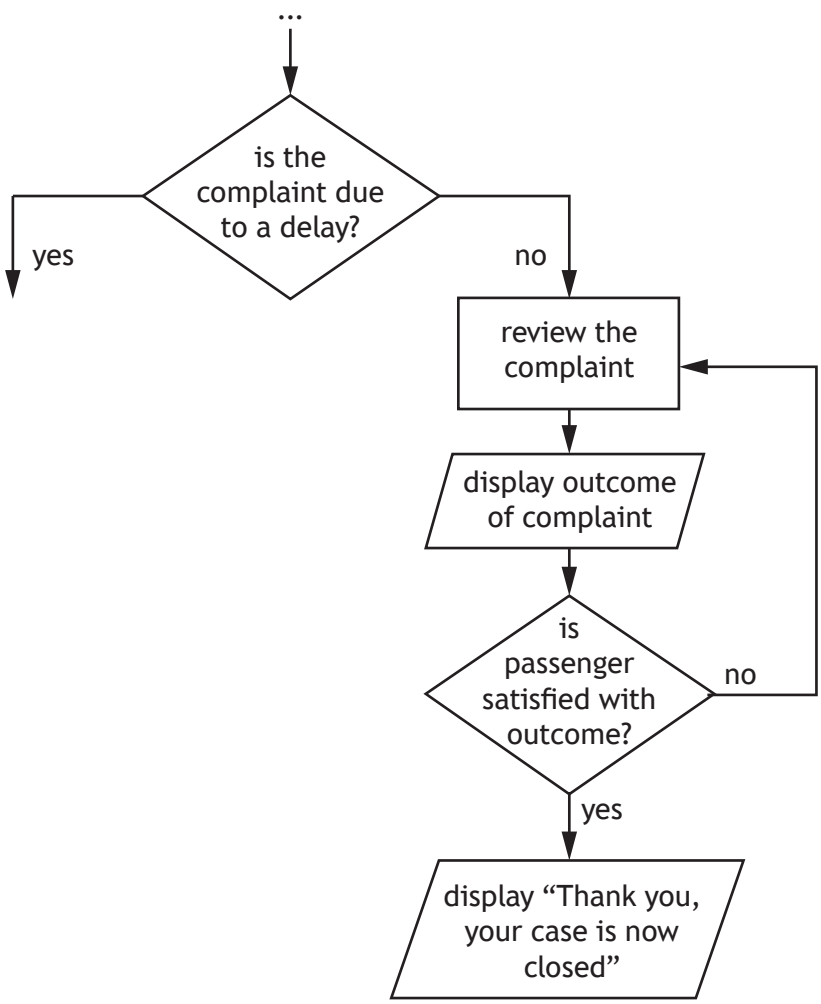
Using a programming language of your choice write Line 7 of the program. **2**

3. A club requires a program to calculate how much each member needs to pay in membership fees.

Complete the table below to state which **type of variable** should be used. **2**

Variable	Sample data	Variable type
membershipFee	37.50	real
yearsOfMembership	6	
memberName	Jones	

4. A train company is designing a program to handle passenger complaints. Part of the design is shown below.



(a) State which type of loop is used in this design. **1**

_____

[Turn over

4. (continued)

(b) When a train is delayed, passengers are entitled to a 25% refund on the cost of their ticket.

Using a design technique of your choice, show how the refund would be calculated. **2**

5. The cruising speed of an aeroplane is 891.6 kilometres per hour. This value would be stored in a computer system using floating-point representation as shown below.

$$0{\cdot}8916 \times 10^3$$

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

Mantissa _____

Exponent _____

6. The code below is being tested to ensure it produces the correct output.

```
...
Line 3  RECEIVE score FROM KEYBOARD
Line 4  IF score = 5 OR score = 10 OR score = 15 THEN
Line 5    IF NOT(score >= 3 AND score <= 12) THEN
Line 6      SEND "Success" TO DISPLAY
Line 7    END IF
Line 8  END IF
```

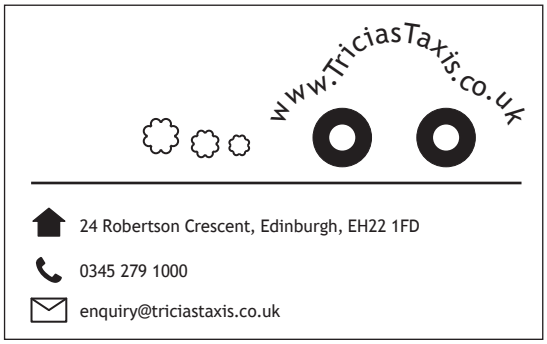
(a) State the score that should be input in Line 3 to display 'Success'. **1**

_____

(b) State one logical operator used in the code above. **1**

_____

7. A graphic designer creates a business card for a taxi company.



State the name of a graphical object used in this design and one attribute of that object that can be altered by the graphic designer. **2**

Object _____

Attribute _____

[Turn over

8. In a flight booking app, users are asked to enter their departure airport, destination airport, departure date, return date, number of adults and number of children.

A message will then be displayed showing the total flight cost and the duration of the trip.

(a) Describe two processes for the flight booking app. **2**

Process 1 _____

_____

Process 2 _____

_____

(b) The design below shows how the total cost of a booking is calculated.

Algorithm

1. Find ticket costs
2. Get quantity of passengers
3. Calculate initial cost of booking
4. Update cost of booking if bag(s) are added
5. Display final cost of booking

Refinements

2.1 Get quantity of adult passengers

2.2 Get quantity of child passengers

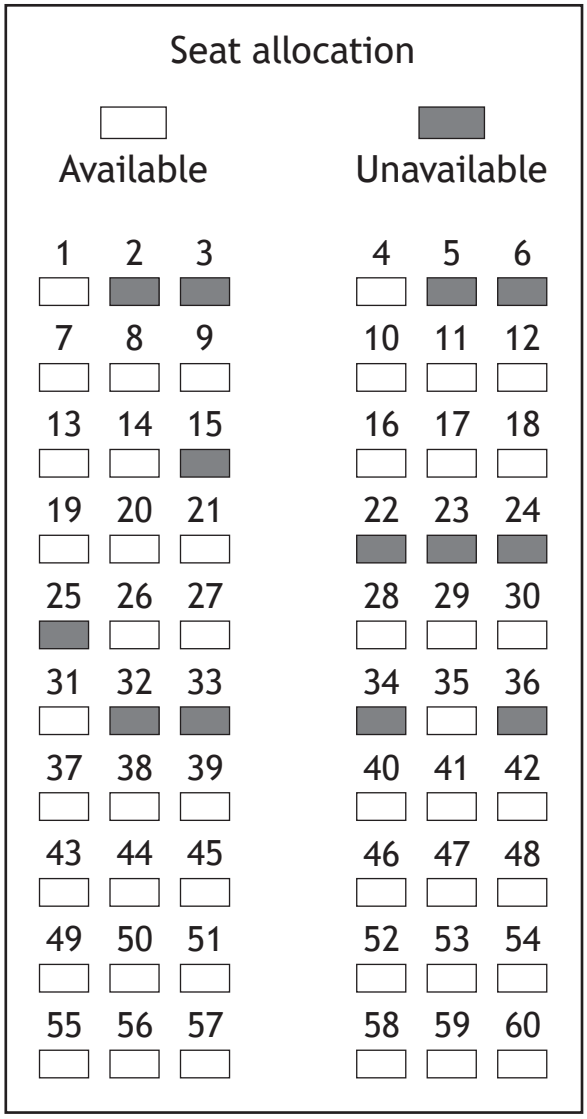
8. (b) (continued)

The app provides an option to add bags to the booking. Each passenger is asked if they want to add a bag. The cost is an additional £7 for each passenger who decides to take a bag.

Using a design technique of your choice, refine step 4. **5**

8. (continued)

(c) Passengers are allocated an available seat. A data structure named `seats` is used to store whether each seat is available (true) or unavailable (false).



(i) State the most suitable data structure and data type used to store the seat availability. **2**

Data structure _____

Data type _____

8. (c) (continued)

(ii) The following pseudocode design shows how an available seat is allocated.

```
1  generate a random seat number
2  loop while the generated seat is unavailable
3      generate another random seat number
4  end loop
5  change seat to unavailable
```

Using a programming language of your choice, write the code required to implement the above design. **4**

(iii) Explain why the above design becomes less efficient as more passengers are allocated seats. **2**

8. (continued)

(d) The app will store passenger information.

State how this information could be transferred securely from the app to the computers running the booking system. **1**

9. A program is being designed to allow users to search for properties for sale.

(a) (i) Pseudocode was used to design the program.
State another technique that could be used to design the program. **1**

_____

(ii) The software development process is described as iterative.
Explain why it may be necessary to return to the design stage. **1**

_____

_____

_____

[Turn over

9. (continued)

(b) (i) The user can search for properties priced from £50,000 to £600,000.

Using a design technique of your choice, design an efficient solution to check that the price entered is valid. **4**

(ii) Test data is used to ensure the validation of the price entered works correctly.

Complete the test table below with one appropriate numerical value for each input. **2**

Type of test	Input	Expected result
Extreme		Program continues
Exceptional		Program displays an error message

9. (continued)

(c) A username and password are added to allow users to save searches.

Part of the code is shown below.

```
...
Line 9    RECEIVE un FROM KEYBOARD
Line 10   RECEIVE pwd FROM KEYBOARD
Line 11   IF un = sUn OR pwd = sPwd THEN
Line 12      SEND "Welcome to saved searches" TO DISPLAY
Line 13   END IF
...
```

(i) Explain how indentation is used to make the code above more readable. **1**

(ii) Describe how Line 11 could be made more readable. **1**

(iii) A user enters the password below.

GRK_0183_J

State how many bits would be required to store the password using extended ASCII code. **1**

(iv) Line 11 should have used AND instead of OR.

State the type of error that using OR would cause when the program is executed. **1**

(d) After final testing, the program is run without requiring any further translation software.

State the type of translator that has been used. **1**

10. Sam is creating a program to calculate and display the total cost of laying new flooring. Flooring is charged at £15 per square meter and skirting boards are charged at £60 per room.

The total cost is calculated by multiplying the total floor area by 15, then adding the number of rooms requiring skirting multiplied by 60.

(a) Using the information above, design a user interface for the program. **3**

(b) (i) State the part of the processor that will perform the calculation once the program is implemented. **1**

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

10. (continued)

(c) Sam completes five jobs in July and earns the following.

£562.77, £675.44, £287.91, £245.22, £899.66

The following section of code calculates Sam's monthly earnings for July.

```
Line 1    DECLARE total INITIALLY 0.0
Line 2    DECLARE job1 INITIALLY 0.0
…
Line 7    RECEIVE job1 FROM KEYBOARD
Line 8    RECEIVE job2 FROM KEYBOARD
Line 9    RECEIVE job3 FROM KEYBOARD
Line 10   RECEIVE job4 FROM KEYBOARD
Line 11   RECEIVE job5 FROM KEYBOARD
Line 12   SET total TO = job1 + job2 + job3 + job4 + job5
Line 13   SEND "Total Monthly Earnings £" & total TO DISPLAY
…
```

When evaluating this code, it is found to be inefficient.

Using a programming language of your choice, re-write Lines 7 to 12 of the code using more efficient constructs. The values for the five jobs should remain stored for use after Line 12. **4**

10. (continued)

(d) Sam takes pictures of floor layouts using a tablet device.

(i) The images are stored as bit-mapped graphics.

Describe how a bit-mapped graphic would be stored. **2**

(ii) Describe one way that Sam could reduce the energy consumption of the tablet. **1**

[END OF SECTION 1]

SECTION 2 — DATABASE DESIGN AND DEVELOPMENT — 25 marks

Attempt ALL questions

11. Every book that is published is given a unique reference as shown below.

978-1-471-83603-9

State the data type that would be used to store this reference in a database. **1**

_____

[Turn over

12. A database table stores the following data.

Result			
forename	**surname**	**test1**	**test2**
Julie	White	7	92
Aaima	Waheed	34	67
Chun	Yang	27	52
Olivia	Arran	58	98
Mia	Branan	78	90
Claire	McKay	10	7
Scott	Harper	42	47

(a) The following SQL statement is implemented in the database.

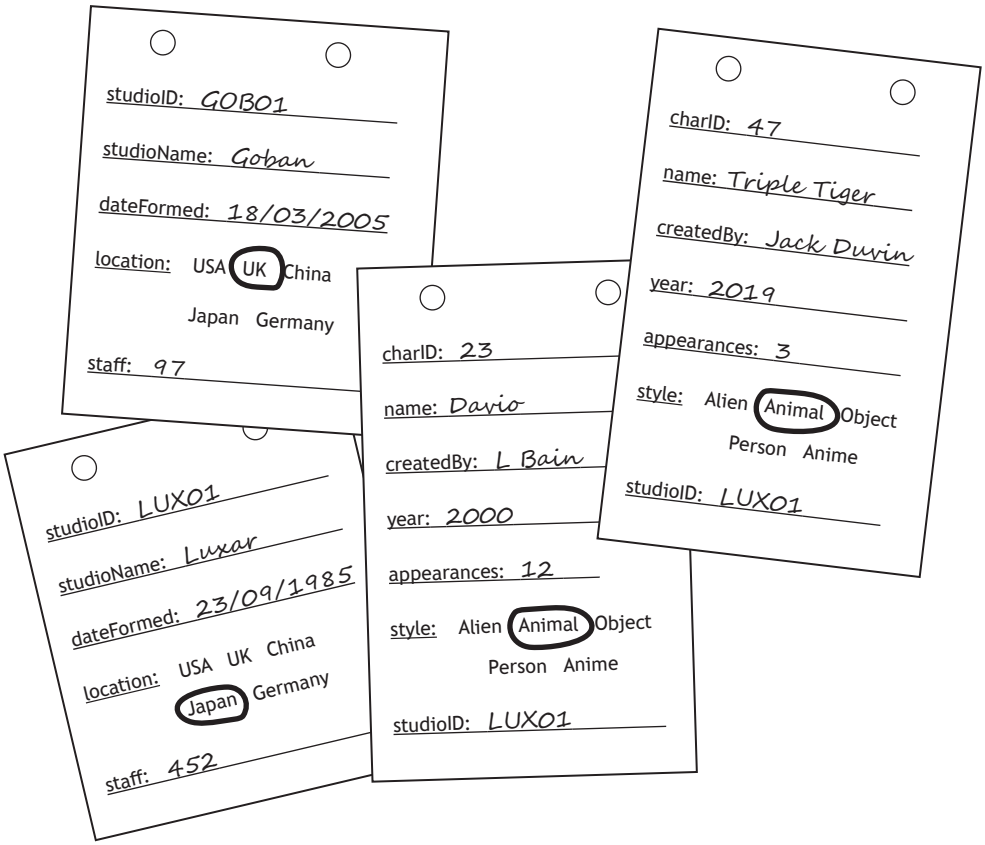
```
SELECT forename, surname
FROM Result
WHERE test1 < 10 OR test2 > 90;
```

Write the expected output from the SQL statement. **3**

(b) Describe how the above SQL statement could be tested. **1**

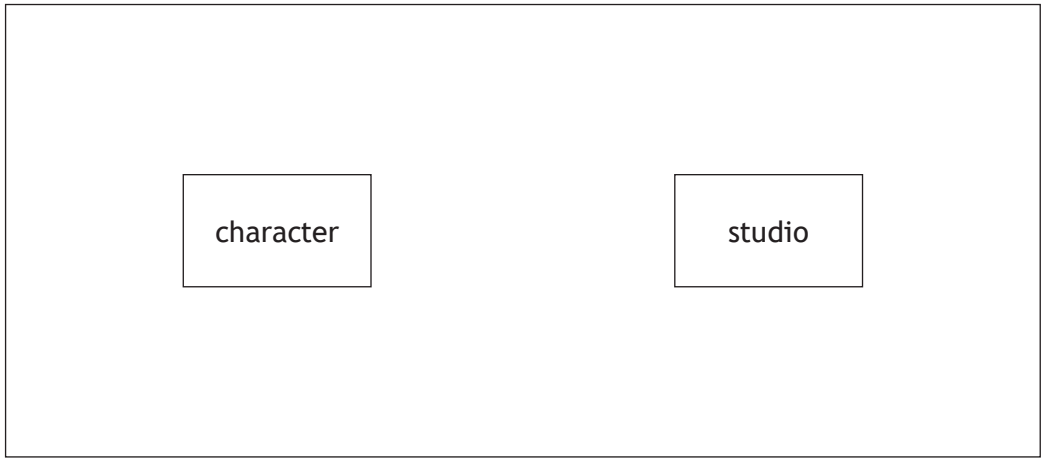
13. Aabish is writing a book about the history of computer animation studios and the characters created by each studio.

As part of her research she makes notes about the studios and characters.



She decides to store this information in a relational database using two entities called character and studio.

(a) Complete the diagram below to show the relationship between the character entity and the studio entity. **1**



MARKS

DO NOT WRITE IN THIS MARGIN

(b) Aabish populates the database with several studios and hundreds of characters. Sample data from each table is shown below.

Studio				
studioID	**studioName**	**dateFormed**	**location**	**staff**
LUX01	Luxar	23/09/1985	Japan	452
DES01	Desney	10/01/2001	UK	298
DES02	Desney	29/10/1992	Japan	1053
...	...	...	...	...

Character						
charID	**name**	**createdBy**	**year**	**appearances**	**style**	**studioID**
1	Fred	F. Smith	1994	23	Person	DES01
2	Daisy Donkey	G.R. Bryant	2003	342	Animal	DES02
3	Toaster	K. Kali	2018	6	Object	DES02
4	Fred	Z. Wayne	1994	76	Alien	LUX01
...	...	...	...	...	...	...

(i) Design a query that could be used to create a list of character names and styles created by 'K. Bell' at the Japanese branch of Goban studios. **5**

Field(s)	
Table(s)	
Search criteria	

13. (b) (continued)

(ii) Aabish uses the database to identify the characters with the least number of appearances from all studios.

name	style	appearances
Triple Tiger	Animal	3
Toaster	Object	6
Davio	Animal	12
Fred	Person	23
Arthur	Alien	24
Biggles	Object	39
...	...	...

Aabish wants to produce similar output for only the Desney studio characters.

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

```
SELECT _____

FROM _____

WHERE _____

_____

ORDER BY _____
```

[Turn over

[BLANK PAGE]

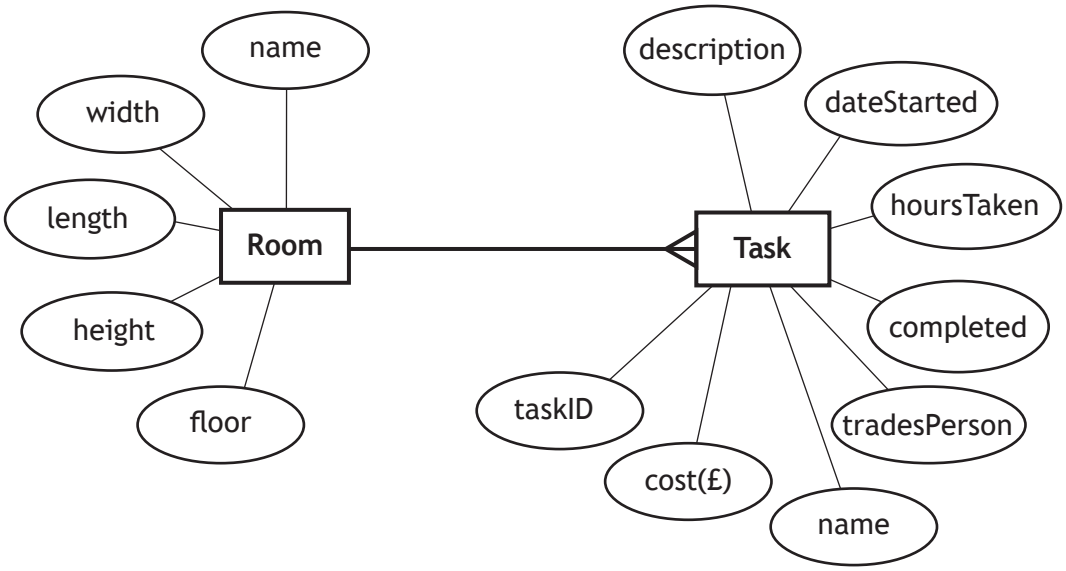
DO NOT WRITE ON THIS PAGE

14. A property renovation company requires a relational database to store information about the tasks to be carried out on each room of a house.

The functional requirements for the database are identified:

- Store details of each room in the house.
- Store details of each task.
- Output a list of tasks carried out by one of the following trades people: electrician, builder, plasterer, decorator, carpenter, plumber.
- Output a list of tasks completed for a single room.

(a) (i) Complete the entity relationship diagram below by identifying key attributes. **2**



(ii) Use the functional requirements above to identify the attribute in the 'Task' entity that would be implemented using restricted choice validation. **1**

_____

(b) Explain why the General Data Protection Regulations do not apply to the information that will be stored in this database. **1**

_____

_____

_____

[Turn over

14. (continued)

(c) The relational database is implemented. The data it currently stores is shown below.

Room				
name	**width**	**length**	**height**	**floor**
living	4.20	4.05	2.20	ground
kitchen	3.25	2.70	2.20	ground
dining	3.05	3.10	2.20	ground
bedroom	3.70	4.15	2.15	first
bathroom	1.80	2.10	2.15	first

Task							
taskID	**description**	**dateStarted**	**hours Taken**	**completed**	**trades Person**	**cost(£)**	**name**
1	Fit new sink	12/4/2022	4	true	plumber	98.58	bathroom
2	Paint living room door	12/4/2022		false	decorator		living
3	Paint kitchen	13/4/2022	3	true	decorator	120.00	kitchen
4	Fit kitchen cupboards	15/4/2022	32	true	carpenter	1790.00	kitchen
5	Plaster walls	16/4/2022		false	plasterer		bedroom
6	Fit new bath	16/4/2022	8	true	plumber	278.54	bathroom
7	Fit new door to bedroom	18/4/2022		false	carpenter		bedroom
8	Paint bedroom	18/4/2022		false	decorator		bedroom

MARKS

DO NOT WRITE IN THIS MARGIN

A porch is to be built onto the front of the house.

The porch is added as a new room by executing the following SQL statement.

```
INSERT INTO Room (name,width,length,height,floor)
VALUES ("Porch",1.20,1.40,2.10,"ground");
```

The task 'construct porch' needs to be added. This task was started by a builder on 19 April 2022. The work is not completed so the hours taken and cost are not yet known.

Write an SQL statement that will add this work to the `Task` table. **3**

(d) The bedroom is no longer being renovated.

The following SQL statements are written to remove the bedroom tasks from the `Task` table.

```
DELETE FROM Task
WHERE taskID = 5;

DELETE FROM Task
WHERE taskID = 7;

DELETE FROM Task
WHERE taskID = 8;
```

Write a single efficient SQL statement to remove the bedroom tasks. **2**

[END OF SECTION 2]

SECTION 3 — WEB DESIGN AND DEVELOPMENT — 25 marks

Attempt ALL questions

15. Read the following CSS code.

```
body{
    font-family:Arial;
}
#section1{
    color:red;
}
.menu{
    text-align:center;
}
```

Identify one property and one class in the code above. **2**

Property _____

Class _____

16. A school website contains a link to the Scottish Qualifications Authority website.
State the type of link used. **1**

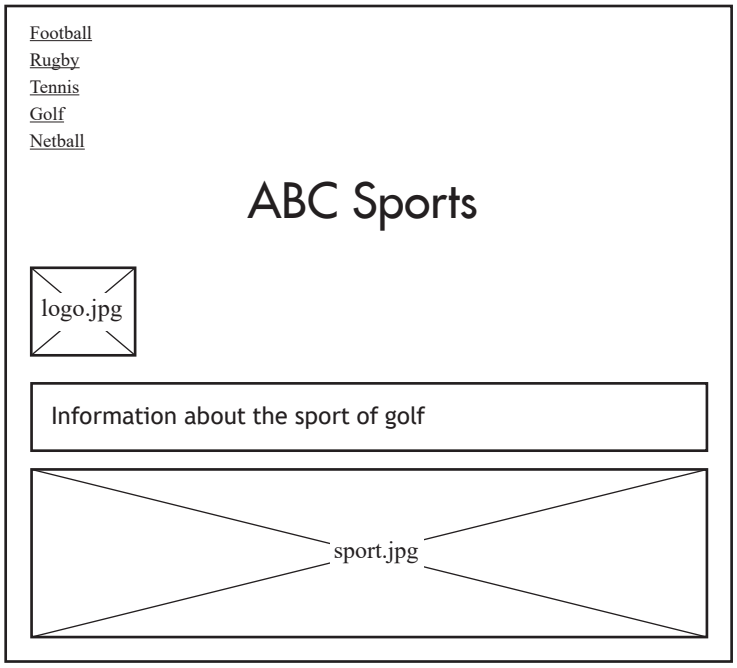
_____

17. ABC Sports employs a web designer to design a new home page for its website.

The functional requirements have been identified below:

- The company Logo should be positioned at the top left.
- The company name should be centred on the page below the main navigation.
- A sport related graphic, the entire width of the page, should be positioned at the bottom of the page.
- Information text about the company should be included.

The web designer produces the following wireframe design.



Identify two reasons why the wireframe design above would not meet the functional requirements. **2**

Reason 1 _____

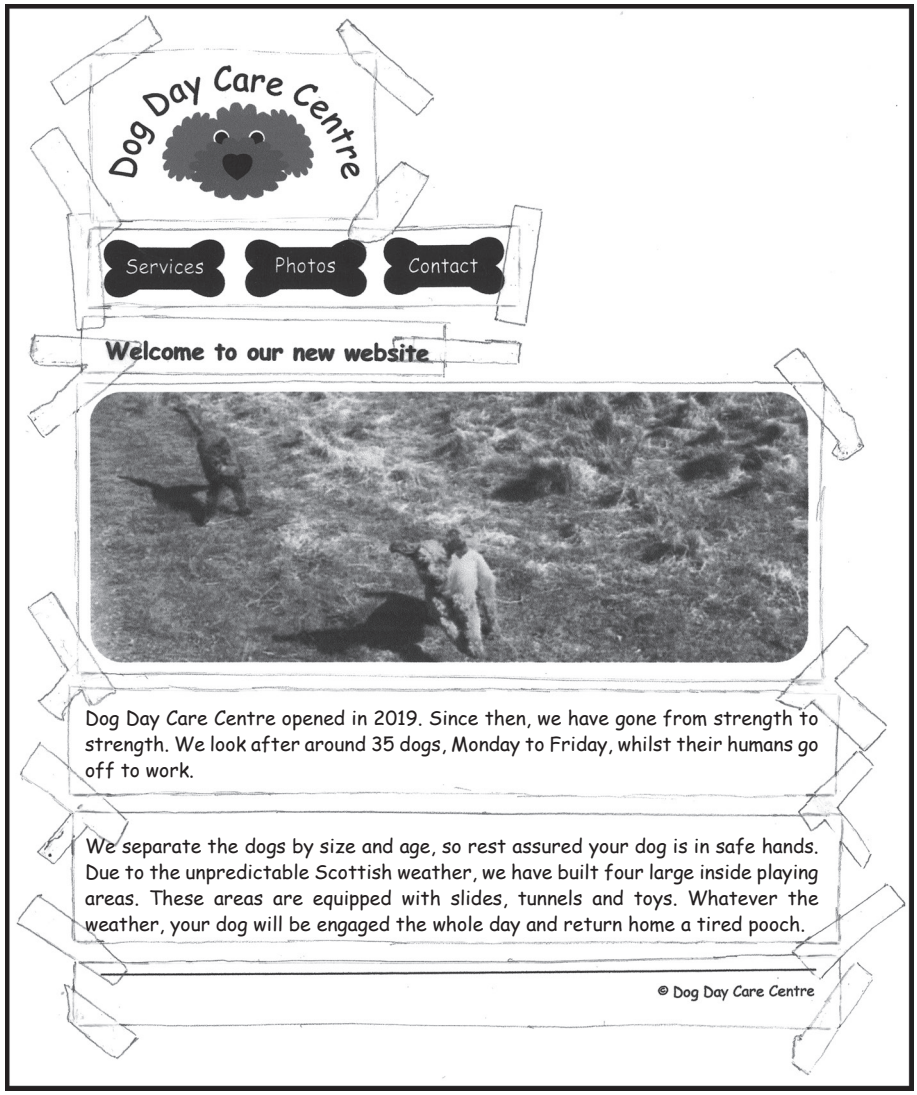
_____

Reason 2 _____

_____

[Turn over

18. Dog Day Care Centre requires a website to advertise their business.
The following design is developed.



(a) (i) Name this type of design. **1**

_____

(ii) State two reasons why this type of design is used as part of the design stage. **2**

Reason 1 _____

_____

Reason 2 _____

_____

18. (continued)

Code from the Dog Day Care Centre website is shown below.

HTML

```
<body id="wellbeingPage">

<h1>Services we offer</h1>

<div class="wellbeing">

<h2>Wellbeing</h2>
<p> Dog Day Care Centre can
look after the health and
wellbeing of your dog
</p>

</div>

…

…

<div> © Dog Day Care Centre
</div>

</body>
```

CSS

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

h1{
    font-family:Calibri;
    font-size:20px;
    color:black;
  }

h2{
    font-family:Calibri;
  }

.wellbeing{
    color:white;
    text-align:left;
  }

#wellbeingPage{
    color:blue;
    text-align:left;
  }
```

(b) (i) State the colour of the 'Wellbeing' heading when displayed in a browser. **1**

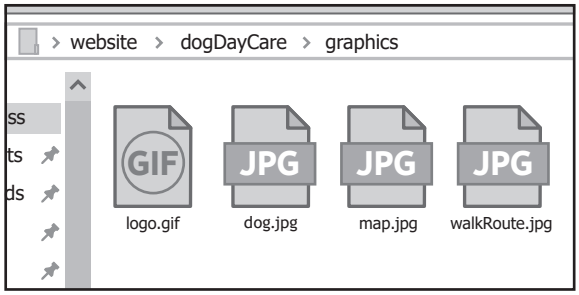
(ii) Additional CSS is required to style '© Dog Day Care Centre' at the bottom of the page.

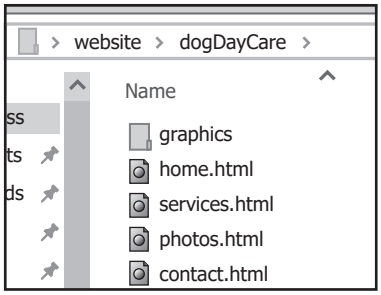
Write a single style rule that would display the copyright information right aligned and as 'Arial' font. **2**

[Turn over

18. (continued)

(c) All the images used on the website are stored in a folder called 'Graphics' in the following location.





Using this structure, complete the following code so that the graphic dog.jpg is displayed on the services.html page. **2**

```
<img src="_____"/>
```

18. (continued)

(d) The Dog Day Care Centre uploads an image of their dog of the week.

During testing, the dog of the week image causes the web page to load slowly because the file size is very large.

(i) The image has a 24-bit colour depth and does not support transparency.

State a file type used for this image. **1**

_____

(ii) Other than the colour depth, state one reason why this image has a large file size. **1**

_____

[Turn over

DO NOT WRITE IN THIS MARGIN

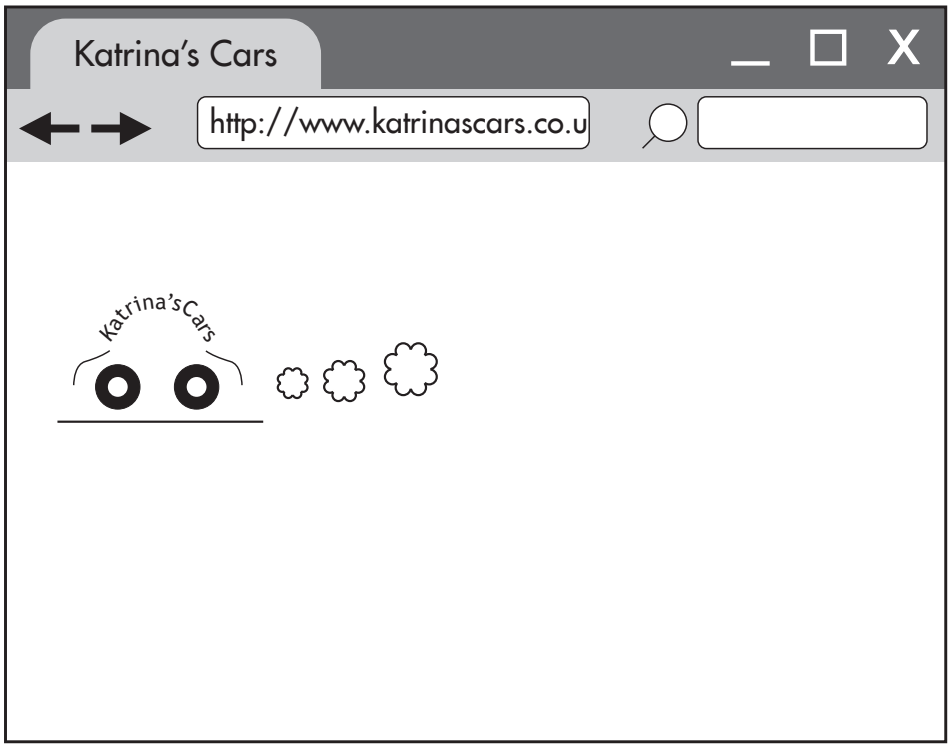
19. Katrina's Cars is a car auction website. The HTML and CSS code for the home page is shown below.

```
<html>

<head>
<title>Katrina's Cars</title>
<style>
h1{text-align:center;}
h2{text-align:right;}
#heading1{text-align:right;}
#heading2{text-align:left;}
</style>
</head>

<body>
<div>
<h1 id="heading1">Katrina's Cars</h1>

<img src="logo.jpg">
</div>

<div>
<h2 id="heading2">Top deals</h2>
<ul>
<li>Maxi Cupar</li>
<li>Mizdo CX-5</li>
<li>Oodi TT</li>
</ul>

</div>
</body>

</html>
```

19. (continued)

(a) (i) Draw how this web page will look when viewed in a browser.

Some of the content has already been added. **4**



(ii) The following CSS is added to the website so that the text of any additional car for auction is coloured red.

```
.newCar{color:red;}
```

Katrina's Cars asks for the following car to be added to the web page.

Morcodes GLS

Complete the missing line of code below to add the car. **2**

```
<ul>
<li>Maxi Cupar</li>
<li>Mizdo CX-5</li>
<li>Oodi TT</li>

_____

</ul>
```

19. (continued)

(b) The following HTML is to be added to the website.

```
<a href="carWeek.html">Car of the Week</a>
```

State the purpose of adding this HTML to the website. **1**

(c) The home page contains a logo that changes to an alternative image when the user hovers over it.

The web developers have used the onmouseover and onmouseout events.

State the language used to implement the above. **1**

(d) Katrina's Cars receives a letter claiming it is using a video that is identical to a video used by another website.

State which law may have been broken. **1**

(e) Katrina's Cars has requested an update to its website following customer feedback.

'We receive a lot of e-mails from our users asking us to cancel their bid on a car. This is taking up a lot of our time. Can you add a feature to do this?'

Explain why the above is an end-user requirement. **1**

[END OF SECTION 3]

[END OF QUESTION PAPER]

MARKS | DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS

MARKS | DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS