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N5

National Qualifications 2019

Mark

# X816/75/01 Computing Science

WEDNESDAY, 22 MAY
9:00 AM – 11:00 AM

*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 — 110**

**SECTION 1 — 25 marks**

Attempt ALL questions.

**SECTION 2 — 85 marks**

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.

## SECTION 1 — 25 marks

**Attempt ALL questions**

**1.** Convert the following 8-bit binary number into denary. **1**

1011 1001

**2.** Add HTML `body`, `h1` and `title` opening and closing elements to complete the code below. **3**

```
<html>
<head>
      <_____________>My first webpage<_____________>
</head>
<_____________>
      <_____________>Welcome to my site<_____________>
    <p>Here is the webpage that I have created.</p>
<_____________>
</html>
```

**3.** A bank requires a program for loan applications. The user will enter how much money they want to borrow and the number of monthly repayments. The user will then be informed how much they must repay each month.

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

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

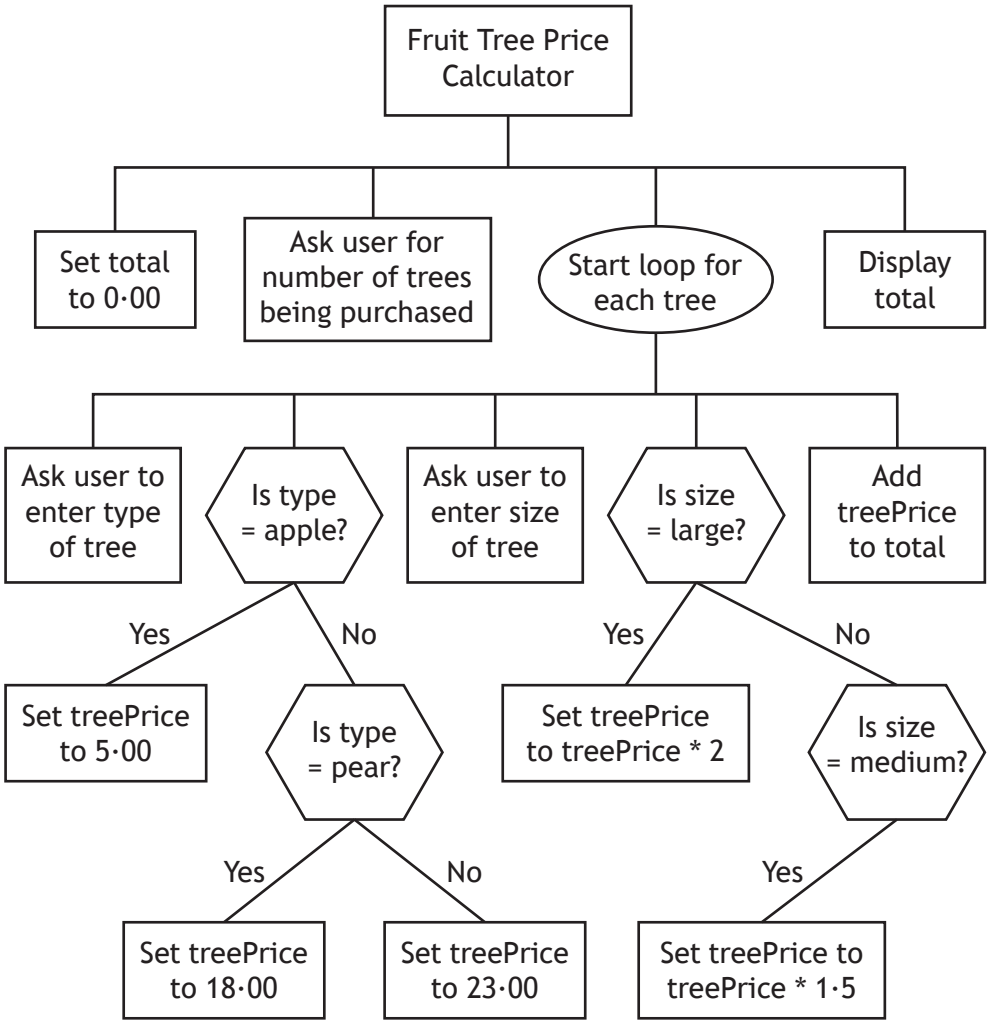
| **Product** | | | |
|---|---|---|---|
| **productCode** | **productName** | **manufacturer** | **description** |
| 366 | Picture Frame | Frame Design | Silver |
| 439 | Crystal Vase | Glass Gifts | 10cm |
| 316 | Glass Bowl | Glass Gifts | 20cm |
| 285 | Scented Candle | WaxWorks | Vanilla |
| 123 | Candle Holder | WaxWorks | Glass jar |
| 56 | Tea Lights | WaxWorks | Pack of 6 |
| 112 | Place Mats | Zingy Zebra | Pack of 5 |

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

```
SELECT productCode, productName, manufacturer, description

FROM Product

ORDER BY _____

_____
```

**5.** A garden centre requires a program to calculate the price of apple, pear and cherry trees being sold.

The design is shown below.




(a) State the type of loop shown in the design above. **1**

(b) The design is tested. For the following inputs state the total displayed. **1**

| **Inputs** | **Total displayed** |
|---|---|
| Number of trees – 2<br>Type of tree – cherry<br>Size of tree – small<br>Type of tree – pear<br>Size of tree – medium | |

**5. (continued)**

(c) The garden centre is considering selling orange trees for £23·00.
Explain why the design does not need to be changed. **1**

_____

_____

_____

**[Turn over**

**6.** An archaeology club wants a website to provide information about the club and how to join.

A screenshot of the completed home page is shown below.

# Archaeology Club

Welcome to the website for the Archaeology Club. Here you will find links to the different pages on the site as well as lots of information about different aspects of archaeology.

Areas of the site:

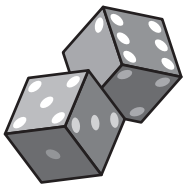
- Fossils
- Dino facts

The club is part of the British Archeological Society

Evaluate the website in terms of its fitness for purpose. **1**

**7.** Part of a program requires a user to input the total score achieved when they roll a pair of six-sided dice.

For example, if the user rolled a 4 and a 1 they would input 5.



(a) State the extreme values required to test this part of the program. **2**

Extreme 1 _____

Extreme 2 _____

(b) The code below shows part of the program.

```
…
FOR loop FROM 1 TO 100 DO
     RECEIVE diceScore FROM KEYBOARD
     SET total TO total + diceScore
END FOR
…
```

State the standard algorithm shown above. **1**

_____

**[Turn over**

**8.** Three records from a database table are shown below.

| **Book** | | | |
|---|---|---|---|
| **bookRef** | **title** | **author** | **publisher** |
| 0783567328120 | The Cat's Pyjamas | R J Petersen | Germiston |
| 0703487922417 | Grass Is Green | V R Singh | East Rand |
| 0724603125633 | Climb the Hill | R McGrath | Brown |

(a) State a suitable type of validation for the `bookRef` field. **1**

(b) Another book by V R Singh is to be added to the table.

The SQL statement below is used to insert this record.

```
INSERT INTO Book (bookRef, title, author, publisher)
VALUES ("0745198374564","V R Singh","I'll Do It
Yesterday","East Rand");
```

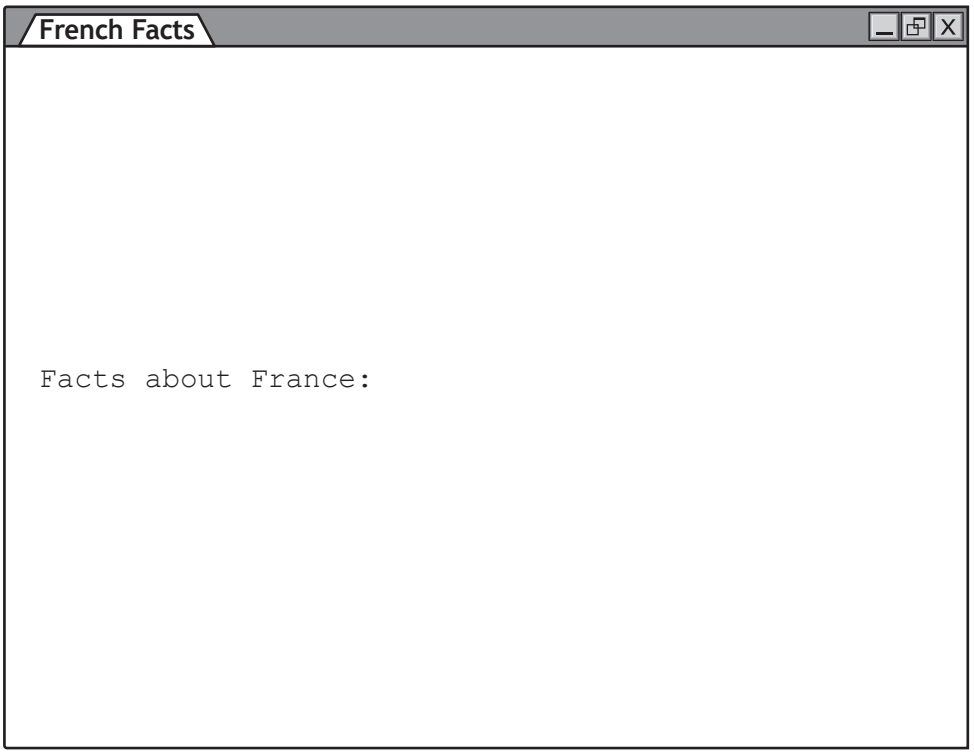
Explain why the SQL statement will not produce the intended result. **1**

**9.** The HTML code below is used to create a web page.

```
<html>
<head>
<title> French Facts </title>
<style>
h1 {text-align:right}
</style>
<head>

<body>
<h1> France </h1>
<p> Facts about France: </p>

<ul>
<li> Capital: Paris </li>
<li> Population: 67 m </li>
<li> Flag: tricolour </li>
</ul>

</body>
</html>
```

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

Some of the content has already been added. **2**



**10.** A database query design includes the following conditions in the search criteria.

```
delivery > 01/05/2019 AND delivery < 31/05/2019
```

(a) State the attribute type used above. **1**

(b) State the part of the processor where these conditions will be evaluated. **1**

**11.** The programming language below uses `&` to concatenate two strings.

```
SET message TO "hello" & "world"
```

When coding, a programmer types `£` instead of `&` leading to an error.
State the type of programming error and describe its effect. **2**

Type _____

Effect _____

**12.** The line below is stored as a vector graphic.



State one attribute of this object. **1**

**[Turn over for next question**

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**SECTION 2 — 85 marks**

**Attempt ALL questions**

**13.** A smart phone app is needed to calculate the cost of electricity. The following information will be entered by the user.

- Previous meter reading
- Current meter reading
- Unit cost
- Discount eligibility

A possible user interface for the app is shown below.

Electricity Cost Calculator

**Previous Meter Reading**

Units 1 3 8 2 3 • 5 7

**Current Meter Reading**

Units 1 5 0 0 7 • 1 1

Unit Cost 2 • 8 3 5 Pence

☐ **Check box if eligible for £5 discount**

**Electricity Cost**

15007·11 - 13823·57 = 1183·54 units used

1183·54 units at 2·835 pence per unit

= £33·553359

Final bill: £33·55

**13. (continued)**

(a) Describe two processes that will be carried out by the program. **2**

Process 1 _____

_____

Process 2 _____

_____

(b) The user interface design is implemented. It contains a bit-mapped graphic and some text.

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

_____

_____

(ii) State a standard code used to represent text characters and the number of bits used to store each character. **2**

Standard code _____

Number of bits _____

(c) State the data types that will be required to store the values of the following inputs. **2**

| | |
|---|---|
| The current meter reading | |
| Check box if eligible for £5 discount | |

**[Turn over**

**13. (continued)**

(d) The current meter reading of 15007·11 would be stored in a computer system using floating-point representation as shown below.

$$0{\cdot}1500711 \times 10^5$$

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

Mantissa _____

Exponent _____

(e) The program uses input validation.

```
...
Line 13  REPEAT
Line 14    RECEIVE currentReading FROM <the touch
           screen keyboard>
Line 15    IF currentReading < previousReading THEN
Line 16      SEND "Reading too low. Please re-enter"
             TO DISPLAY
Line 17    END IF
Line 18  _____________________________________
```

Using a programming language of your choice, complete Line 18.

Ensure that only acceptable values can be entered for the current meter reading. **2**

Line 18 _____

_____

**13. (continued)**

(f) Another part of the program is shown below.

```
...
Line 25   SET meterDifference TO currentReading -
          previousReading
Line 26   SET cost TO (meterDifference*unitCost)/100
...
```

Using a programming language of your choice, write the code to

- subtract £5 from the cost if the discount check box is selected
- display the calculated electricity cost to two decimal places. **4**

**14.** A youth club plans to create a database to store details of club members.

(a) The youth club leaders have been discussing the requirements of the new database.


Use the information above to identify two functional requirements. **2**

Requirement 1 _____

_____

Requirement 2 _____

_____

**14. (continued)**

(b) The youth club currently records information on paper documents.

Examples are shown below.

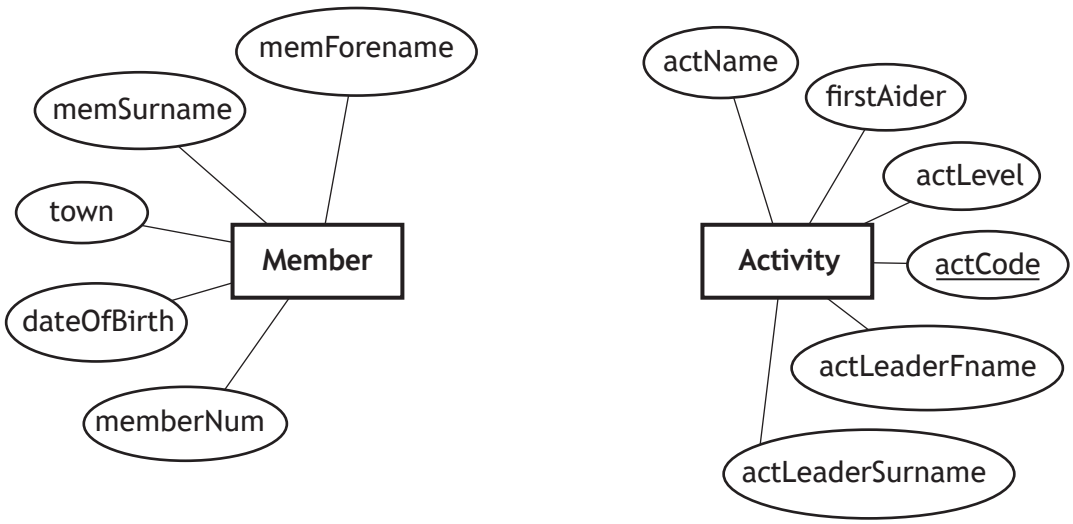
| Club Membership Card | |
|---|---|
| Member Forename: | *Saliha* |
| Member Surname: | *Shad* |
| Membership Number: | *43* |
| Town: | *Corkerhill* |
| Date of Birth: | *18/03/2006* |
| Activity Code: | *426* |

| Activity Card | |
|---|---|
| Activity Name: | *Craft* |
| Activity Code: | *426* |
| Activity Level: | Beginner (Intermediate) Advanced |
| Activity Leader First Name: | *Jack* |
| Activity Leader Surname: | *Jones* |
| First Aider: | ☑ Yes ☐ No |

Each activity can have a maximum of 10 club members. Each club member can register for only one activity.

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

- drawing any missing attributes
- drawing the relationship between the entities
- naming the relationship between the entities
- identifying any additional key attributes. **4**




**[Turn over**

**14. (continued)**

(c) State and describe a type of validation that could be applied to the `actLevel` attribute. **2**

Type of validation _____

Description _____

_____

_____

(d) State two implications of the General Data Protection Regulation (GDPR) for the youth club. **2**

Implication 1 _____

_____

_____

Implication 2 _____

_____

_____

**15.** Chill Zone is an online electrical retailer. Fridge freezers need to be added to its current website.

(a) Analysis was carried out to identify the requirements for the fridge freezer pages.

Part of the analysis report is shown below.

> Each new page of the site should focus on a specific fridge freezer. Each page should also allow a user to view pictures, read reviews and view the technical specifications of each fridge freezer. The page should also include a video showing the item in use.

Using the information from the analysis report above, identify two end-user requirements of the fridge freezer pages. **2**

Requirement 1 _____

_____

Requirement 2 _____

_____

(b) All the images that Chill Zone wants to use are on the fridge freezer manufacturers' websites.

(i) Describe what Chill Zone must do to avoid prosecution under the Copyright, Designs and Patents Act when using these images. **1**

_____

_____

**[Turn over**

**15. (b) (continued)**

(ii) Chill Zone must select one of the fridge freezer images below. Each image has the same resolution.

| Image A | Image B |
|---|---|
|  |  |
| starFrostFree.jpg<br>800 × 400 | starFrostFree.gif<br>800 × 400 |

State one advantage of each image compared to the other. **2**

Image A advantage _____

_____

Image B advantage _____

_____

**15. (continued)**

(c) Some of the HTML code used to create one of the pages on Chill Zone's website is shown below.

```
<html>
<head>
<title> Star Frost Free </title>
<link rel = "stylesheet" type="text/css"
   href="ChillStyle.css">
</head>

<body>
<h1> Star Frost Free </h1>
<h2> Images </h2>
<p>View pictures of the new Star Frost Free </p>
<img src="starFrostFreeOpen.jpg"
   onmouseover="this.src='starFrostFreeClosed.jpg'">

<h2> Reviews </h2>
<p class = "review"> A great fridge! </p>
<p class = "review"> Perfect size for our kitchen
</p>
…

…
<p>Go to <a href="home.html">Home Page</a> </p>
</body>
</html>
```

(i) When viewed in a browser the fridge freezer can be displayed as either an image showing the door open or an image showing the door closed.

Identify the JavaScript event used to implement this feature. **1**

_____

**[Turn over**

**15. (c) (continued)**

(ii) The code below is added.

Describe two purposes of this code. **2**

```
<video width = "500" height = "250" controls>
<source src="starFrostFree.mp4" type="video/mp4">
</video>
```

(iii) Explain why the line of code below is included in every page of the website. **1**

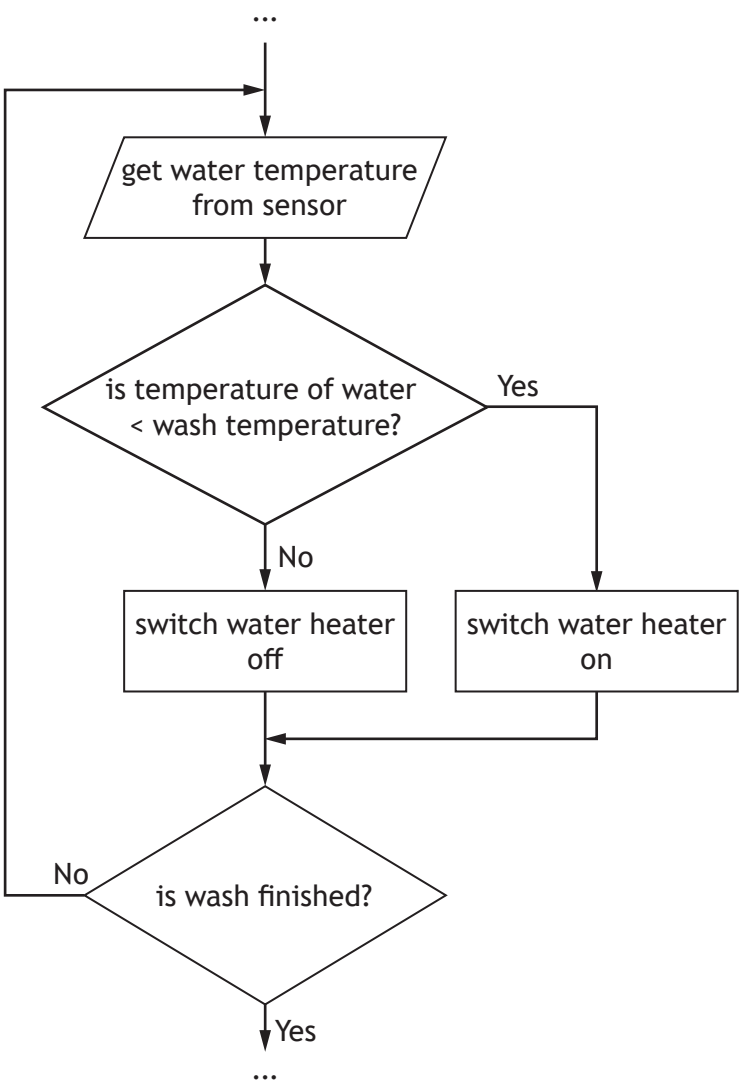
```
<link rel = "stylesheet" type="text/css"
   href="ChillStyle.css">
```

(d) State one security precaution that Chill Zone should take to protect its customers' payment details when buying online. **1**

**16.** A program to control the water temperature inside a washing machine is being designed. The user will select a wash temperature using the control panel on the machine.

The program should ensure that the water stays heated at the correct temperature throughout the wash.

The design for the part of the program that maintains the water temperature is shown below.




(a) State the design technique that has been used to design the solution. **1**

_____

**[Turn over**

**16. (continued)**

(b) To implement the program several programming constructs will be required.

(i) State the condition used in the loop construct. **1**

_____

(ii) State one other construct that has been used in the design and describe how that construct has been used. **2**

Construct _____

Description _____

_____

_____

(c) When the wash is finished, the water will drain out. A sensor continuously detects the amount of water in the machine during the draining process. When there is no more water in the machine the door will automatically open.

Using a design technique of your choice, design a solution to this problem. **3**

**16. (continued)**

(d) When the program is implemented, the water temperature will be stored in the memory of the washing machine's built-in computer.

(i) State the bus used to transfer the stored water temperature to the processor. **1**

(ii) Explain how a computer system organises data in memory so that it can be retrieved. **2**

(e) The finished program was compiled before it was stored in the washing machine's memory.

Explain why this program was compiled. **1**

**[Turn over**

**17.** A company uses a relational database to store details of job vacancies for current employees. Each employee can apply for only one vacancy.

The tables below show current job vacancies and employees.

| **Vacancy** | | | |
|---|---|---|---|
| **jobRef** | **jobTitle** | **department** | **startDate** |
| HR22 | Clerk | HR | 04/06/2019 |
| PD18 | Manager | Production | |
| AD36 | Administrator | Admin | 30/06/2019 |
| FN42 | Finance Officer | Finance | |
| PD20 | Sales Manager | Production | 10/07/2019 |

| **Employee** | | | | | | |
|---|---|---|---|---|---|---|
| **appRef** | **jobRef** | **initial** | **surname** | **payGrade** | **drivingLicence** | **cvAttached** |
| 325 | HR22 | C P | Martin | 2 | ☑ | ☑ |
| 326 | PD18 | G L | Wood | 1 | ☑ | ☑ |
| 327 | HR22 | H | Patel | 3 | ☐ | ☑ |
| 328 | HR22 | B F | Lee | 3 | ☑ | ☐ |
| 329 | AD36 | M | Aliyev | 3 | ☐ | ☑ |
| 330 | PD18 | L M | Nowak | 2 | ☐ | ☑ |
| 331 | HR22 | S | Patel | 1 | ☑ | ☑ |

(a) The start date for two jobs in the Vacancy table has not been entered.

Describe what should be done to ensure that `startDate` is not left blank. **1**

(b) Design a query to display the job title and names of employees at pay grade 2 who have applied for any job in the Production department. **4**

| | |
|---|---|
| Field(s) | |
| Table(s) | |
| Search criteria | |

**17. (continued)**

(c) The pay grade for H Patel should be pay grade 2 and not pay grade 3. The SQL statement below is written to make the change.

```
UPDATE Employee
SET payGrade = 3
WHERE surname = "Patel";
```

(i) Give two reasons why this SQL statement is not fit for purpose. **2**

Reason 1 _____

_____

Reason 2 _____

_____

(ii) Re-write the SQL statement to make it fit for purpose. **2**

**[Turn over**

(d) The updated tables below show current job vacancies and employees.

| Vacancy | | | |
|---|---|---|---|
| **jobRef** | **jobTitle** | **department** | **startDate** |
| HR22 | Clerk | HR | 04/06/2019 |
| PD18 | Manager | Production | 28/06/2019 |
| AD36 | Administrator | Admin | 30/06/2019 |
| FN42 | Finance Officer | Finance | 04/07/2019 |
| PD20 | Sales Manager | Production | 10/07/2019 |

| Employee | | | | | | |
|---|---|---|---|---|---|---|
| **appRef** | **jobRef** | **initial** | **surname** | **payGrade** | **drivingLicence** | **cvAttached** |
| 325 | HR22 | C P | Martin | 2 | ☑ | ☑ |
| 326 | PD18 | G L | Wood | 1 | ☑ | ☑ |
| 327 | HR22 | H | Patel | 2 | ☐ | ☑ |
| 328 | HR22 | B F | Lee | 3 | ☑ | ☐ |
| 329 | AD36 | M | Aliyev | 3 | ☐ | ☑ |
| 330 | PD18 | L M | Nowak | 2 | ☐ | ☑ |
| 331 | HR22 | S | Patel | 1 | ☑ | ☑ |

The following SQL statement is implemented in the database.

```
SELECT jobTitle, appRef
FROM Vacancy, Employee
WHERE Vacancy.jobRef=Employee.jobRef AND drivingLicence=False
ORDER BY jobTitle DESC;
```

(i) Write the expected output from the SQL statement. **5**

(ii) Describe how this expected output could be used to check that the SQL statement works correctly. **1**

**18.** The Giants basketball team has a website.

(a) The website contains the following four pages.

- Home page
- Information about the club
- Upcoming fixtures
- How to contact the club

All the pages on the site include a link back to the home page. The page with fixture information also contains an external hyperlink to the Scottish Basketball League.

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

**18. (continued)**

(b) The upcoming fixtures for July are shown on the webpage below.

Giants - Fixtures

## Upcoming Fixtures in July

**Giants**

Opponent - Date - Venue

Panthers - 1st July - Home

Stags - 8th July - Away

Bears - 15th July - Away

Vipers - 22nd July - Home

Buffalos - 29th July - Away

Home

Scottish Basketball League

The text 'Opponent – Date – Venue' is styled using the following rule.

```
#fixtures   {font-size:14px;
            background-color:white;
            text-align:left;
            color:navy}
```

(i) State the type of selector used in the above style. **1**

**18. (b) (continued)**

(ii) Each away game should have a red background with yellow text.

Write a single style rule that could be used to style all of the away games. **3**

(c) During testing it was found that the external hyperlink shown below did not navigate to the Scottish Basketball League website.

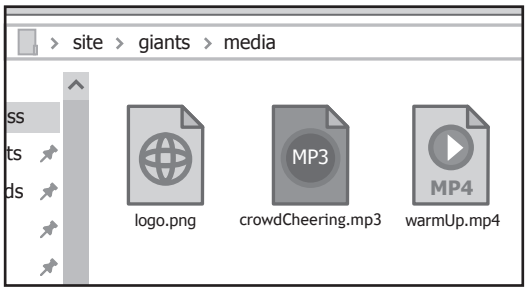
```
<a href="ScottishBasketballLeague.html">Scottish
Basketball League </a>
```

Describe the problem with the addressing that has been highlighted by this testing. **1**

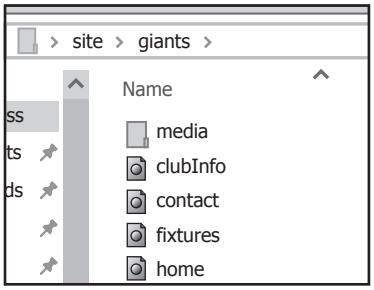
**[Turn over**

**18. (continued)**

(d) All the video, audio and images used on the Giants website are stored in a folder called 'media' in the following location.




Each page on the site displays an image of the Giants logo in the same position.




(i) Identify the graphic file format used to store the image. **1**

_____

(ii) Write the code that would be needed to display this image on the club information page. **2**

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

**[Turn over for next question**

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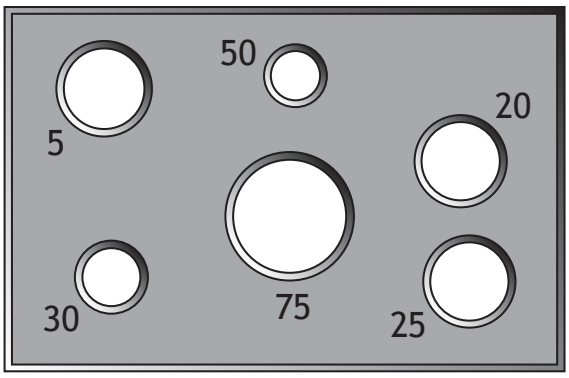
**19.** A fairground game involves throwing balls through holes in a large wooden board. Each hole scores different points.

The game is played using the following four rules.




1. A player starts with 3 balls and throws them one at a time.
2. If a ball is successfully thrown through a hole the points are added onto the player's score.
3. The game ends immediately if a player's score is greater than or equal to 50.
4. If the score reaches exactly 50 points the player is told they have won a prize.

A program is written to keep the score for a player.

```
...
Line 3    DECLARE total INITIALLY 0
Line 4    DECLARE balls INITIALLY 3
Line 5    WHILE total < 50 AND balls > 0 DO
Line 6       RECEIVE ballScoreOne FROM KEYBOARD
Line 7       SET total TO total + ballScoreOne
Line 8       SET balls TO balls - 1
Line 9       RECEIVE ballScoreTwo FROM KEYBOARD
Line 10      SET total TO total + ballScoreTwo
Line 11      SET balls TO balls - 1
Line 12      RECEIVE ballScoreThree FROM KEYBOARD
Line 13      SET total TO total + ballScoreThree
Line 14      SET balls TO balls - 1
Line 15   END WHILE
Line 16   SEND "Well done! You have won a prize." TO DISPLAY
```

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

_____

(b) The program runs but does not meet the functional requirements stated in the rules.

(i) State the type of error that has occurred. **1**

_____

**19. (b) (continued)**

(ii) The program has been edited as shown, but still breaks rule 3 and rule 4 of the game.

```
...
Line 3    DECLARE total INITIALLY 0
Line 4    DECLARE balls INITIALLY 3
Line 5    WHILE total < 50 AND balls > 0 DO
Line 6       RECEIVE ballScore FROM KEYBOARD
Line 7       SET total TO total + ballScore
Line 8       SET balls TO balls - 1
Line 9    END WHILE
Line 10   SEND "Well done! You have won a prize." TO
          DISPLAY
```

Using a design technique of your choice, design a solution that meets the requirements of all four game rules. **4**

**19. (continued)**

(c) A single ball can achieve a variety of different possible scores.

Two versions of input validation were coded and tested to check that only valid scores are entered.

**Version A**

```
...
Line 6    RECEIVE ballScore FROM KEYBOARD
Line 7    WHILE ballScore < 0 OR ballScore > 75 DO
Line 8       RECEIVE ballScore FROM KEYBOARD
Line 9    END WHILE
```

**Version B**

```
Line 1    DECLARE possScore INITIALLY
          [0,5,20,25,30,50,75]
...
Line 6    DECLARE found AS BOOLEAN INITIALLY false
Line 7    REPEAT
Line 8       RECEIVE ballScore FROM KEYBOARD
Line 9       FOR check FROM 0 TO length(possScore)-1 DO
Line 10         IF possScore[check] = ballScore THEN
Line 11            SET found TO true
Line 12         END IF
Line 13      END FOR
Line 14   UNTIL found
```

(i) Explain why it would not be appropriate to use the input validation shown in Version A. **1**

_____

_____

_____

(ii) Name the data structure used in line 1 of Version B and state the data type that it is used to store. **2**

Name of data structure _____

Data type stored _____

**19. (c) (continued)**

(iii) Describe how the `found` variable is used in Version B. **2**

[END OF QUESTION PAPER]

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## ADDITIONAL SPACE FOR ANSWERS

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## ADDITIONAL SPACE FOR ANSWERS

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| Question 6 | XEG/shutterstock.com |
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