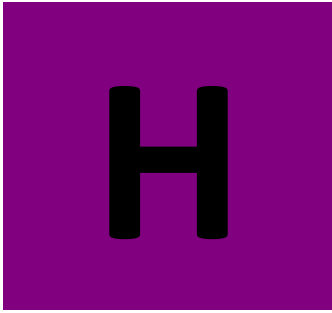




National
Qualifications

Mark

2022/2023

Computing Science

Duration — 2 hours

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forenames(s)

Surname

Number of seat

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

Read all questions carefully before attempting.

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

Use **black** or **blue** ink. Show all workings.

SECTION 1 – SOFTWARE DESIGN AND DEVELOPMENT AND COMPUTER SYSTEMS - 55 marks

Attempt ALL questions

Marks

DO NOT
WRITE
IN THIS
MARGIN

1. Convert the denary number -39 to its 8-bit two's complement representation.

1

--

2. State the name of the software development methodology that follows a strict plan, measured against a timescale set at the beginning of the project.

1

3. Encryption is used to secure transmission of data.

- (a) Explain the relationship between a public key and a private key.

1

- (b) State one method of distributing public keys.

1

4. Machine code instructions are fetched from memory and executed by the processor.

Complete the missing steps of the fetch-execute cycle in the table below stating the computer bus used at each stage.

3

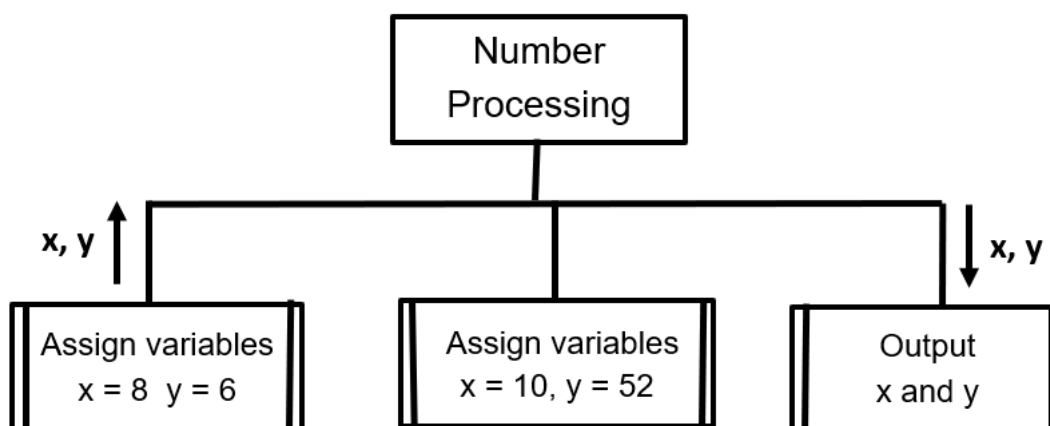
Step 1	
Step 2	
Step 3	
Step 4	Instruction is decoded and executed.

Marks

DO NOT
WRITE
IN THIS
MARGIN

5.

A program design is drawn that consists of three steps as shown below.



State the expected output.

	x	y
Output		

2

6. Describe how increasing the number of processor cores affects system performance.

2

7. Peter has deliberately introduced a computer virus into his workplace network.

(a) State the name of the law that Peter has broken.

1

(b) Describe another criminal offence under this law.

1

[Please turn over

Marks

DO NOT
WRITE
IN THIS
MARGIN

8. The rating system for hotels uses stars to assess the accommodation. The lowest rating is one star and the highest is five stars.

A program is required to read hotel data from a text file. This file contains the names of 50 Scottish hotels, their location and star rating, and if the hotel is pet friendly or not.

Each line of the data file stores the name, location, rating (1 to 5) and pet (yes or no) for a single hotel, as shown below:

Campbell Law, Edinburgh, 2, no

When run, the program should also:

- display the name(s) of the hotel(s) with the highest-stored star rating
- write the name of the highest rated pet-friendly hotel(s) to a file

- (a) Using the problem description, identify the functional requirements of the program.

3

Inputs:

Processes:

Outputs:

8. continued

Marks

DO NOT
WRITE
IN THIS
MARGIN

- (b) The top-level design for the program is shown below. Complete the design to show the missing data flow in and out of each subprogram.

3

Top-level design		
1. Read in hotel data from file into an array of records	IN	
	OUT	hotelData(name, location, rating, pets)
2. Display the names of the hotels with the highest stored rating	IN	
	OUT	max_rating
3. Write the name of the highest rated pet-friendly hotel(s) to a file	IN	
	OUT	

- (c) State the name of the programming technique that allows the values of local variables within a main program to be accessed, updated and used within multiple sub-programs without the need to create or use global variables.

1

[Please turn over

8. *continued*

Marks

DO NOT
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IN THIS
MARGIN

(d) The program is designed to use an array of records.

- (i) Using a programming language of your choice, define a suitable record structure for the hotel data.

2

RECORD oneHotel IS

- (ii) Using a programming language of your choice, declare a variable called `hotelData` that can store the data for the 50 hotels. Your answer should use the record structure created in part (i).

2

(e) When refined, the first three lines of Step 2 are as follows:

2.1 Call a function to return the maximum rating
stored

2.2 SEND `max_rating` to Display

2.2 Loop for each hotel in `hotelData`

... .

... .

- (i) Explain why a function is a suitable type of subprogram for 2.1.

1

8. continued

Marks

DO NOT
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IN THIS
MARGIN

- (f) State two reasons why the modularity of this program will make it easier to maintain.

2

1. _____

2. _____

9.



Image 1



Image 2

Each image above has been stored as both a bitmapped and a vector image, and image 2 was created by editing image 1.

Explain the difference between the file sizes of image 1 and the corresponding image 2 in each format.

2

	Bitmapped	Vector
Explanation of the difference in file size between image 1 and image 2		

10. A program is to be developed to generate sports race numbers for a group of 25 pupils. The program will ask the user to enter the first name, surname and age of each pupil. The age entered must be between 12 and 18. The program should output each of the pupil names with their unique sports race number.

2

State two possible boundaries of this program.

1. _____

2. _____

Marks

DO NOT
WRITE
IN THIS
MARGIN

11. A set of grades achieved by 13 pupils in a recent computing science test is stored in an array and a function is used to count the number of pupils that achieved a particular grade. The possible grades awarded for the test range from 'E' to 'A'.

```

LINE 1 FUNCTION countGrades (ARRAY OF STRING results,
                                STRING grade) RETURNS INTEGER
LINE 2     SET count TO 0
LINE 3     FOR EACH value FROM results DO
LINE 4         IF value = grade THEN
LINE 5             SET count TO count + 1
LINE 6         END IF
LINE 7     END FOR
LINE 8     RETURN count
LINE 9     END FUNCTION
...
LINE 10 <Main Program>
LINE 11 SET grades TO ['C', 'B', 'A', 'B', 'B', 'C', 'D', 'A', 'A']
LINE 12 RECEIVE gradeToCount FROM KEYBOARD (STRING)
LINE 13 SET number TO countGrades (grades, gradeToCount)

```

- (a) Identify an actual parameter in the above code. 1
- _____
- (b) Identify a formal parameter in the above code. 1
- _____
- (c) State the scope of the variable `count` and justify your choice of scope. 2
- Scope: _____
- Justification: _____
- _____
- _____
- (d) Describe how a watchpoint could be used to test that the number of A grades are counted correctly. 2
- _____
- _____
- _____

[Please turn over

11. *continued*

Marks

DO NOT
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IN THIS
MARGIN

- (e) Explain how the code given on the previous page can be made more robust.

2

12. Details about a set of seven electric cars are stored in four parallel arrays. The kWh figure indicates the energy that the battery can store. The range and top speed stored is in miles and miles per hour.

name()

Koa EV3 GT	Alexi e1	SDA i4 eDrive50	Bonita IQ 5	Alsat Model 3	Odak Eng iV 90	Mord Stem
------------	----------	-----------------	-------------	---------------	----------------	-----------

kWh()

72.5	28.5	80.7	70	57.3	77	37
------	------	------	----	------	----	----

range()

225	105	290	235	235	260	140
-----	-----	-----	-----	-----	-----	-----

topSpeed()

162	90	118	115	140	99	89
-----	----	-----	-----	-----	----	----

The names of the cars that have a maximum speed greater than 95 miles/hour that have a range between 250 and 300 miles should be output.

- (a) State the name of a standard algorithm needed to produce this output.

1

- (b) Using a programming language of your choice, write the necessary code.

5

12. *continued*

Marks

DO NOT
WRITE
IN THIS
MARGIN

- (c) Electric cars do not emit the same pollutants as petrol or diesel cars.

State the name of an environmentally-friendly car management system and describe how it can help petrol or diesel cars reduce their environmental impact.

2

Name of management system:

Description:

[END OF SECTION 1]

[Please turn over

SECTION 2 – DATABASES DESIGN AND DEVELOPMENT - 25 marks

Attempt ALL questions

Marks

DO NOT
WRITE
IN THIS
MARGIN

13. A database for a dental surgery is being developed. An end-user group of this database is the reception staff at the surgery and one of the requirements of this group is to search for the names of the patients who are scheduled for an appointment on a specified date. A query is created to perform this search, but an error is encountered during the testing of the query.

- (a) State one thing that may need to be checked to resolve this problem.

1

- (b) Describe another possible requirement of the reception staff from the database.

1

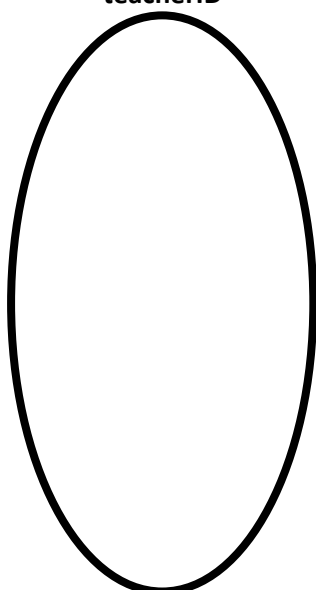
14. The following entity represents some data about a group of language teachers. It indicates which teacher teaches which language courses and which courses are taught by which teacher.

Complete the matching entity-occurrence diagram below.

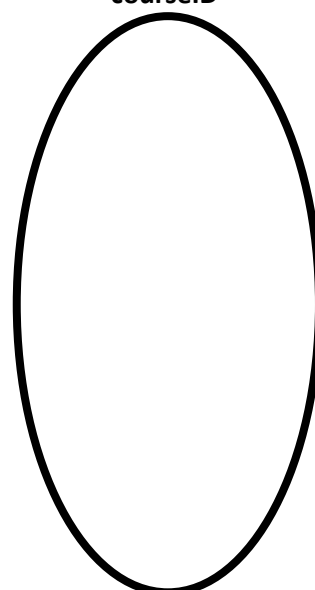
teacherID	courseID
610483	FREN1
610571	SPAN2
610211	FREN1
610483	GERM2
610523	GERM2
610211	GERM1
610918	SPAN1
610918	FREN1

2

teacherID



courseID



Marks

DO NOT
WRITE
IN THIS
MARGIN

15. A database entity is shown below.

Entity: Stock				
category	itemID	itemName	amount	unitPrice
Dairy	56	Greek yoghurt	34	2.99
Dairy	18	Lurpak butter	21	2.79
Bakery	50	Jam doughnut	12	0.99
Bakery	92	Blueberry muffin	25	1.05
Dairy	65	Clotted cream	8	3.50
Bakery	5	Apple turnover	30	1.20
Dairy	60	Mango Keifir	7	2.85

Complete the table below showing the output from the following SQL statement:

```
SELECT category, MIN(unitPrice) AS [Cheapest item]
FROM Stock
GROUP BY category;
```

2

Category	

16. State one criteria that can be used to evaluate the output from an SQL query.

1

[Please turn over

Marks

DO NOT
WRITE
IN THIS
MARGIN

17. A relational database has been created to store the details of this session's inter-school under-14 football league. The School, Team, Player and Match details are stored in four separate entities. Some schools have entered more than one team but a player can play for only one team. Each match has a designated organiser who will update the database, if and when required.

Entity: School	Entity: Team	Entity: Player	Entity: Match
<u>schoolID</u> schoolName postcode contactName contactEmail contactTel	<u>teamID</u> teamName schoolID * matchID *	<u>playerID</u> teamID * position firstName surname	<u>matchID</u> venue postcode date startTime name email

An extract from each table is shown below.

School

<i>SchoolID</i>	<i>schoolName</i>	<i>postcode</i>	<i>contactName</i>	<i>contactEmail</i>	<i>contactTel</i>
A210	Logan High	KY12 7QT	Tim Murphy	loganenquiries:@fife.gov.uk	07752 34512:
T366	Firpark Campus	KY5 6KS	Sue Brigg	firparkenquiries:@fife.gov.uk	07662 34128:
C22	Bell Academy	KY9 5AS	John Browne	bellenquiries:@fife.gov.uk	0723 186200
A210	Logan High	KY12 7QT	Tim Murphy	loganenquiries:@fife.gov.uk	07752 34512:

Team

<i>teamID</i>	<i>teamName</i>	<i>schoolID</i>	<i>matchID</i>
561	Top Shots	T366	F101
122	Cupar High A	X407	F423
237	Logan Flyers A	A210	F223
267	Logan Flyers B	A210	F925
351	The Bells	C22	F755

<i>playerID</i>	<i>teamID</i>	<i>position</i>	<i>firstName</i>	<i>surname</i>
2314	237	7	James	O Neill
3288	267	2	Emma	Henderson
1009	561	1	Gregory	Edwards

Player

Match

<i>matchID</i>	<i>venue</i>	<i>postcode</i>	<i>date</i>	<i>startTime</i>	<i>name</i>	<i>email</i>
CM003	George V Park	KY14 7QX	12/09/2023	10:00	Ray Keanie	frankk@gmail.com
CM267	Firpark Campus	KY5 6KS	12/09/2023	10:00	Paula Knight	knighty@outlook.com
CM345	Braid Green	KY1 7PU	28/10/2023	15:00	Pat Burke	pbur@hotmail.co.uk

- (a) Complete the following line of the data dictionary for this database:

3

Entity	Attribute	Key (PK/FK)	Data Type	Validation	Sample Data
Team	schoolID		Text		A210

17. continued

Marks

DO NOT
WRITE
IN THIS
MARGIN

- (b) Use the information on the previous page to complete a matching entity relationship diagram. You do not have to show the individual attributes.

4



- (c) A number of queries on the database are to be generated using SQL statements. These queries will be designed in advance.

- (i) Design a query that will display a list of the full names of all the goalkeepers (position 1) stored in the databases together with their team name and the name of their school. For example, a line from the output would be:

Gregory Edwards Top Shots Firpark Campus

3

Field(s)/Attribute(s) and calculations(s)	
Table(s)/Entity(ies)	
Search criteria	
Grouping	
Sort	

[Please turn over

17. continued

Marks

DO NOT
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IN THIS
MARGIN

- (c) (ii) Complete the query design below that uses an aggregate function and a readable heading to display the total number of matches that are scheduled for the month of October.

3

Field(s)/Attribute(s) and calculations(s)	
Table(s)/Entity(ies)	Match
Search criteria	
Grouping	
Sort	

- (d) The match organiser for the match at George V Park on 12 September at 10:00 has been entered incorrectly. It should be Frank Keanie and not Ray Keanie as indicated. The following query is written to correct the error:

```
UPDATE Match
SET name = 'Frank Keanie'
WHERE date = '12/9/2023' AND startTime = '10:00';
```

The output is not as expected.

Re-write the last part of the SQL statement to give the correct output.

1

17. *continued*

Marks

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MARGIN

- (e) The names of the teams that are playing of the first day of the scheduled matches are required. Two queries are used to achieve the correct output.

The results of Query 1 are used in Query 2.

Complete the SQL statements to produce the correct output.

Query 1: Find first date

```
SELECT _____ AS
[Earliest Date]
FROM Match;
```

1

Query 2: Display the team names that are playing in the first date

3

```
SELECT teamName
FROM
WHERE
```

[END OF SECTION 2]

[Please turn over

SECTION 3 – WEB DESIGN AND DEVELOPMENT - 25 marks

Attempt ALL questions

Marks

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MARGIN

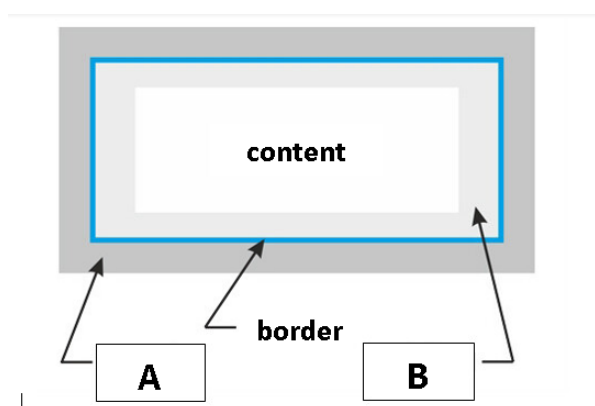
18. Describe one way that compatibility testing on a website can be conducted.

1

19. State the name of the two property labels of the CSS box model missing from the diagram.

A _____ is the area outside the border.

B _____ is the area around the content.



2

20. As part of the design process, the developers of the website create a low-fidelity prototype.

Describe two purposes of a low-fidelity prototype.

2

1. _____

2. _____

Marks

DO NOT
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IN THIS
MARGIN

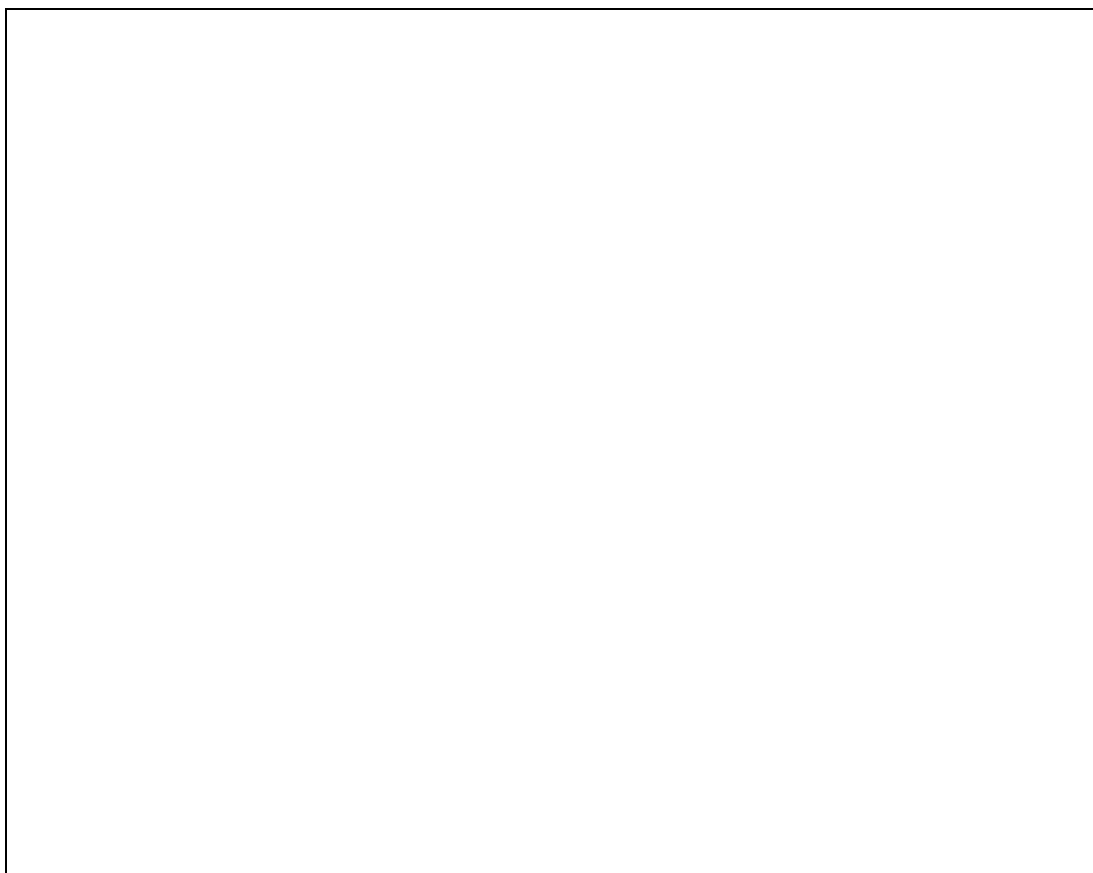
21. The Scottish Laughter Society have commissioned a Jokes website. A horizontal navigation bar will be used with links to four pages: computers, animals, sports and voting. The website displays two chosen jokes of the week in three different categories (computers, animals, sports). On the voting page there is a form for users to vote for their favourite joke of the week from the website. The voting page also has a link to a sub-page which lists the top-voted jokes from previous weeks. There is a link to the laughter society website (scotlandlaughter.org.uk) from the home page.

The structure of the website should include the following:

- a home page
- a computer page
- an animal page
- a sport page
- a voting page
- any subpages
- external links
- and the navigation bar

- (a) Draw a multi-level structure design for the Jokes website.

4



[Please turn over

21. continued

Marks

DO NOT
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MARGIN

- (b) When styling is applied to the Computer page, the top of the page is displayed in a browser as:



The expected output is:



The styles.css code is shown below:

```
Line 1 {margin:0;padding:0}

Line 2 /* Background Colours */
Line 3 header, footer {background-color:palegreen}
Line 4 nav {background-color:orange}
Line 5 main {background-color:white}

Line 6 /* Margins */
Line 7 header, nav, main, footer {margin-left:5px; margin-top:10px}
Line 8 body {margin:auto}
Line 9 h2, p {margin-bottom:25px}

Line 10 /* Padding */
Line 11 main {padding:5px}
Line 12 header {padding:10px}
Line 13 footer {padding:10px}

Line 14 /* Text Properties */
Line 15 h1 {font-size:60px;color:black}
Line 16 h2 {font-size:40px;color:black}
Line 17 p {font-size: 20px}

Line 18 a {color:blue}

Line 19 /* Sizes */
Line 20 .imageBanner {float:centre;width:300px;height:120px}
Line 21 header {height:120px}
Line 22 nav {height:50px}
Line 23 footer {height:60px}

Line 24 /* Navigation List Properties */
Line 25 nav ul {list-style-type:none}
Line 26 nav ul li {float:left;width:140px;margin-left:10px;text-align:left}
Line 27 nav ul li a {display:block;padding:15px;color:black;background-
Line 28 nav ul li a:hover {background-color:cyan;color:darkblue}
```

21. continued

- | | | DO NOT
WRITE
IN THIS
MARGIN |
|---------|--|--------------------------------------|
| | Marks | |
| (b) (i) | Identify the line in styles.css that needs to be amended to give the expected output. Re-write to make this amendment. | 2 |
| | Line number: _____ | |
| | Re-written code: _____ | |
| | _____ | |
| (ii) | State the line numbers where grouping selectors have been used. _____ | 1 |
| (iii) | Describe one advantage of using grouping selectors. _____ | 1 |
| | _____ | |
| | _____ | |
| (iv) | State a line number where a descendent selector has been used. _____ | 1 |
| (v) | Explain clearly how the styling applied using the following lines could be tested: | 2 |
| | Line 25: _____ | |
| | _____ | |
| | _____ | |
| | Line 28: _____ | |
| | _____ | |
| | _____ | |

[Please turn over

21. continued

Marks

DO NOT
WRITE
IN THIS
MARGIN

(c) The HTML code for the computer jokes page is shown below.

```
<html>
<head>
<title>Book Club</title>
  <link rel="stylesheet" type="text/css" href="styles.css">
</head>
<body>
<header>
  <h1>Computer Jokes Page</h1>
  
</header>
<nav>
  <ul>
    <li><a href="home.html">Home</a></li>
    <li><a href="computer.html">Computer Jokes</a></li>
    <li><a href="animal.html">Animal Jokes</a></li>
    <li><a href="sport.html">Sport Jokes</a></li>
  </ul>
</nav>
<main>
<h2>The two computer jokes that received the highest number
of votes </h2>
<p>Q: What did mommy spider say to baby spider?</p>
<p>A: You spend too much time on the web.</p> <br>
<p>Q: Why was there a bug in the computer?
<p>A: Because it was looking for a byte to eat.</p>
</main>
<footer>
  <p>Comments about our website, email: smith-
jca@gmail.com</p>
</footer>
</body>
</html>
```

Explain how a *section* element could be used in this page.

1

21. continued

Marks

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MARGIN

- (d) To vote for their favourite joke of the week, users of the website complete and submit a form with the following items of information:

- age range (under 18, 18-65 or over 65)
- week beginning date
- favourite category (computers, animals or sports)
- favourite joke (1 or 2)

A user should only be able to vote for one joke in one category in each submission. Part of the HTML code for the form is shown below:

```
Line 11 Select favourite category </br>
Line 12 <select name="category" size = "3" multiple>
Line 13 <option value="computer">computers</option>
Line 14 <option value="animal">animals</option>
Line 15 <option value="sport">sports</option>
Line 16 </select>
:
```

- (i) Describe the error contained within this code.

1

- (ii) Write the code that will appear in the browser as:

Number of your favourite joke (1 or 2):

The input should be appropriately validated.

3

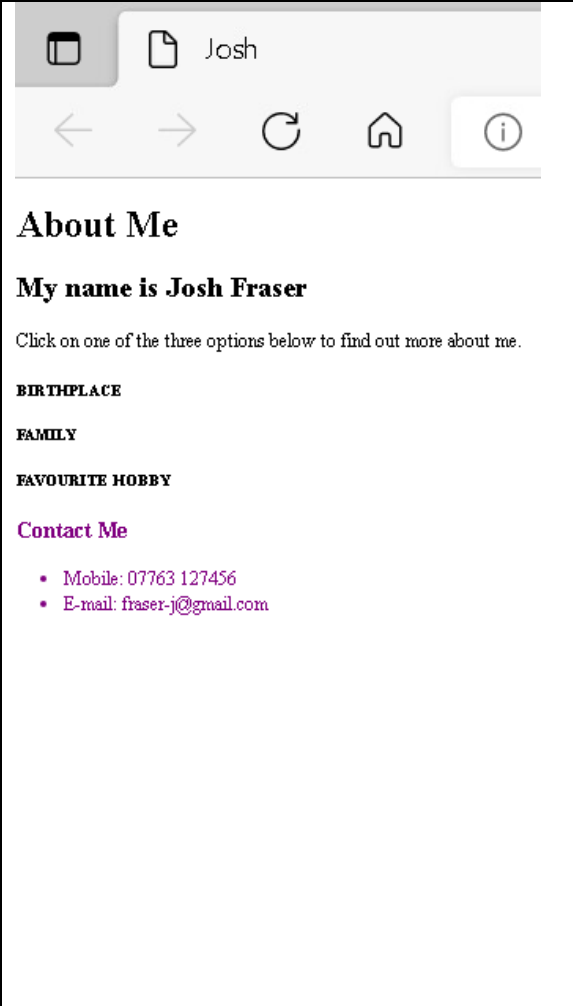
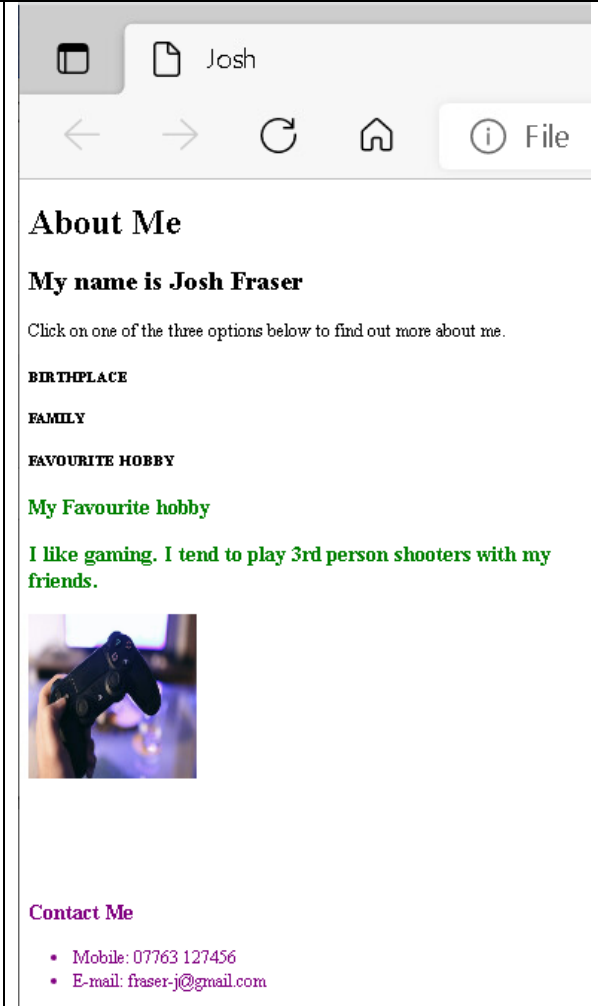
[Please turn over

Marks

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WRITE
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MARGIN

22. Josh has been asked to create an interactive webpage by his computing teacher. The webpage should reveal an item of information about himself and an associated image when the mouse is placed over an information heading. The details and the image are hidden when the mouse is moved away from the label.

Josh has decided to use three labels: Birthplace, Family and Favourite Hobby.

	
<i>Browser view when the page loads or the mouse is moved away from the label</i>	<i>Browser view when the mouse is placed over the label 'Favourite Hobby'</i>

22. *continued*

Marks

DO NOT
WRITE
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MARGIN

Here is an extract from Josh's HTML file.

```

.....
Line 24  function displayHobby() {
Line 25      document.getElementById("born").style.display="none";
Line 26      document.getElementById("family").style.display="none";
Line 27          <missing line>
Line 28  }
.....

.....
Line 46  <h5 onmouseover="displayHobby()" onmouseout ="hideAll()">
        FAVOURITE HOBBY</h5>
.....

Line 66  <section id="hobby" style="display:none; height:350px;
        width:500px; color:green">
Line 67  <h3><b>My Favourite hobby</b><h3>
Line 68  <p>I like gaming. I tend to play 3rd person shooters with
        my friends.</p>
Line 69  
        </section>

```

(a) State where lines 24 to 28 should be placed within the HTML document.

2

(b) Write the code for line 27.

2

[END OF SECTION 3]

[END OF QUESTION PAPER]

ADDITIONAL SPACE FOR ANSWERS

Marks

DO NOT
WRITE
IN THIS
MARGIN

ADDITIONAL SPACE FOR ANSWERS

Marks

DO NOT
WRITE
IN THIS
MARGIN

Marking Suggestions - SECTION 1

Number		Question	Instruction	Marks
1.		Convert the denary number -39 to its 8-bit two's complement representation.	11011001 (1 mark)	1
2.		State the name of the software development methodology that follows a strict plan, with progress measured against a timescale set at the beginning of the project.	Waterfall (model/methodology) (1 mark) Accept iterative software development cycle	1
3.		Encryption is used to secure transmission of data.		
	(a)	Explain the relationship between a public key and a private key.	One from: (1 mark) - Mathematically linked - Message that is encrypted with a public key can only be decrypted using the corresponding private key. Max 1 mark	1
	(b)	State one method of distributing public keys.	One from: (1 mark) - A digital certificate - Public key server. Max 1 mark	1
4.		Machine code instructions are fetched from memory and executed by the processor. Complete the missing steps of the fetch-execute cycle in the table below stating the computer bus used at each stage. See QP	Step 1 The address bus pinpoints the address of the location in memory to be read. (1 mark) Step 2 The read line on the control bus is activated (1 mark) Step 3 The contents at the memory address is transferred to the processor using the data bus -1 mark if order of steps is incorrect Max 3 marks	3

5.		A program design is drawn that consists of three steps as shown below. The design includes one procedure which does not return any values to the main program. See QP State the expected output.	x = 8 (1 mark) y = 6 (1 mark) Max 2 marks	2
6.		Describe how increasing the number of processor cores affects system performance.	It improves system performance. (1 mark) The more cores a processor has, the more sets of instructions the processor can receive and process at the same time. (1 mark) Max 2 marks	2
7.		Peter has deliberately introduced a computer virus into his workplace network.		
	(a)	State the name of the law that Peter has broken.	Computer Misuse Act (1990)	1
	(b)	Describe another criminal offence under this law.	One from: • Unauthorised access to computer material. • Unauthorised access to computer materials with intent to commit a further crime. • Unauthorised modification of data. • Making a computer virus Max 1 mark 0 marks for distributing a computer virus	1

8.			The rating system for hotels uses stars to assess the accommodation. The lowest rating is one star and the highest is five stars. A program is required to read hotel data from a text file. This file contains the names of 50 Scottish hotels, their location and star rating, and if the hotel is pet friendly or not. Each line of the data file stores the name, location, rating (1 to 5) and pet (yes or no) for a single hotel, as shown below: Campbell Law, Edinburgh, 2, no When run, the program should also: • display the name(s) of the hotel(s) with the highest-stored star rating and the location(s) • write the name of the highest-rating pet-friendly hotel(s) to a file.	
	(a)	Using the problem description, identify the functional requirements of the program	Inputs • Hotel data from file 1 mark 'from file' expected Processes • Find the hotel(s) with the highest-stored star rating 1 mark Outputs 1 mark • the name(s) of the hotel(s) with the highest-stored star rating and their location(s) • the name of the highest-rating pet-friendly hotel(s) (to a file) Both bullet points required for last mark Max 3 marks	3

8.	(b)		The top-level design for the program is shown below. Complete the design to show the missing data flow in and out of each subprogram. See QP.	<table><tr><th colspan="3">Top-level design</th></tr><tr><td rowspan="2">4. Read in hotel data from file into an array of records</td><td>IN</td><td></td></tr><tr><td>OUT</td><td>hotelData(name, location, rating, pets)</td></tr><tr><td rowspan="2">5. Display the names of the hotels with the highest stored rating</td><td>IN</td><td>hotelData(name, location, rating, pets) 1 mark</td></tr><tr><td>OUT</td><td>max_rating</td></tr><tr><td rowspan="2">6. Write highest rated, pet-friendly hotels to file</td><td>IN</td><td>hotelData(name, location, rating, pets), max rating 2 marks, 1 mark each</td></tr><tr><td>OUT</td><td></td></tr></table> Accept index_array (of max rating) as an IN parameter for step 3 instead of max_rating if given as an OUT parameter for step 2. Max 3 marks	Top-level design			4. Read in hotel data from file into an array of records	IN		OUT	hotelData(name, location, rating, pets)	5. Display the names of the hotels with the highest stored rating	IN	hotelData(name, location, rating, pets) 1 mark	OUT	max_rating	6. Write highest rated, pet-friendly hotels to file	IN	hotelData(name, location, rating, pets), max rating 2 marks, 1 mark each	OUT		3
Top-level design																							
4. Read in hotel data from file into an array of records	IN																						
	OUT	hotelData(name, location, rating, pets)																					
5. Display the names of the hotels with the highest stored rating	IN	hotelData(name, location, rating, pets) 1 mark																					
	OUT	max_rating																					
6. Write highest rated, pet-friendly hotels to file	IN	hotelData(name, location, rating, pets), max rating 2 marks, 1 mark each																					
	OUT																						
	(c)		State the name of the programming technique that allows the values of local variables within a main program to be accessed, updated and used within multiple sub-programs without the need to create or use global variables.	Parameter passing (1 mark)	1																		
	(d)		The program is designed to use an array of records.																				
		i	Using a programming language of your choice, define a suitable record structure for the hotel data.	Pseudocode solution: <pre>RECORD oneHotel IS {STRING name, STRING location, INTEGER rating, BOOLEAN pet}</pre> Four correct fields (1 mark) Four correct data types (1 mark) Accept STRING for pet, brackets not required Max 2 marks	2																		
		ii	Using a programming language of your choice, declare a variable called <code>hotelData</code> that can store the data for the 50 hotels. Your answer should use the record structure created in part (i).	Pseudocode solution: <pre>DECLARE hotelData AS ARRAY OF oneHotel INITIALLY [] * 50</pre> 1 mark for an array of oneHotel 1 mark for declaration of required size (50 records) Max 2 marks	2																		

8.	(e)	i	When refined, the first three lines of Step 2 are as follows: see QP.		
			Explain why a function is a suitable type of subprogram for 2.1.	A single value is returned from the subprogram. 1 mark	1
	(e)	ii	Using pseudocode and the <code>hotelData</code> array, complete an algorithm for step 2.1.	Pseudocode solution: <pre> FUNCTION findMaxRating(hotelData()) RETURNS INTEGER 1. SET max_rating = hotelData[0].rating (1 mark) 2. FOR index = 1 TO 49 (1 mark) 3. IF hotelData[index].rating > max_rating THEN (1 mark) 4. SET max_rating = hotelData[index].rating (1 mark) 5. END IF 6. END FOR 7. RETURN max_rating (1 mark) 8. END FUNCTION 2. Accept number of hotels instead of 49/ FOR hotel in hotelData() 3. Accept IF max_rating >= hotelData[index].rating THEN -1 if reference to rating field is missing (third and fourth bullet points). Max 5 marks </pre>	5

8.	(e)	iii	The function is adapted to be tested with the following data: see QP. Using the hotelData array and other variables defined in part (ii), create a trace table to find the maximum star rating. Campbell Law, Edinburgh, 2, no Bay View, Anstruther, 4, no North Pier, Oban, 1, yes no	<table><tr><th>Line</th><th>index</th><th>hotelData[index].rating</th><th>max_rating</th></tr><tr><td>1</td><td>0</td><td>2</td><td>2</td></tr><tr><td>2</td><td>1</td><td>4</td><td>2</td></tr><tr><td>3</td><td>1</td><td>4</td><td>2</td></tr><tr><td>4</td><td>1</td><td>4</td><td>4</td></tr><tr><td>2</td><td>2</td><td>1</td><td>4</td></tr><tr><td>3</td><td>2</td><td>1</td><td>4</td></tr><tr><td>4</td><td>2</td><td>1</td><td>4</td></tr><tr><td>7</td><td>3</td><td></td><td>4</td></tr></table> One mark each for: - Tracing the array index/record (1 mark) Don't penalise if 3 missing in Line 7. - Tracing the rating field (1 mark) - Tracing max_rating (1 mark) Max 3 marks Note that a different layout may be given. Second bullet point may be awarded for tracing the condition hotelData[index].rating > max_rating Don't penalise if Line 2 is omitted. This line will have to be adapted to fit 3 records. Note that the candidate should complete a trace table to match their answer to part (ii).	Line	index	hotelData[index].rating	max_rating	1	0	2	2	2	1	4	2	3	1	4	2	4	1	4	4	2	2	1	4	3	2	1	4	4	2	1	4	7	3		4	3
Line	index	hotelData[index].rating	max_rating																																						
1	0	2	2																																						
2	1	4	2																																						
3	1	4	2																																						
4	1	4	4																																						
2	2	1	4																																						
3	2	1	4																																						
4	2	1	4																																						
7	3		4																																						

8.	(f)	State two reasons why the modularity of this program will make it easier to maintain.	Two from: • The separate subprograms can be tested and changed without causing unexpected consequences with other parts of the program • Often there is less code to change/update as a subprogram from a module is often reused • It is easier to locate (and therefore correct) errors, if any (because the errors can be narrowed down to a specific subprogram/file of subprograms) • Different individuals/teams can focus on correcting/updating individual parts of the program • Other suitable Max 2 marks	2									
9.		 Image 1  Image 2 Each image above has been stored as both a bitmapped and a vector image, and image 2 was created by editing image 1. Explain the difference between the file sizes of image 1 and the corresponding image 2 in each format.	<table><tr><th></th><th>Bitmapped</th><th>Vector</th></tr><tr><td>Explanation of the difference in file size between image 1 and image 2</td><td>No difference as the number of pixels remain the same.</td><td>Bigger file size as the attributes of another (star) object must be stored</td></tr><tr><td></td><td>1 mark</td><td>1 mark</td></tr></table> Explanation required for each mark. Max 2 marks		Bitmapped	Vector	Explanation of the difference in file size between image 1 and image 2	No difference as the number of pixels remain the same.	Bigger file size as the attributes of another (star) object must be stored		1 mark	1 mark	2
	Bitmapped	Vector											
Explanation of the difference in file size between image 1 and image 2	No difference as the number of pixels remain the same.	Bigger file size as the attributes of another (star) object must be stored											
	1 mark	1 mark											
10.		A program is to be developed to generate sports race numbers for a group of 25 pupils. The program will ask the user to enter the first name, surname and age of each pupil. The age entered must be between 12 and 18. The program should output each of the pupil names with their sports race number. State two possible boundaries of this program.	Two from: • The number of pupils must be no less or greater than 25 • The age of each pupil must be between 12 and 18 • Each generated race number should be unique Max 2 marks	2									

11.		A set of grades achieved by 13 pupils in a recent computing science test is stored in an array and a function is used to count the number of pupils that achieved a particular grade. The possible grades awarded for the test range from 'E' to 'A'. See QP		
	(a)	Identify an actual parameter in the above code	One from: (1 mark) - grades (/grades()) - gradeToCount Max 1 mark	1
	(b)	Identify a formal parameter in the above code.	One from: (1 mark) - results (/results()) - grade Max 1 mark	1
	(c)	State the scope of the variable <code>count</code> and justify your choice of scope.	Scope: Local (1 mark) Justification: the variable <code>count</code> is only accessible within a subprogram/ the subprogram <code>countGrades</code> (1 mark) Max 2 marks	2
	(d)	Describe in detail how a watchpoint could be used to test that the number of A grades are counted correctly.	Set a watchpoint (at line 4/line 5) to track when the <code>value/count</code> variable reaches a certain value/changes (1 mark) This will cause the program to pause execution at this line when the condition set is reached. The value of <code>value/count</code> can be inspected for accuracy (1 mark) Max 2 marks A suitable variable to track or suitable line number is required for the first mark.	2
	(e)	Explain how the code given on the previous page can be made more robust.	Two from: - Validate the input of <code>gradeToCount</code> (1 mark) - Must be E, D, C, B or A (1 mark) Max 2 marks	2

12.		Details about a set of seven electric cars are stored in four parallel arrays. The kWh figure indicates the energy that the battery can store. The range and top speed stored is in miles and miles per hour. See QP The names of the cars that have a maximum speed greater than 95 miles/hour that have a range between 250 and 300 miles should be output..		
	(a)	State the name of the standard algorithm needed to produce this output.	Linear search (1 mark) 0 marks for count occurrences	1
	(b)	Using a programming language of your choice, write the necessary code.		
		Possible pseudocode solution: <pre> 1. FOR index = 0 TO 6 2. IF topSpeed(index) >95 AND (range(index) >=250 AND range(index) <=300) THEN 3. SEND name(index) TO DISPLAY 4. END IF 5. END FOR </pre> 1 mark each for: - fixed loop: 0 TO 6/1 To 7 (with end loop or indentation) - IF statement (with end IF or indentation) with logic operator AND joining the two conditions - Simple condition - topSpeed(index) >95 - Complex condition- range(index) >=250 AND range(index) <=300 - Output of corresponding name (name(index)) Max 5 marks		5

12.	(c)	Electric cars do not emit the same pollutants as petrol or diesel cars. State the name of an environmentally-friendly car management system and describe how it can help petrol or diesel cars reduce their environmental impact.	Name of management system - one from: (1 mark) • Start-stop system • Engine control unit • Other suitable Description: (1 mark) Reduces fuel consumption and thus the emissions of pollutants into the environment by • automatically shutting down the engine when the car is not moving and automatically re-starting when the accelerator is pressed. • using sensors to ensure the engine's air/fuel ratio is controlled accurately. • Other suitable Max 2 marks A description of how the management system can reduce harm to the environment is required for the second mark. 'Reduces fuel consumption' only - 0 marks	2
End of Section 1				

Marking - Suggestions - SECTION 2

Number			Question	Instruction	Marks
13.			A database for a dental surgery is being developed. An end-user group of this database is the reception staff at the surgery and one of the requirements of this group is to search for the names of the patients who are scheduled for an appointment on a specified date. A query is created to perform this search, but an error is encountered during the testing of the query		
	(a)		State one thing that may need to be checked to resolve this problem.	One from: • Query design • SQL statement(s) Max 1 mark	1
	(b)		Describe another possible requirement of the reception staff from the database.	One from: • enrol patients • search for basic patient data • output appointment letters • output a summary of patient details • other suitable Max 1 mark	1

14.			The following entity represents some data about a group of language teachers. It indicates which teacher teaches which language courses and which courses are taught by which teacher. See QP. Complete the matching entity-occurrence diagram below.							
			teacherID 610483 610571 610211 610523 610918 courseID FREN1 SPAN2 GERM2 GERM1 SPAN1 2 marks for 8 correct matches -1 for each incorrect or missing match Min 0 marks, Max 2 marks	2						
15.			A database entity is shown below. See QP. Complete the table below showing the output from the following SQL statement: SELECT category, MIN(price) AS [Cheapest item] FROM Stock GROUP BY category; <table><tr><th>Category</th><th>Cheapest item</th></tr><tr><td>Dairy</td><td>2.79</td></tr><tr><td>Bakery</td><td>0.99</td></tr></table> 1 mark for each column, max 2 marks Note second column heading required for second mark.	Category	Cheapest item	Dairy	2.79	Bakery	0.99	2
Category	Cheapest item									
Dairy	2.79									
Bakery	0.99									
16.			State one criteria that can be used to evaluate the output from an SQL query. One from: Fitness for purpose Accuracy of output Max 1 mark	1						

17.		A relational database has been created to store the details of this session's inter-school under-14 football league. The School, Team, Player and Match details are stored in four separate entities. Some schools have entered more than one team but a player can play for only one team. Each match has a designated organiser who will update the database, if and when required. See QP for structure. An extract from each table is shown below. See QP.						
	(a)	Complete the following line of the data dictionary for this database: See QP	<table><tr><th>Key (PK/FK)</th><th>Validation</th></tr><tr><td>FK 1 mark</td><td>Presence check (1 mark) Lookup from School entity (1 mark)</td></tr></table> Max 3 marks	Key (PK/FK)	Validation	FK 1 mark	Presence check (1 mark) Lookup from School entity (1 mark)	3
Key (PK/FK)	Validation							
FK 1 mark	Presence check (1 mark) Lookup from School entity (1 mark)							
	(b)	Use the information on the previous page to complete a matching entity relationship diagram. You do not have to show the individual attributes	<pre>graph LR; School[School] -- has --> Team[Team]; Team[Team] -- has --> Player[Player]; Team[Team] -- has --> Match[Match];</pre> 1 mark each for each correct 1-to-Many relationship - 3 marks Suitable relationship descriptions X 3 - 1 mark Max 4 marks	4				

17.	(c)		A number of queries on the database are to be generated using SQL statements. These queries will be designed in advance.												
	(c)	i	Design a query that will display a list of the full names of all the goalkeepers (position 1) stored in the databases together with their team name and the name of their school. For example, a line from the output would be: Gregory Edwards Top Shots Firpark Campus	<table><tr><td>Field(s)/Attribute(s) and calculations(s)</td><td>firstName, surname, teamName, schoolName</td></tr><tr><td>Table(s)/Entity(ies)</td><td>Player, Team, School</td></tr><tr><td>Search criteria</td><td>Position = 1</td></tr><tr><td>Grouping</td><td></td></tr><tr><td>Sort</td><td></td></tr></table> 1 mark for each of the first three rows, max 3 marks Correct field/attribute order required for the first mark	Field(s)/Attribute(s) and calculations(s)	firstName, surname, teamName, schoolName	Table(s)/Entity(ies)	Player, Team, School	Search criteria	Position = 1	Grouping		Sort		3
Field(s)/Attribute(s) and calculations(s)	firstName, surname, teamName, schoolName														
Table(s)/Entity(ies)	Player, Team, School														
Search criteria	Position = 1														
Grouping															
Sort															
	(c)	ii	Complete the query design below that uses an aggregate function and a readable heading to display the total number of matches that are scheduled for the month of October.	<table><tr><td>Field(s)/Attribute(s) and calculations(s)</td><td>Number of matches in October = COUNT(*)</td></tr><tr><td>Table(s)/Entity(ies)</td><td>Match</td></tr><tr><td>Search criteria</td><td>date LIKE “*/10/*”</td></tr><tr><td>Grouping</td><td></td></tr><tr><td>Sort</td><td></td></tr></table> • Number of matches in October/suitable heading (1 mark) • = COUNT(*)/=Count(ALL) (1 mark) • date LIKE */10/% or equivalent (“*/10/*”) (1 mark) Max 3 marks date LIKE _/10/_ or date LIKE ?/10/? - 0 marks	Field(s)/Attribute(s) and calculations(s)	Number of matches in October = COUNT(*)	Table(s)/Entity(ies)	Match	Search criteria	date LIKE “*/10/*”	Grouping		Sort		3
Field(s)/Attribute(s) and calculations(s)	Number of matches in October = COUNT(*)														
Table(s)/Entity(ies)	Match														
Search criteria	date LIKE “*/10/*”														
Grouping															
Sort															

17.	(d)	The match organiser for the match at George V Park on 12 September at 10:00 has been entered incorrectly. It should be Frank Keanie and not Ray Keanie as indicated. The following query is written to correct the error: See QP. The output is not as expected. Re-write the last part of the SQL statement to give the correct output.	<pre>WHERE date = '12/9/2023' AND startTime = '10:00' AND venue = 'George V Park';</pre> Max 1 mark Accept AND postcode = 'KY1 7PU'	1
	(e)	The names of the teams that are playing in the first day of the scheduled matches are required. Two queries are used to achieve the correct output. The results of Query 1 are used in Query 2. Complete the SQL statements to produce the correct output. See QP	Query 1: Find first date <pre>SELECT min(date) AS [Earliest Date] FROM Match;</pre> 1 mark for min(date) Query 2: Display the team names that are playing in the first date <pre>SELECT teamName FROM Team, Match, [Find first date] (1 mark) WHERE Team.matchID = Match.matchID AND (1 mark) date = [Earliest date] (1 mark)</pre> Max 3 marks Inner join may be used for second mark	1 3
End of Section 2				

Marking - Suggestions - SECTION 3

Number			Question	Instruction	Marks
18.			Describe one way that compatibility testing on a website can be conducted.	One from: (1 mark) - The website should be tested on as many different devices as possible. - The website should be tested on as many different browsers as possible. to check that the website will display/perform as expected whatever device or browser is used. Max 1 mark	1
19.			State the name of the two property labels of the CSS box model missing from the diagram. See QP. A _____ is the area outside the border. B _____ is the area around the content.	A Margin (1 mark) B Padding (1 mark) Max 2 marks	2
20.			As part of the design process, the developers of the website create a low-fidelity prototype.		
			Describe two purposes of a low-fidelity prototype.	Two from: (1 mark each) - allows designers to easily test interactions and navigation menus of a website. - simple and in-expensive ways to communicate the proposed design to the client before implementation - provides a blueprint for the web developers - other suitable Max 2 marks	2

21.		The Scottish Laughter Society have commissioned a Joke website. A horizontal navigation bar will be used with links to four pages: computers, animals, sports and voting. The website displays two chosen jokes of the week in three different categories (computer, animal, sport). On the voting page there is a form for users to vote for their favourite joke of the week from the website. The voting page also has a link to a sub-page which lists the top-voted jokes from previous weeks. There is a link to the laughter society website (scotlandlaughter.org.uk) from the home page. The structure of the joke website should include the following: • a home page • a computer page • an animal page • a sport page • a voting page • any subpages • external links • and the navigation bar	
(a)		Draw a multi-level structure design for the Jokes website. <pre>graph TD; Home[Home] --> Scotland[scotlandlaughter.org.uk]; subgraph NavigationBar []; Computer[Computer]; animal[animal]; sport[sport]; voting[voting]; end; voting --> topJokes[top jokes];</pre> 1 mark each for: • Home with links to four pages - computer, animal, sport and voting pages • Navigation bar clearly identifies - dotted line/other • Suitable named subpage from voting page • One-way link to scotlandlaughter.org.uk from the home page Max 4 marks	4

21.	(b)		When styling is applied to the Computer page, the top of the page is displayed in a browser as: See QP. The styles.css code is shown below: See QP.		
		i	Identify the line in styles.css that needs to be amended to give the expected output. Re-write to make this amendment.	Line number: <i>Line 15</i> (1 mark) Re-written code: <code>h1 {font-size:60px;color:black; display:inline}</code> display:inline (1 mark) Max 2 marks	2
		ii	State the line numbers where grouping selectors have been used.	Lines 3, 7 and 9 (1 mark) All three line numbers required	1
		iii	Describe one advantage of using grouping selectors.	The use of grouping selectors (one from): • reduces the amount of code/lines of code/file size • results in the faster loading of the stylesheet • makes the styling code more readable Max 1 mark	1
		iv	State one line number where a descendent selector has been used.	One from: (1 mark) • Line 25 • Line 26 • Line 27 • Line 28 Max 1 mark	1
		v	Explain clearly how the styling applied using the following lines could be tested:	Line 25: Check that the bullets have been removed from the list of pages on the navigation bar (1 mark) Line 28: Check that the background colour changes (to cyan) and the text colour changes (to dark blue) when the mouse hovers over a page link (on the navigation bar). (1 mark) Max 1 marks	2

21.	(c)		Explain how a <i>section</i> element could be used in this page.	One from: (1 mark) - To divide the page into parts, each part containing content relating to a separate computer joke. - Other suitable Max 1 mark Context required for the mark to be awarded.	1
	(d)		To vote for their favourite joke of the week, a user of the Joke website complete and submit a form with the following items of information: - age range (under 18, 18-65 or over 65) - week beginning date - favourite category (computers, animals or sports) - favourite joke (1 or 2) A user should only be able to vote for one joke in one category in each submission. Part of the HTML code for the form is shown below: see QP		
	(d)	i	Describe the error contained within this code.	One from: (1 mark) - The 'multiple' attribute at line 12 specifies that multiple options can be selected at once. - More than one option can be selected at once. Max 1 mark Only one vote should be permitted - 0 marks	1

21,	(d)	ii	Write the code that will appear in the browser as: Number of your favourite joke (1 or 2): The input should be appropriately validated.	Number of your favourite joke(1 or 2): <code><input type= "number" name = "favourite" min= "1" max = "2"></code> Correct label - Number of your... (1 mark) (it may be enclosed within <p>, <h...> or <label> tags) <code>input type= "number" (1 mark)</code> <code>min= "1" max= "2" (1 mark)</code> Max 3 marks	3
22.			Josh has been asked to create an interactive webpage by his computing teacher. The webpage should reveal an item of information about himself and an associated image when the mouse is placed over an information heading. The details and the image are hidden when the mouse is moved away from the label. Josh has decided to use three labels: Birthplace, Family and Favourite Hobby. See QP for browser output. Here is an extract from Josh's HTML file. See QP.		
	(b)		State where lines 24 to 28 should be placed within the HTML document.	Within <style> </style> tags (1 mark) And one from: (1 mark) • within the <body> section • within the <head> section Max 2 marks 0 marks for within a linked JS file	2
	(c)		Write the code for line 27.	<code>document.getElementById("hobby").style.display= "block";</code> "hobby" (1 mark) "block" (1 mark) Max 2 marks -1 if full line is not given.	2
End of Section 3					

Section 1	55	1	2	3 a	3 b	4	5	6	7 a	7 b	8 a	8 b	8 c	8 di	8 dii	8 ei	8 eii	8 eiii	8 f	9	10	11 a	11 b	11 c	11 d	11 e	12 a	12 b	12 c
SDD Development methodologies	1	1																											
SDD Analysis	5										3										2								
SDD Design	8											3					5												
SDD Implementation (Data types and structures)	4													2	2														
SDD Implementation (Computational constructs)	6												1			1						1	1	2					
SDD Implementation (Algorithm specification)	6																										1	5	
SDD Testing	7						2											3							2				
SDD Evaluation	4																		2							2			
CS Data Representation	3	1																		2									
CS Computer Structure	5					3		2																					
CS Environmental Impact	2																												2
CS Security precautions	4			1	1				1	1																			
DDD Analysis																													
DDD Design																													
DDD Implementation																													
DDD Testing																													
DDD Evaluation																													
WDD Analysis																													
WDD Design																													
WDD Implementation (CSS)																													
WDD Implementation (HTML)																													
WDD Implementation (JavaScript)																													
WDD Testing																													
WDD Evaluation																													

Section 2 and Section 3	50	13 a	13 b	14	15	16	17 a	17 b	17 ci	17 cii	17 d	17 e		18	19	20	21 a	21 bi	21 bii	21 biii	21 biv	21 bv	21 c	21 di	21 dii	22 a	22 b
SDD Development methodologies																											
SDD Analysis																											
SDD Design																											
SDD Implementation (Data types and structures)																											
SDD Implementation (Computational constructs)																											
SDD Implementation (Algorithm specification)																											
SDD Testing																											
SDD Evaluation																											
CS Data Representation																											
CS Computer Structure																											
CS Environmental Impact																											
CS Security precautions																											
DDD Analysis	1		1																								
DDD Design	15			2			3	4	3	3																	
DDD Implementation	5										1	4															
DDD Testing	3	1			2																						
DDD Evaluation	1					1																					
WDD Analysis																											
WDD Design	6															2	4										
WDD Implementation (CSS)	7														2			2	1	1	1						
WDD Implementation (HTML)	5																						1	1	3		
WDD Implementation (JavaScript)	4																									2	2
WDD Testing	3													1								2					
WDD Evaluation																											

	Number Marks	%
SDD	41	51.25
CS	14	17.5
DDD	25	31.25
WDD	25	