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National Qualifications 2022

Mark

CS(N5)22A

Computing Science

Duration — 1 hour 30 minutes

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forenames(s)

Surname

Number of seat

Date of birth

Day | Month | Year

Scottish candidate number

Total marks - 80

SECTION 1 – 55 marks

Attempt ALL questions in this section.

Attempt questions in **EITHER**:

Section 2 (25 marks) - Database Design and Development – Page 16

OR

Section 3 (25 marks) - Web Design and Development – Page 22

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 marks for this paper.

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MARKS | DO NOT WRITE IN THIS MARGIN

SECTION 1 – 55 marks

Attempt ALL questions in this section

1. Describe how a real number is stored in a computer's memory. **2**

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

201

3. A computer program is used to count the number of shoppers visiting a web site.

State the most suitable data type to store the number of shoppers. **1**

4. A programming language below uses ^ for exponentiation.

```
SET newvalue TO input1value ^ input2value
```

When coding, a programmer types ! instead of ^ leading to an error.

State the type of programming error and describe its effect. **2**

Type

Effect

MARKS | DO NOT WRITE IN THIS MARGIN

5. SVG is a graphics format. An example of an SVG graphic is:

```
<rect x="0" y="0" width="100" height="100"
style="fill:rgb(0,0,255); stroke:rgb(0,0,0)" />
```

(a) State the name for this method of graphic representation. **1**

(b) From the example, identify two attributes of the graphic **with their values.** **2**

6. A computer processor makes use of memory locations with unique addresses, a data bus and an address bus.

(a) Describe the purpose of the address bus. **1**

(b) Describe the purpose of the data bus. **1**

(c) Describe the purpose of memory locations with unique addresses. **1**

[Turn over

MARKS | DO NOT WRITE IN THIS MARGIN

7. A computer program is used to manage the security lighting for a home. The following code is used to manage the lighting. The brightness for the lights is from 0 (0% brightness) to 100 (100% brightness). The light detected is 0 when there is no light and 100 in the full daylight.

```
Line 01  SET night TO true
Line 02  SET brightness TO 100
Line 03  WHILE night
Line 04      RECEIVE light1 FROM <front door light sensor>
Line 05      RECEIVE light2 FROM <back door light sensor>
Line 06      RECEIVE motion1 FROM <front door motion sensor>
Line 07      RECEIVE motion2 FROM <back door motion sensor>
Line 08      SET lightval TO (light1 + light2)/2
Line 09      IF lightval > 50 THEN
Line 10         SET night TO false
Line 11      ELSE
Line 12         SET brightness TO brightness - lightval
Line 13      END IF
Line 14      IF (motion1 OR motion2) THEN
Line 15         SET oldbrightness TO brightness
Line 16         SET brightness to 100
Line 17         <set all outside lights on at brightness level>
Line 18         <wait 60 seconds>
Line 19         SET brightness to oldbrightness
Line 20      END IF
Line 21      <set all outside lights on at brightness level>
Line 22  END WHILE
Line 23  <set all outside lights off>
```

(a) State the largest value for `lightval` that would result in line 12 being executed. **1**

(b) Complete this test table. **2**

	light1 (line 04)	light2 (line 05)	lightVal (line 08)	brightness (line12)
Loop 1	32	32	32	68
Loop 2	20	22	21	
Loop 3	15	19	17	
Loop 4	10	12	11	

MARKS

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7. (continued)

(c) The program is supposed to make the outdoor lights brighter when less light is detected outside but the program doesn't work as expected.

(i) Describe the error in the program. **2**

(ii) Write code to resolve this error. Identify the position of any lines of code you are adding or changing. **2**

(d) (i) Explain what happens at line 14, if motion is detected for both motion1 and motion2 sensors **at the same time**. **2**

(ii) Explain the purpose of the variable `oldbrightness` in lines 15 to 19. **1**

[Turn over

MARKS | DO NOT WRITE IN THIS MARGIN

8. A program will calculate the total cost for groups purchasing tickets for a water park.

Adults pay £30 per ticket; children pay £15. If the size of the party is over 6 people, there is a discount of £5 per person which is subtracted from the total ticket cost. If there are no children in the party and there are not more than 6 adults, then an option to upgrade to the spa is offered at £10 per person.

An algorithm for this is shown below.

1. Get party details from the customer
2. <Offer Spa option, if qualifies, and then calculate totalCost>
3. SEND totalCost TO DISPLAY

(a) Using a design technique of your choice, design a solution for step 2 above.

6

MARKS | DO NOT WRITE IN THIS MARGIN

8. (continued)

(b) As part of a new promotion for the Water Park, customers with children, who spend more than £90, are offered tokens for a child friendly area of the water park.

```
…
Line 72  IF totalCost > 90 THEN
Line 73          SEND “You qualify for tokens” TO DISPLAY
Line 74          IF totalCost > 150 THEN
Line 75                  SEND "You have 500 tokens for the play area."
Line 76          ELSE
Line 77                  SEND "You have 100 tokens for the play area."
Line 78          END IF
Line 79  END IF
…
```

(i) State the output if **2**

totalCost is 150

totalCost is 85

(ii) When the code is tested, a user enters 2.5 for the number of children. The program continues to run and calculates the total cost.

Explain how the program could be made fit for purpose. **1**

(c) The water park has a web site that customers use to purchase their tickets. The web site has a firewall.

Describe two features of the role of a firewall. **2**

Feature 1:

Feature 2:

[Turn over

9. Happy Shopper is an online store that uses a computer program to generate check digits for customer orders.

An example order number would be 87212.

To calculate the check digit, all the digits are added together and divided by 11. The remainder is the check digit.

8 + 7 + 2 + 1 + 2 = 20

20 / 11 = 1 remainder 9 so 9 is the check digit.

A predefined function, called remainder, can be used to calculate the remainder. For example:

```
SET checkdigit TO remainder(20, 11)
```

Order numbers are stored in an array when the check digit is calculated.

ordernum	8	7	2	1	2

(a) Using a design technique of your choice, design a solution that will calculate and display the check digit using this array. **4**

[Turn over

9. (continued)

(b) This program used a predefined function called remainder.

(i) State another predefined function. **1**

(ii) Explain, using an example, how the value returned by your predefined function in (i) is calculated from the parameters it is provided. **1**

(c) Once the check digit is calculated, it is printed, with the order number, on labels which are attached to each order. e.g.

When posting the orders, an employee types the order number and check digit into a program which checks if this is correct.

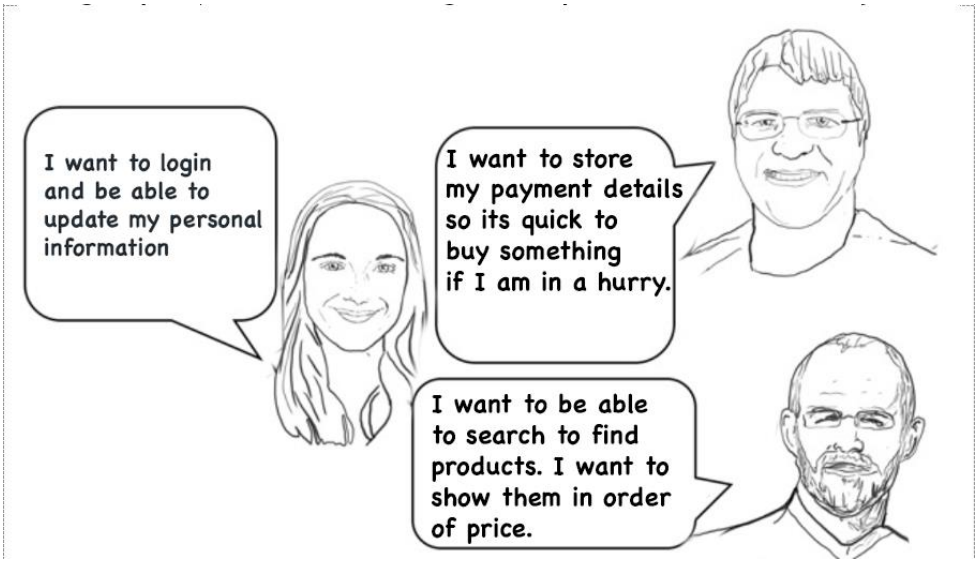
Complete missing parts of the design below. **2**

```
Line 01   REPEAT
Line 02     RECEIVE ordernumber FROM (INTEGER) KEYBOARD
Line 03     SET checkdigit TO <last digit in ordernumber>
Line 04     SET mycheck TO <calculation of check digit from order number>
Line 05     IF _____________________________THEN
Line 06     ELSE
Line 07       SEND "Error: enter order number again
Line 08     END IF
Line 09
Line 10   UNTIL ____________________________________________
Line 11   SEND "Order number is correct" TO DISPLAY
```

9. (continued)

(d) A focus group is held with customers to discover what they want from the company to help them make a better online store.

The group have been discussing what they want from an online store.



Use the information above to identity two functional requirements for an improved online store. **2**

Requirement 1:

Requirement 2:

[BLANK PAGE]

Please turn over for Question 10.

MARKS | DO NOT WRITE IN THIS MARGIN

10. A delivery company has an app which sends customers a notification when their delivery is 8 or fewer delivery stops away. The app then sends a message to the customer each time a delivery is completed, counting down the number of stops until the item is delivered to the customer.

When the delivery is 8 or fewer stops away the customer receives:

"Your package is now X stops away."

Where X is the number of stops until the delivery to the customer. After the item is delivered, a message is sent to the customer:

"Your item was delivered"

The data for the delivery notifications is shown below. It is stored in the order of the deliveries e.g.

deliveries
…
fraser.m@mysite.com
s.strange@marvels.org
amber.r@stirling.co.uk
megan@revolution.org
colin.c@morgan.org
morag.s@wishaw.org
…

A program which manages the notifications is shown below:

```
Line 01  SET deliveryNum TO 1 # this is the number of the current delivery
Line 02  WHILE deliveryNum <= < total number of deliveries to be made >
Line 03    SEND "Has delivery to " + deliveries[deliveryNum] + " been completed?"
           TO DISPLAY
Line 04    RECEIVE response FROM keyboard
Line 05    stopsTo = 1 # is how many stops to the delivery
Line 06    deliveryOrder = 1 # is the position in deliveries data being processed
Line 07    FOR EACH delivery FROM deliveries
Line 08      IF deliveryOrder = deliveryNum THEN
Line 09        <send "Your item was delivered" to deliveries[deliveryNum]>
Line 10      ENDIF
Line 11      IF (stopsTo < 9) AND (deliveryOrder > deliveryNum) THEN
Line 12        <send "Your package is now " + stopsTo + " stops away." to
               deliveries[deliveryNum + stopsTo]>
Line 13        SET stopsTo TO stopsTo + 1
Line 14      ENDIF
Line 15    END FOR
Line 16    SET deliveryNum To deliveryNum + 1
Line 17  END WHILE
```

MARKS | DO NOT WRITE IN THIS MARGIN

10. (continued)

(a) State the data structure used to store `deliveries`. **1**

(b) Delivery drivers sometimes make over 150 deliveries in a day. A member of the programming team says that the code for notifications is not efficient.

Explain why this code is not efficient. **2**

(c) Using a design technique of your choice, design a suitable input validation to ensure that only a valid input of either "Yes" or "No" is accepted at line 04. **3**

[Turn over

10. (continued)

(d) Any response from the driver means that the delivery has been completed. In the next version of the program, a response of "Yes" means the deliver was successful but a response of "No", means to try to deliver the next day.

Amend the code from lines 08 to 10, adding additional code so that the correct notification is sent, depending on the response from the driver. **4**

(e) Give two reasons why the delivery programme would be compiled to run on the phones of delivery drivers. **2**

Reason 1:

Reason 2:

[*END OF SECTION I*]

Attempt **EITHER**

Section 2 – Database Design and Development (Page 16)

OR

Section 3 – Web Design and Development (Page 22)

[Turn over for Section 2]

MARKS | DO NOT WRITE IN THIS MARGIN

SECTION 2 – Database Design and Development

Attempt ALL questions if you choose to complete this Section

11. A mobile phone company offers a range of benefits to customers as add-ons to their monthly subscriptions. The monthly costs of these benefits are held in a database. Part of the database table is shown below.

Benefit				
benefitID	**company**	**benefitType**	**description**	**costMontly**
0028	ASOS	Discount	20% off	4.99
0029	Disney	Streaming	Subscription	5.90
0030	Amazon	Streaming	Subscription	4.50
0031	Audible	Discount	20% off	1.99
0032	Next	Discount	10% off	3.99
0033	Lastminute.com	Voucher	£200 voucher	7.50
0034	Boohoo	Discount	20% off	4.99
0035	Apple	Streaming	Subscription	4.99

A programmer writes the following SQL statement to update the discount for Next.

```
UPDATE Benefit
SET costMonthly TO 4.99
WHERE benefitType = "Discount";
```

(a) Explain why the SQL statement above would give an unexpected result. **1**

(b) Rewrite the SQL statement to give the expected output. **2**

MARKS

DO NOT WRITE IN THIS MARGIN

12. The output below was produced by running a query in the database.

User				
id	username	firstname	lastname	lastLogin
555	FluffyRabbit	Lucas	Schmidt	2021-10-11 11:43:18
291	SteelTitan	Amerlia	Scott	2021-10-11 17:46:17
762	TheArk	Noah	Scott	2021-10-11 14:31:00
372	SoftSteel	Grace	Simmons	2021-10-11 16:37:00
933	BlueShot	Liam	Simmons	2021-10-11 14:37:00
102	IronMerc	Olivia	Smith	2021-10-11 17:51:17
300	JimmyS	James	Smith	2021-10-10 09:42:59
071	Lee-I-Am	Liam	Smith	2021-10-10 09:42:58
287	deluxe_vegan	Mia	Stewart	2021-10-11 17:46:17

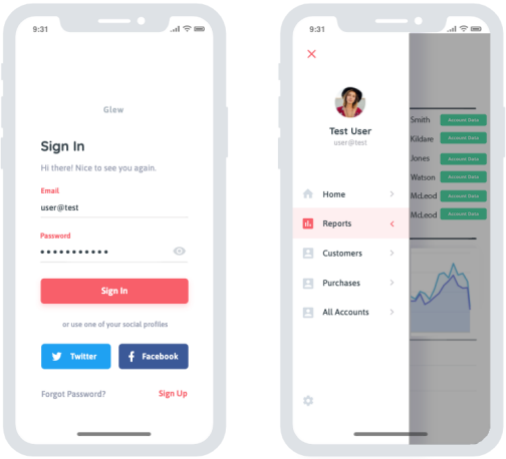
Complete the SQL statement used to produce this sorted output. **2**

```
SELECT id, username, firstname, lastname, lastLogin
FROM user
ORDER BY
```

13. A business is developing an app to allow customers to sign-in and place orders.

During testing, an account is added to the service that allows a user to view all the personal details of customers, see payment data and information about transactions.

When testing was completed and the app was published for customers, this account was not removed and appears to have been discovered by customers using the app.



State the requirement of the UK General Data Protection Regulation (UK GDPR) that the company has failed to comply with. **1**

[Turn over

MARKS | DO NOT WRITE IN THIS MARGIN

14. ScotiMon is a digital card game, where players use cards representing digital pets which battle against each other.

Skill			
SkillID	Skill	Value	Modifier
1928	Flare	20	None
1929	Dragon Paw	10	Remove 1 damage counter from your Scotimon
1945	Tackle	10	None
1950	Double Kick	40x	Flip 2 coins. Attack does 40 damage times the number of heads.
1951	Lunge	30	Flip a coin, if tails, this attack does nothing
1960	Flare	20+	Flip a coins, if heads, does double damage.
1964	Energy	30	None
1969	Razor Wind	20	Flip a coin, if tails, this attack does nothing

Card			
CardID	Creature	HealthPoints	SkillID
281	Kiltmonster	100	1969
299	Bagon	50	1950
311	Dunbusken	70	1950
491	Delcatty	80	1945
109	Lochnessy	70	1929
112	Haggisy	40	1969
298	Whiskimon	80	1960
297	Glasvonage	90	1951
296	Torchie	100	1969

(a) When the database was designed, it was important that `HealthPoints` was a number from 1 to 150.

Describe what was done to ensure `HealthPoints` is entered correctly. **1**

(b) Design a query to display the creature, health points, with skills that have a value of "20" or "20+". **4**

Field(s)	
Table(s)	
Search Criteria	

MARKS | DO NOT WRITE IN THIS MARGIN

14. (continued)

(c) A creature is added to the database:

CardID	Creature	HealthPoints	SkillID
281	Tiktoket	90	9999

Explain why this new entry in the database breaks referential integrity. **2**

(d) A query is required to add a new skill to the database.

SkillID	Skill	Value	Modifier
2001	Sling Shot	30	None

Write SQL to add this record to the database. **3**

[Turn over

MARKS | DO NOT WRITE IN THIS MARGIN

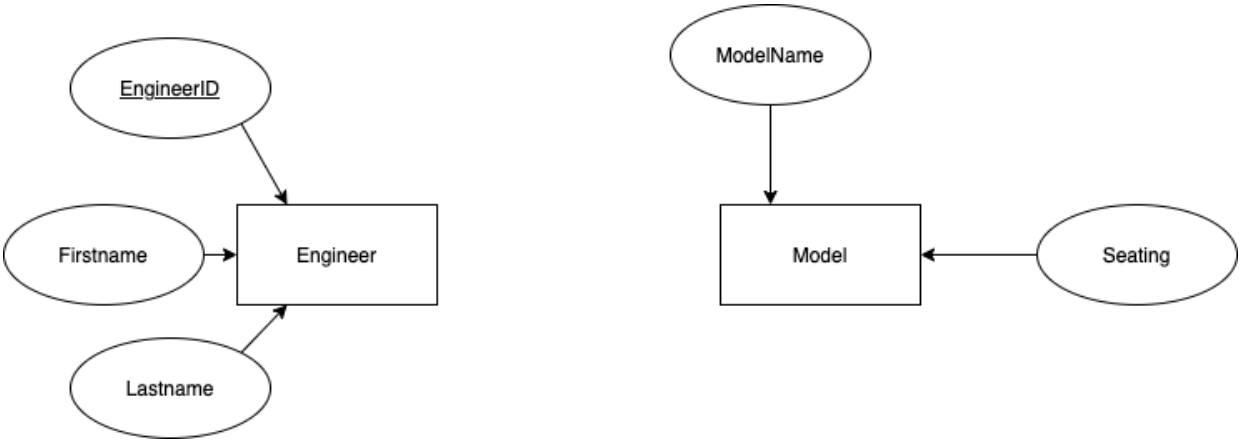
15. A company makes a range of electric cars. Each car model has a lead engineer. Some engineers work on more than one model.

Model					
ModelID	ModelName	Range	TopSpeed	EngineerID	Seating
1	Model S	396	200	6	Up to 4
2	Model 3	360	162	7	Up to 5
3	Model X	340	163	11	Up to 7
4	Model Y	314	150	11	Up to 7
5	Model Z	380	180	7	Up to 5
…	…	…	…	…	…

Engineer			
EngineerID	Firstname	Lastname	Base
6	Leena	Gade	Washington
7	Antonia	Terzi	Paris
8	Astrid	Linder	Paris
9	Chika	Kako	Berlin
10	Alicia	Davis	Edinburgh
11	Trista	Schieffer	Los Angeles
…	…	…	…

(a) Complete the entity relationship diagram below by:

- drawing any missing attributes from either entity
- drawing the relationship between the entities
- naming the relationship between the entities
- identifying any additional key fields **6**



15. (continued)

(b) An SQL query is written which produces the following output.

Base	ModelName	Range	Firstname	Lastname
Washington	Model S	396	Lenna	Gade
Paris	Model 3	360	Antonia	Terzi
Paris	Model Z	380	Antonia	Terzi

Write an SQL query to produce the output above. **3**

[*END OF SECTION 2*]

MARKS | DO NOT WRITE IN THIS MARGIN

SECTION 3 – Web Design and Development

Attempt ALL questions if you choose to complete this Section

16. Add HTML body, head and title opening and closing elements to complete the code below. **3**

```
<html>

      <_____________>

            <_____________>Maintenance Page<_____________>

      <_____________>

      <_____________>

            This site is currently offline for maintenance

      <_____________>

</html>
```

17. A web designer has two images available to use in a web site. Both images are the same resolution.

JPEG Image

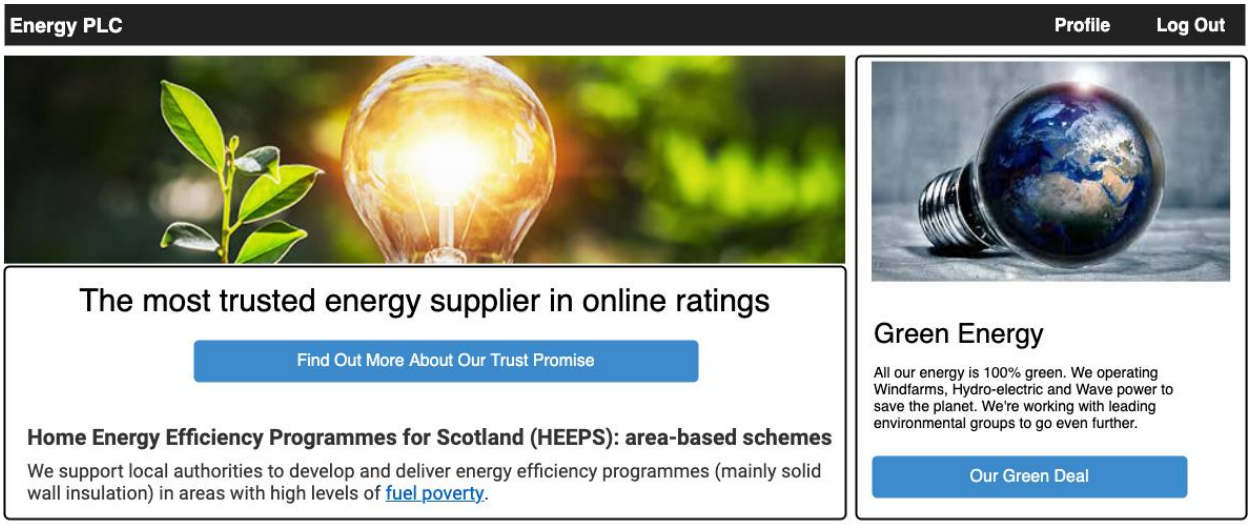
Record.jpg
700 x 500

PNG Image

Record.png
700 x 500

State two advantages of using PNG rather than JPG. **2**

18. An energy company want to share information about energy costs with customers through a page on their web site. A screenshot of the completed page is shown below.



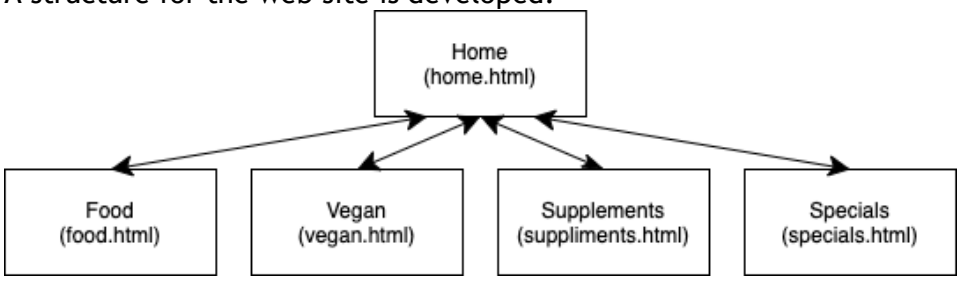
Evaluate the web page, in terms of fitness for purpose. **1**

[Turn over

MARKS | DO NOT WRITE IN THIS MARGIN

19. A health food business wants to open a web site so customers can order online.

(a) A structure for the web site is developed.



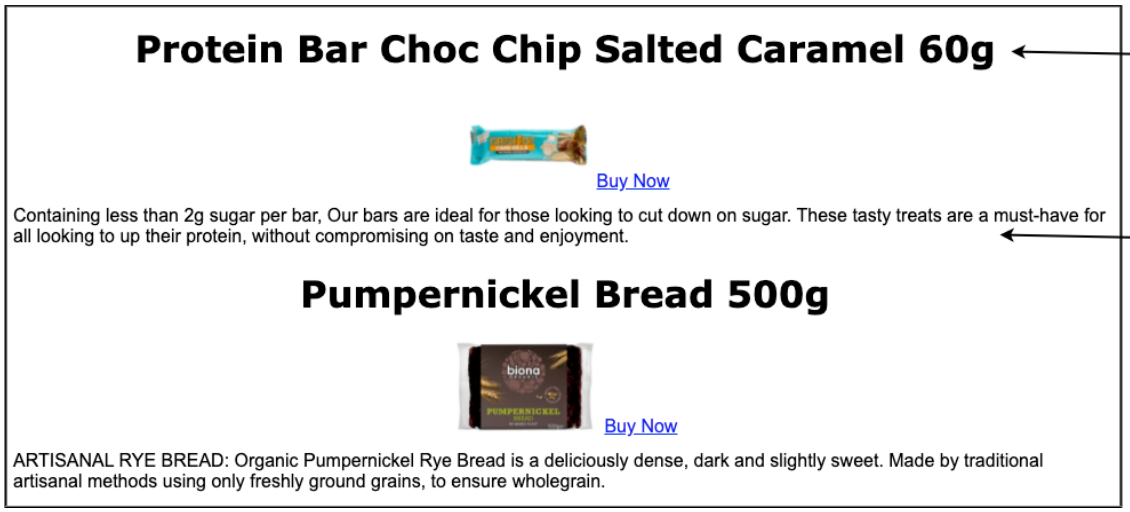
This is represented on the home page as:

- Home
- Food
- Vegan
- Supplements
- Specials

Write HTML to create this menu. **4**

19. (continued)

(b) A page listing products is shown below.



The following HTML generates part of the page.

```
<div class="productheading">
   <h1>Protein Bar Choc Chip Salted Caramel 60g</h1>
</div>
<div class="producttext">
   <div class="productimage">
      <img class="productimage" src="chocbar.png" alt="Protein Bar Choc Chip
Salted Caramel" />
      <a id="link1" href="#" onMouseOver="CustomerNote('link1');"
onMouseOut="CustomerOut('link1');">Buy Now</a>
    </div>
    <div class="maintext"><p>Containing less than 2g sugar per bar, Our bars
are ideal for those looking to cut down on sugar. These tasty treats are a
must-have for all looking to up their protein, without compromising on taste
and enjoyment.</p>
    </div>
</div>
```

(i) Write the CSS rule for `productheading`. **3**

19. (b) (continued)

(ii) A rule is defined for `producttext` but no rule is defined for `maintext`. Describe how this will affect the text in the "maintext" DIV. **2**

(iii) An id is used with the anchor element:

```
id="link1"
```

Describe the difference between an id and a class. **2**

(c) When a user moves the mouse pointer on to the "Buy Now" text, it changes to "Add to basket". Explain how a JavaScript event is used to implement this feature. **2**

(d) The product page is tested to ensure the links and navigation work as expected.

State two other examples of tests that can be carried out on a web page. **2**

Test 1

Test 2

MARKS

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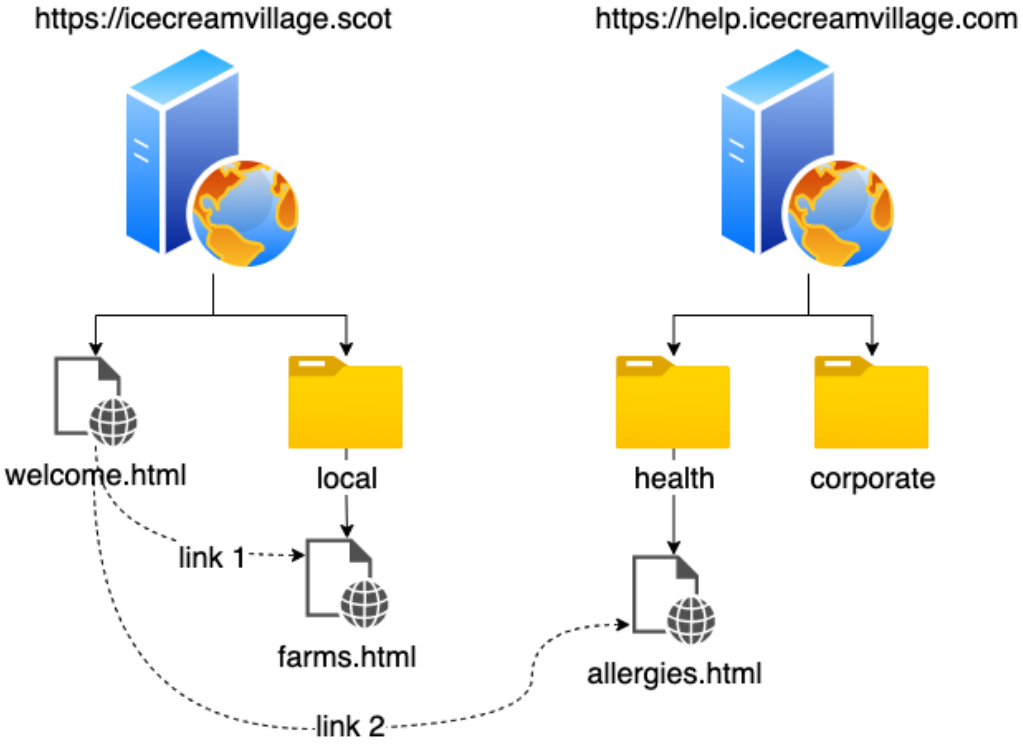
20. A web developer is creating two websites for a customer. These will be held on two web servers as shown.



(a) The file, welcome.html, contains two hyperlinks. Link 1 uses relative addressing and Link 2 uses absolute addressing.

Write the addresses for each hyperlink. **2**

Link 1:

Line 2:

[Turn over

19. (continued)

(b) During the design process, low-fidelity prototypes are used. **2**

Describe two ways that low-fidelity prototypes would be used in the development of the web sites. **2**

[*END OF SECTION 3*]

[*END OF QUESTION PAPER*]

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ADDITIONAL SPACE FOR ANSWERS

MARKS | DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS