1 Draw **one** line from each verification method to indicate whether it is used during data transfer or data entry.

Verification Method	Use
Parity byte check	
Checksum	Data transfer
Visual check	
Parity block check	Data entry

[2]

6 Students are learning about a simple check digit method for data validation. In this method, a single check digit is appended to the end of an original number to give a new number.

The students are studying a method which:

- calculates the sum of all the digits in the original number
- uses integer division to calculate the remainder when the sum is divided by 10
- uses the remainder as the check digit
- appends the check digit to the original number, creating the new number.

For example:

original number	4162
sum of all digits	4 + 1 + 6 + 2 = 13
remainder when the sum is divided by 10 using integer division	3
new number	41623

The method described can be used to detect single-digit errors. For example, if the new number is incorrectly input as 41633, then the check digit does not match and the input will be rejected.

(a) An incorrect attempt was made to enter 41623. The **first two** digits were entered incorrectly; the **last three** digits were entered correctly.

When this number was tested, the check digit was found to be correct and the input was accepted.

Identify an example of the incorrect attempt to enter 41623 and explain why this number would **not** be rejected.

Number .....

Explanation .....

.....

[2]

(b) A module `Generate()` will take an integer value representing an original number and return an integer value representing a new number which includes the check digit.

The original number is always at least three digits in length.

Write pseudocode for the module `Generate()`

Assume that the parameter is valid.

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..... [7]

5 A bank allows customers to access their accounts using an application that they can download onto a device such as a smartphone.

(a) The system that allows customers to access their accounts using the application is a client-server model.

Describe the roles of the different devices in this model.

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..... [4]

(b) The bank wants to protect the integrity of its data while transferring the data to other banks. Parity check is one example of data verification.

Complete the description of parity check when Computer A is transmitting data to Computer B.

Computer A and Computer B agree on whether to use ..... parity. Computer A divides the data into groups of ..... . The number of 1s in each group is counted. If the agreed parity is ..... and the group has an even number of 1s, a parity bit of 1 is appended, otherwise a parity bit of 0 is appended.

In a parity ..... check the bytes are grouped together, for example in a grid. The number of 1s in each column (bit position) is counted. A bit is assigned to each column to make the column match the parity. These parity bits are transmitted with the data as a parity ..... .

[5]

(c) The bank also needs to keep its customers' data private and secure.

(i) The bank's network has a firewall.

Explain how a firewall can help protect the customers' data.

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..... [3]

(ii) Customers need to use biometric authentication to access their accounts.
One biometric authentication method is facial recognition.

Facial recognition uses Artificial Intelligence (AI).

Describe how AI is used in facial recognition.

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..... [4]

2 An organisation uses a database to store data about the types of bird that people have seen.

(a) The database is managed using a Database Management System (DBMS).

(i) State what is meant by a data dictionary **and** give **one** example of an item typically found in a data dictionary.

Definition .....

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Example .....

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[2]

(ii) State what is meant by data integrity **and** give **one** example of how this is implemented in a database.

Definition .....

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Example .....

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[2]

(b) The database, `Birds`, stores information about the types of bird and the people who have seen them.

Data about each bird seen is stored with its location and data about the person who saw the bird.

Database `Birds` has the following tables:

```
BIRD_TYPE(BirdID, Name, Size)

BIRD_SEEN(SeenID, BirdID, Date, Location, PersonID)

PERSON(PersonID, FirstName, LastName, EmailAddress)
```

(i) Complete the table by identifying **two** foreign keys and the database table where each is found.

Foreign key	Database table

[2]

(ii) The database `Birds` has been normalised.

Draw **one** line from each Normal Form to the most appropriate definition.

Normal Form	Definition
First Normal Form (1NF)	All fields are fully dependent on the primary key.
Second Normal Form (2NF)	There are no repeating groups of attributes.
Third Normal Form (3NF)	There are no partial dependencies.

[1]

(iii) Part of the database table `BIRD_TYPE` is shown:

BirdID	Name	Size
0123	Blackbird	Medium
0035	Jay	Large
0004	Raven	Large
0085	Robin	Small

The database only supports these data types:

- character
- varchar
- Boolean
- integer
- real
- date
- time

Write a Structured Query Language (SQL) script to define the table `Bird_Type`.

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..... [4]

(iv) The database tables are repeated here for reference:

```
BIRD_TYPE(BirdID, Name, Size)

BIRD_SEEN(SeenID, BirdID, Date, Location, PersonID)

PERSON(PersonID, FirstName, LastName, EmailAddress)
```

Complete the SQL script to return the number of birds of each size seen by the person with the ID of J_123.

```
SELECT BIRD_TYPE.Size, ..... (BIRD_TYPE.BirdID)

       AS NumberOfBirds

FROM BIRD_TYPE, .....

WHERE ..... = "J_123"

AND BIRD_TYPE.BirdID = .....

..... BIRD_TYPE.Size;
```

[5]