1 Images are being created to advertise holidays.

Some of the images are bitmap images and some are vector graphics.

(a) Complete the table by defining the image terms.

Term	Definition
Drawing list	....
Pixel	....
Colour depth	....

[3]

(b) The bitmap images are photographs of the holiday locations.

(i) Colour depth and image resolution are both included in the file header of a bitmap image.

Identify **two other** items that could be included in the file header of each photograph.

1 .....

2 .....

[2]

(ii) One of the photographs has a bit depth of 8 bytes and an image resolution of 1500 pixels wide and 3000 pixels high.

Calculate the file size of the photograph in megabytes. Show your working.

Working .....

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.....

File size ..... MB

[2]

(c) The photographs are compressed before they are uploaded to a web server. Customers download the photographs from this web server.

(i) Explain the reasons why compressing the photographs will benefit the customers.

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..... [3]

(ii) An image can be compressed using run-length encoding (RLE).

Explain the reasons why RLE may **not** reduce the file size of a bitmap image. Give **one** example in your answer.

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..... [3]

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 .....

.....

Example .....

.....

[2]

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

Definition .....

.....

Example .....

.....

[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]

3 A computer has an Operating System (OS).

(a) Describe how the Operating System manages the peripheral hardware devices of the computer.

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..... [4]

(b) Hardware management is one key management task carried out by the Operating System.

Identify **two other** key management tasks carried out by the Operating System.

1 .....

2 .....

[2]

(c) The Operating System has utility software including defragmentation software.

Explain how defragmentation can improve the performance of the computer.

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..... [3]

(d) The computer stores data in binary form.

(i) State the difference between a kibibyte and a kilobyte.

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..... [1]

(ii) Convert the denary number 964 into Binary Coded Decimal (BCD).

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..... [1]

(iii) Convert the positive binary integer 11110010 into hexadecimal.

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..... [1]

(iv) Give the smallest **and** largest two's complement binary number that can be represented using 8 bits.

Smallest .....

Largest .....

[2]

(v) Add the following two binary integers using binary addition. Show your working.

```
  1 0 1 1 0 0 0 0
+ 0 0 0 1 1 0 1 1
```

[2]

(vi) Show the result of a 3-place right logical shift on the binary number:

11001100

..... [1]

4 A networked closed-circuit television (CCTV) system in a house uses sensors and cameras to detect the presence of a person. It then tracks the person and records a video of their movements.

Data from the CCTV cameras is transmitted to a central computer.

(a) This computer has both Read Only Memory (ROM) and Random Access Memory (RAM).

(i) Describe the contents of the ROM in the central computer.

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..... [2]

(ii) The central computer has Dynamic RAM (DRAM).

Identify **two** advantages of using DRAM instead of Static RAM (SRAM).

1 .....

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2 .....

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[2]

(b) The central computer stores the video files on secondary storage.

Describe **two** reasons why magnetic storage is more appropriate than solid state storage for this computer.

1 .....

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2 .....

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[4]

(c) The CCTV system uses Artificial Intelligence (AI) to identify the presence of a person in the house and to track their movements.

Describe how AI is used in this system.

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..... [3]

(d) The CCTV cameras are connected to a network and transfer their data wirelessly to the central computer.

(i) Each device on the network has an IP address.

Complete the description of IP addresses.

An IPv4 address contains ..... groups of digits. Each group is represented in ..... bits and the groups are separated by full stops.

An IPv6 address contains ..... groups of digits. Each group is represented in ..... bits. Multiple groups that only contain zeros can be replaced with a ..... .

[5]

(ii) The network makes use of subnetting.

Describe **two** benefits of subnetting a network.

1 .....

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2 .....

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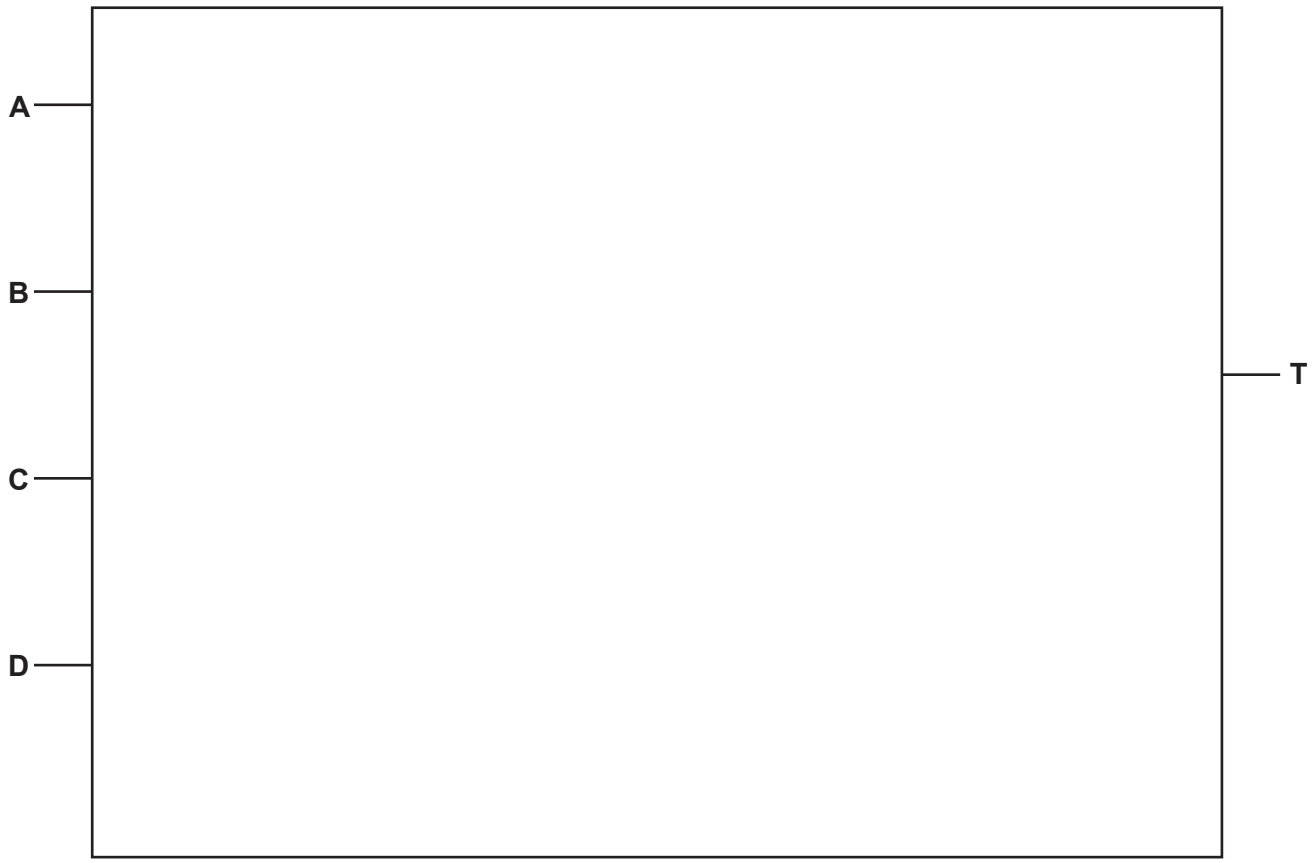
[4]

5 **(a)** Draw the logic circuit for this logic expression:

T = (NOT **A** OR **B**) XOR (**C** NAND **D**)



[2]

(b) Describe the function of the NAND and NOR logic gates.

NAND .....

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NOR .....

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[2]

6 An interrupt is generated when a key is pressed on a computer keyboard.

Explain how the computer handles this interrupt.

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..... [5]