Data Representation

1.3 Data Storage and file compression

1 (c) A company advertises its backup memory device as having 500 GB of storage.
A customer wishes to know how many 8 MB files could be stored on the device.

The company claimed that up to 62 500 files (assuming each file is 8 MB) could be stored.

The customer calculated that 64 000 files could be stored.

Explain the difference between these two storage values. Show any calculations you use in your explanation.

....

....

....

....

....

....

.... [3]

2 (a) Nicolae made the following statement:
"data input is validated by typing it in twice"

State why this statement is incorrect.

....

.... [1]

(b) Nicolae needs to send 30 photos to a friend and he chooses to send all 30 together as a single email attachment. Each photo is 1.8 MB in size, but the maximum possible attachment size is only 20 MB.

State how Nicolae can solve this problem.

....

.... [1]

3   Seven computer terms and seven descriptions are shown below.

Draw a line to link each computer term to its most appropriate description.

Computer term	**Description**

| Interface | Reduction of file size by permanently removing some redundant information from the file |

| Interrupt | File compression format designed to make photo files smaller in size for storage and for transmission |

| JPEG | File compression system for music which does not noticeably affect the quality of the sound |

| Lossless compression | Hardware component that allows the user to communicate with a computer or operating system |

| Lossy compression | The file is reduced in size for transmission and storage; it is then put back together again later producing a file identical to the original |

| MIDI | Signal sent to a processor which may cause a break in execution of the current routine, according to priorities |

| MP3 format | Standard adopted by the electronic music industry for controlling devices such as synthesisers and sound cards |

[6]

4   A security system records video footage. One minute of video requires 180 MB of storage. The recording system can store several hours of video footage.

(a) Name and describe a suitable storage device for this recording system.

....

....

....

.... [2]

(b) Calculate how much storage would be needed for 2 hours of video footage.

Show your working and give the answer in Gigabytes (GB).

....

....

....

.... [2]

5 MP3 file compression reduces the size of a music file by 90%.

(a) A music track is 80 MB in size.

Calculate the file size after compression.

....

How many MP3 files of the size calculated above could be stored on an 800 MB CD?

....
[2]

(b) (i) Explain how MP3 files retain most of the original music quality.

....

....

....

....

....
[2]

(ii) State the type of file compression used in MP3 files.

.... [1]

(iii) Name another file compression format.

.... [1]

6   Steffi has a number of files of different sizes that contain her work.

Tick (✓) to show whether each statement is **true** or **false**.

Statement	true (✓)	false (✓)
47KB is larger than 10MB.		
250bytes is smaller than 0.5MB.		
50GB is larger than 100MB.		
1TB is smaller than 4GB.		

[4]

7 **(a)** Gurdeep wants to send a large file to Jennifer over the Internet.

State **two** benefits of compressing the file to send it.

Benefit 1 ....

....

....

Benefit 2 ....

....

....

[2]

(b) Two types of compression are lossy and lossless.

Choose the most suitable type of compression for the following and explain your choice.

(i) Downloading the code for a computer program:

Type of compression ....

Explanation ....

....

....

....

[3]

(ii) Streaming a video file:

Type of compression ....

Explanation ....

....

....

....

[3]

8 Data files are stored in different file formats.

Complete the table by providing a suitable file format for each file type. The first one has been done for you.

File type	File format
Pictures	.JPEG
Text	
Sound	
Video	

[3]

9 **(a)** A computer has 2048 MB of RAM.

How many GB of RAM does the computer have?

Show your working.

....

....

....

.................................GB   [2]

10 Michele wants to email a file to Elsa. The file is too large so it must be compressed.

(a) Name **two** types of compression that Michele could use.

Compression type 1 ....

Compression type 2 ....

[2]

(b) The file Michele is sending contains the source code for a large computer program.

Identify which type of compression would be most suitable for Michele to use.

Explain your choice.

Compression type...

Explanation...

....

....

....

....

....
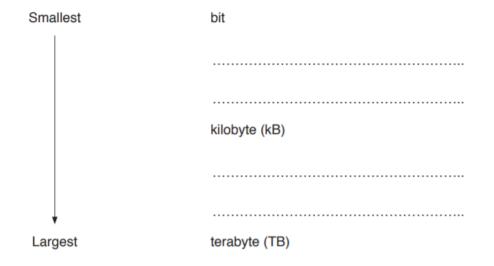
[4]

11   Different units of data can be used to represent the size of a file, as it changes in size.

Fill in the missing units of data, using the list given:

- byte
- gigabyte (GB)
- megabyte (MB)
- nibble

The units of data increase in size from smallest to largest.

Smallest   bit

....

....

kilobyte (kB)

....

....

Largest   terabyte (TB)

[4]

12   **(a)**   Nancy has captured images of her holiday with her camera. The captured images are stored as digital photo files on her camera.

Explain how the captured images are converted to digital photo files.

....

....

....

....

....

....

....

.... [4]

(b) Nancy wants to email the photos to Nadia.

Many of the photos are very large files, so Nancy needs to reduce their file size as much as possible.

Identify which type of compression would be most suitable for Nancy to use. Explain your choice.

Compression type ....

Explanation ....

....

....

....

....

....

[4]

13 **(a)** Computer files can be saved in different file formats.

Four file formats and **four** file types are given.

Draw a line to match each file format to the most suitable file type.

File format	**File type**
.jpeg	Text file
.mp3	Image file
.mp4	Audio file
.txt	Video file

[3]

(b) Jamelia wants to store an image file. The image has an 8-bit resolution and is 150 pixels by 100 pixels in size.

Calculate the file size of the image. Give your answer in kilobytes (kB). Show all of your working.

....

....

....

....

....

....

File size .... kB

[3]

(c) Large files can be compressed to reduce their file size.

Two types of compression that can be used are lossy and lossless.

Explain how a file is compressed using lossless compression.

....

....

....

....

....

.... [3]

(d) The table contains **four** different file formats that use compression.

Tick (✔) to show whether each file format uses **lossy** or **lossless** compression.

File format	Lossy (✔)	Lossless (✔)
.jpeg		
.mp3		
.mp4		
.zip		

[4]

14   The following text is stored as a text file:

> She sells sea shells on the seashore. The shells that she sells are sea shells I am sure.

Explain how lossless compression would compress this file.

....

....

....

....

....

....

....

....

.... [5]

15 Computer memory size is measured in multiples of bytes.

Four statements about computer memory sizes are given in the table.

Tick (✓) to show if the statement is **True** or **False**.

Statement	True (✓)	False (✓)
25 kB is larger than 100 MB		
999 MB is larger than 50 GB		
3500 kB is smaller than 2 GB		
2350 bytes is smaller than 2 kB		

[4]

16 Audrey wants to send a sound file to Nico using email.

The file is too large to attach to an email so Audrey decides to compress the file.

She uses lossy compression to reduce the size of the sound file.

(a) Describe how lossy compression reduces the size of the sound file.

....

....

....

....

....

....

....

.... [4]

(b) Nico asks Audrey why she used lossy compression rather than lossless.

    (i) State **one** advantage Audrey could give of using lossy rather than lossless to compress the sound file.

    ....

    .... [1]

    (ii) State **one** disadvantage Nico could give of using lossy rather than lossless to compress the sound file.

    ....

    .... [1]

(c) Audrey sometimes records MIDI files.

    (i) Explain what is meant by a MIDI file.

    ....

    ....

    ....

    ....

    ....

    ....

    ....

    .... [4]

(ii) MIDI uses serial data transmission.

Explain **two** advantages of using serial transmission rather than parallel transmission.

Advantage 1 ....

....

....

....

Advantage 2 ....

....

....

....

[4]

17 Audrey wants to send a sound file to Nico using email.

The file is too large to attach to an email so Audrey decides to compress the file.

She uses lossy compression to reduce the size of the sound file.

(a) Describe how lossy compression reduces the size of the sound file.

....

....

....

....

....

....

....

.... [4]

18 Nina is recording some music tracks that she has written. She is researching whether she should record them in MIDI or MP3 format.

Explain what is meant by MIDI and MP3 format.

MIDI ....

....

....

....

MP3 ....

....

....

....

[4]

19 A music company has a website that allows users to stream music. The music is stored in sound files.

(a) The sound files are compressed using lossless compression.

(i) Describe how the sound files are compressed using lossless compression.

....

....

....

....

....

....

....

....

....

.... [4]

(ii) State **one** reason why the music company would compress the sound files using lossless, rather than lossy, compression.

....

.... [1]

(iii) Give **one** benefit, to the user, of the music company compressing the sound files.

....

.... [1]

(iv) Give **one** drawback of the music company using lossless, rather than lossy, compression for the sound files.

....

.... [2]

20 Jolene displays videos on her website. She uses lossy compression to reduce the file size of the videos.

(a) Describe how lossy compression reduces the file size of the videos.

....

....

....

....

....

.... [3]

(b) State **two** reasons why Jolene would use lossy rather than lossless compression for the videos.

Reason 1 ....

....

Reason 2 ....

....
[2]

21 Georgia is a wedding photographer. She wants to store 10 photographs on a USB flash memory drive for a customer. Each photograph is 100 pixels wide and 50 pixels high.

The photographs are 8-bit colour photographs.

(a) Calculate the total file size, in kilobytes (kB), of all the photographs. For this calculation, you may use the unit of measurement of 1024 or 1000.

Show all your working.

....

....

....

....

....

....

....

Answer .... kB

[3]

(b) Georgia compresses photographs to store them on the USB flash memory drive. It is important that the compression does **not** affect the quality of the photographs in any way.

State which type of compression is the most suitable. Justify your choice.

Compression type ....

Justification ....

....

....

....

[3]

(c) Georgia uses a digital camera. The digital camera takes a photograph that is then converted into a digital image.

Complete the paragraph about the operation of a digital camera, using the most appropriate terms from the list. **Not** all terms in the list need to be used.

- analogue-to-digital
- binary
- charge-coupled
- digital-to-analogue
- lens
- light
- mirror
- pixel
- reflection
- sensor
- storage

When Georgia pushes the button to take a photograph, an aperture opens at the front of

the camera to allow .... to stream in through

the .... This is captured by a sensor called a

.... device. The ....

converter then converts each .... into a digital value.

[5]

22 Sammi works for a finance company and has a laptop that he uses for his work. He has confidential data about his customers stored on his laptop.

Sammi does **not** connect the laptop to any networks.

(a) Sammi is concerned about his customers' confidential data being viewed by other people in his office.

One method he uses to prevent others viewing the data is encryption.

Identify **three** other methods Sammi could use to prevent his customers' confidential data being viewed.

1 ....

2 ....

3 ....

[3]

(b) Sammi creates videos for the finance company website that give customers advice about their finances.

He uses lossy compression to reduce the file size of the videos for the website.

(i) Give **three** ways that lossy compression can reduce the file size of the videos.

1 ....

....

2 ....

....

3 ....

....

[3]

(ii) Give **one** drawback of using lossy compression to reduce the file size of the videos.

....

.... [1]

(c) Sammi could have used lossless compression to compress the videos for the website.

(i) Give **one** reason why he would use lossless compression, rather than lossy compression, for the videos.

....

.... [1]

(ii) Give **two** disadvantages of Sammi using lossless compression, rather than lossy compression, for the videos.

Disadvantage 1 ....

....

Disadvantage 2 ....

....

[2]

23 (a) Xia has **three** files stored on her computer.

Tick (✓) **one** box to show which is the largest file size.

File size	Tick (✔)
999 kB	
1 MB	
850 000 bytes	

[1]

(b) Denise has **three** files stored on her computer.

Tick (✓) **one** box to show which is the smallest file size.

File size	Tick (✔)
4000 MB	
2 GB	
2 500 000 kB	

[1]

24 Julius creates a computer application that calculates how many years it will take to pay for a house.

(a) Julius uploads his application to his website for people to download. Before he uploads the application, he translates the code using a compiler.

Explain why Julius uses a compiler, rather than an interpreter, to do this.

....

....

....

....

....

....

....

.... [4]

(b) Julius also creates videos to explain how to use the application that he has created. He reduces the file size of the videos using lossless compression.

(i) Describe how lossless compression reduces the file size of the video.

....

....

....

....

....

.... [3]

(ii) State why Julius uses lossless compression, rather than lossy compression.

....

.... [1]

25 Jack has an MP3 file stored on his computer.

    (a) **(i)** Tick (✓) to show which type of data is stored in an MP3 file.

Tick (✓)

Video   ☐

Sound   ☐

Image   ☐

[1]

        (ii) Tick (✓) to show whether the MP3 file is a lossy compressed file or a lossless compressed file or **not** a compressed file.

Tick (✓)

Lossy compressed file   ☐

Lossless compressed file   ☐

Not a compressed file   ☐

[1]

26 An image is stored on a computer. The image is 16-bit colour and is 100 pixels high and 150 pixels wide.

Calculate the file size of the image in bytes. Show all your working.

....

....

....

....

....

Answer .... bytes

[3]

27 Frida has a JPEG file stored on her computer.

(a) Tick (✓) to show which type of data is stored in a JPEG file.

Tick (✓)

Video ☐

Sound ☐

Image ☐

[1]

(b) Compression can be used to reduce the size of a file.

Tick (✓) to show whether the JPEG file is a lossy compressed file or a lossless compressed file or **not** a compressed file.

Tick (✓)

Lossy compressed file ☐

Lossless compressed file ☐

Not a compressed file ☐

[1]

(c) Frida scans a text document into her computer so that she can store a digital version. She uses a 2D scanner to do this.

Describe how the text document is scanned by the 2D scanner to create the digital version.

....

....

....

....

....

....

....

.... [4]

(d) Frida compresses the document for storage.

The compression algorithm she uses recognises repeating patterns in the data and indexes these patterns. No data is permanently removed.

Identify the type of compression Frida has used.

.... [1]

28 Jessica wants to store a large number of small thumbnail images on a USB flash memory drive. Each thumbnail image is 16-bit colour and is 100 pixels wide and 100 pixels high.

She has 5 MB of storage space available on her USB flash memory drive.

Calculate how many images she can store in the 5 MB of storage space. Show all your working.

....

....

....

....

....

....

Number of images ....

[4]

29 **(b)** Tick (✓) to show whether the videos are MP3 files, MP4 files or MIDI files.

Tick (✓)

MP3 files ☐

MP4 files ☐

MIDI files ☐

[1]

(c) The video files are compressed using lossy compression.

Give **two** benefits of using lossy compression to compress the video files.

Benefit 1 ....

....

Benefit 2 ....

....

[2]

30 **(b)** Text that is input into a computer can be stored in a text file.

A text file can be compressed using lossless compression.

(i) State what effect this has on the file size.

....

.... [1]

(ii) Describe how lossless compression compresses the text file.

....

....

....

....

....

....

....

.... [4]

(iii) Give **two** reasons why the text file may have been compressed.

1 ....

....

2 ....

....
[2]

31 Data can be measured in bits.

(a) Give the name of the data storage measurement that is equal to 8 bits.

.... [1]

(b) State how many bits there are in a kibibyte (KiB).

.... [1]

(c) Give the name of the data storage measurement that is equal to 1024 gibibytes (GiB).

.... [1]

(d) A 16-bit colour image has a resolution of 512 pixels wide by 512 pixels high.

Calculate the file size of the image in kibibytes (KiB). Show all your working.

....

....

....

....

....

Answer .... KiB

[3]

32 The size of a file can be measured in different units.

(a) State how many bits there are in a byte.

.... [1]

(b) State how many kibibytes (KiB) there are in 2 mebibytes (MiB).

.... [1]

(c) Identify the unit of data that is equal to 4 bits.

.... [1]

33   The size of a file can be measured using different units.

(a) Tick (✓) **one** box to show which of these is **not** a unit of measurement for a file.

A   bit   ☐

B   bot   ☐

C   nibble   ☐

D   byte   ☐

[1]

(b) The size of a file can be reduced by compressing it.

(i)   Give **two** types of compression that can be used to reduce the size of a file.

1 ....

2 ....

[2]

(ii)   Give **three** benefits of reducing the size of a file for storage and transmission.

1 ....

....

2 ....

....

3 ....

....

[3]

34 Data storage can be measured using different units of measurement.

(a) Identify the name of the smallest unit of measurement of data.

.... [1]

(b) State how many nibbles there are in 2 bytes.

.... [1]

(c) A 10 second sound effect is recorded for a movie.

It is recorded with a sample rate of 22,016 Hz and a sample resolution of 8 bits.

Calculate the file size of the sound effect in kibibytes (KiB). Show all your working.

....

....

....

....

....

....

Answer .... KiB

[3]

(d) The sound effect file is compressed for storage.

(i) State what is meant by file compression.

....

.... [1]

(ii) Give **one** benefit of compressing the file for storage.

....

.... [1]

35 An employee has a report that they need to email to their employer.

The employee compresses the report file before emailing it.

(a) State the effect the compression has on the report file.

....

.... [1]

(b) Give **two** benefits of compressing the report file before emailing it.

1 ....

....

2 ....

....
[2]

(c) The employee decides to use lossless compression to compress the file.

Explain why lossy compression is **not** suitable.

....

....

....

....

....

.... [3]