

MULTIMEDIA



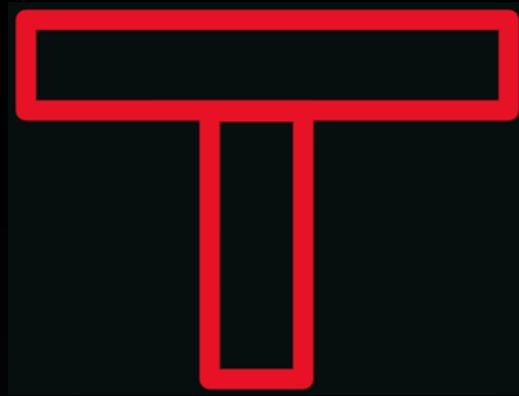
Papers Dock

COMPUTER SCIENCE 9618 PAPER I

Images



Bitmap



Vector

Each Box is a pixel by
combining pixels Bitmap
Image is created

Drawing Objects ,
Shapes and instructions
to make them are store
which makes vector
graphics

Pudding Dock

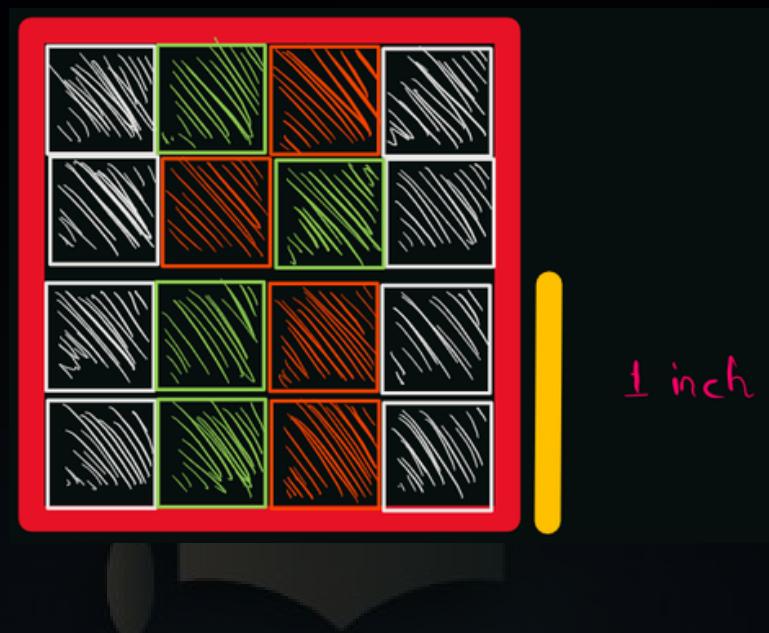
Vector Graphics : Images made up of drawing objects, the properties of each object determines its shape and appearance.

Bitmap Images : Images store as an array of individual pixels in the format of rows and columns.

Bitmap

Pixel : A single square of one color and the smallest addressable element in an image

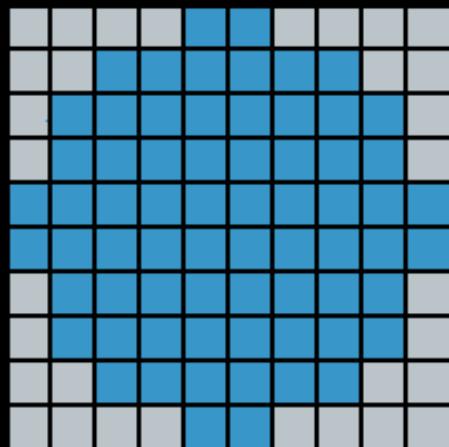
Image Resolution



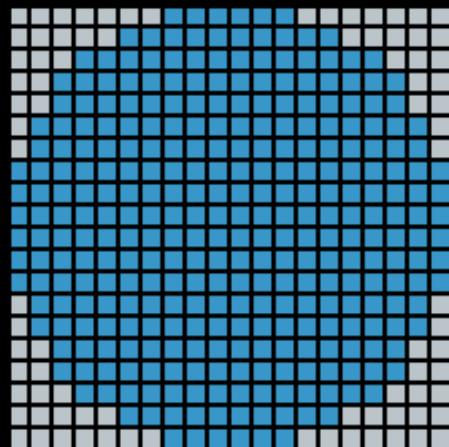
Measure in pixels per inch, this value determines the amount of detail an image has.

Higher Image Resolution means that there are more pixels per inch resulting in more pixel information and creating high quality images.

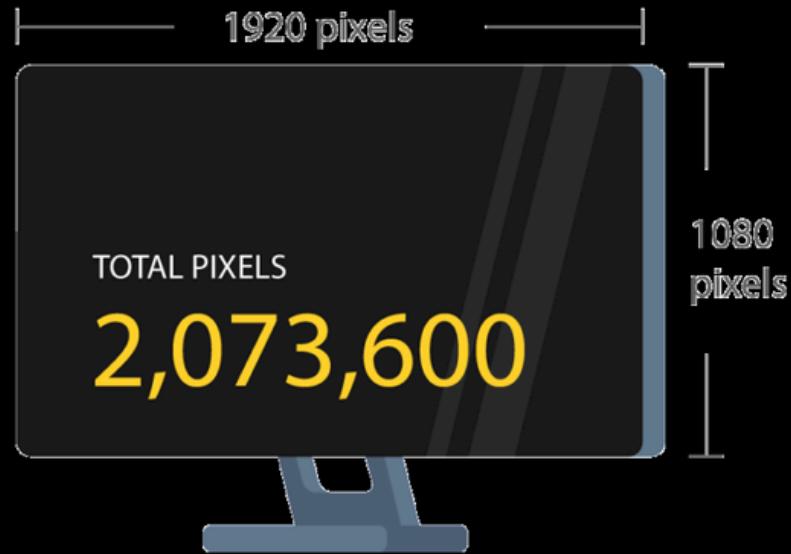
10 PPI



20 PPI



Screen Resolution



Number of pixels which can be viewed horizontally and vertically on the screen

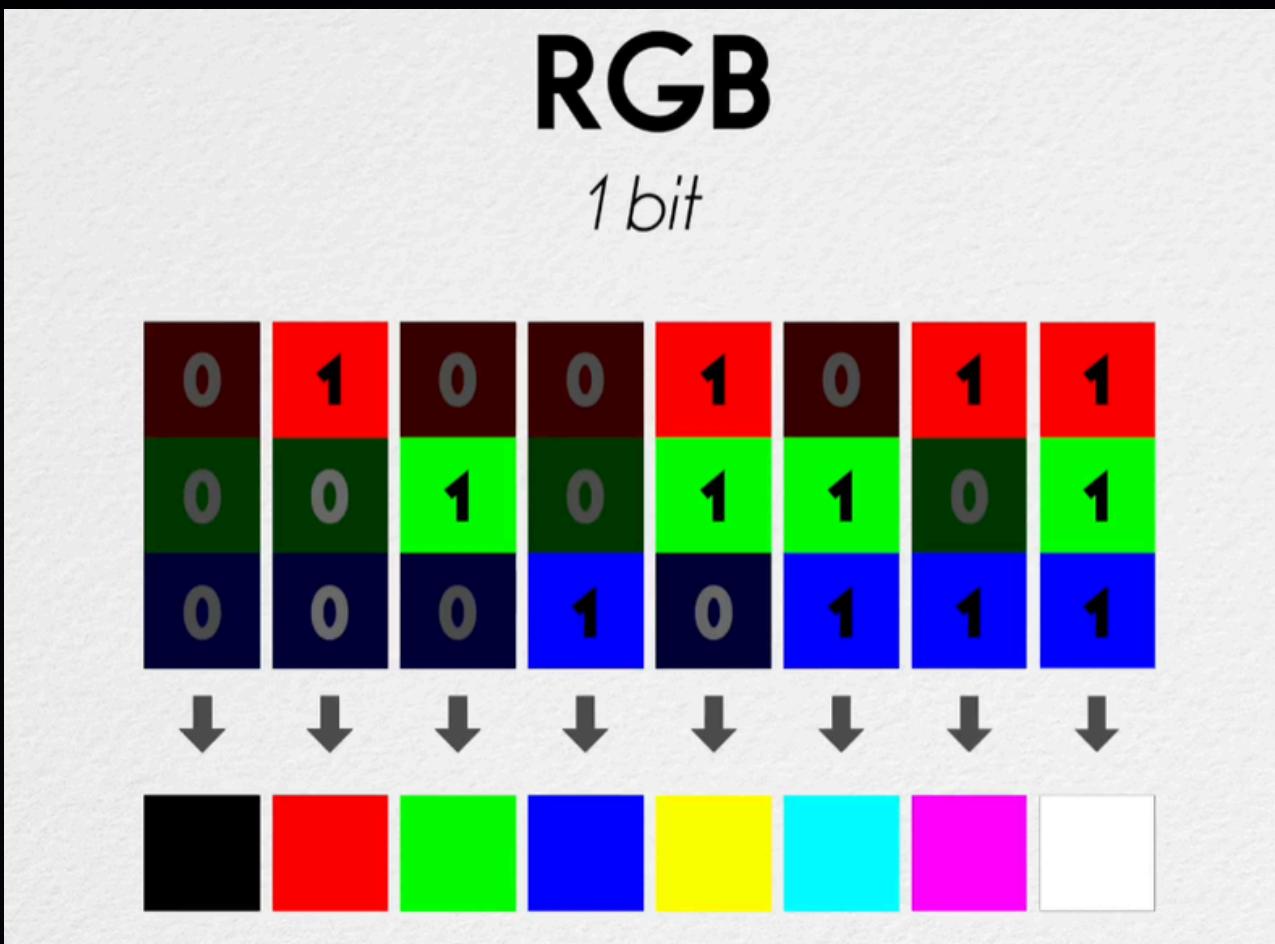
Color Depth / Bit Depth

Number of bits allocated to represent each pixel color.



The amount of colors that an image can have depends on Color Depth. If we increase the Color depth that means more binary combinations can be made which means that more colors can have a binary value

1 bit	2 bits	3 bits	...	8 bits
0	00 01 10 11	000 001 010 011 100 101 110 111		



The number of colors depends on how many different combinations of 0 and 1 we can make by using bits. More combination means more colors for example if I have one bit per pixel that means 2 combination so two colors can be represented. (Either 0 or 1). So to find out how many combinations are there we use 2 raise to the power of number of bits.

Exam Style Question

Maximum number of colours

68

256

127

2

249

Minimum number of bits

1

2

3

7

8

9

[3]

Metadata : Data about data , for example filename, file format, color depth

File Header : Data about the bitmap image such as image size, number of pixels, Type of compression, color depth, file location

How Images Are Encoded Into A Digital Format

- The images are stored as bitmap images.
- Each Image is made up of pixels.
- Each pixel is of a single color.
- Sequence of binary numbers is stored of each image



Features Of Graphic Editing Software

- Re-Size

Increase / Decrease the size of the image

- Crop

Remove certain part of the image

- Blur

Reduce the focus

- Red-Eye Reduction

Reduces red light reflected from human eye

Effects Of Changing The Bit Depth

- The number of bits used to represent each color
- Increase in bit depth means the image has a greater range of colors and Decrease in bit depth means the image has a smaller range of colors
- Increase in bit depth makes the image closer to the original. whereas Decrease in bit depth makes the image like less realistic

Impacts Of Increasing Image Resolution On The Quality Of A Bitmap Image

- more pixels can be stored
- the image is sharper and less pixelated

Impacts Of Decreasing Image Resolution On The Quality Of A Bitmap Image

- less pixels can be stored
- the image is more pixelated

Vector Graphics

What are the features of vector graphics ?

- **Vector graphics stores a set of instructions about how to draw the shape.**
- **Can be enlarged without the image being pixelated**
- **Do not compress well**
- **Individual elements of a vector graphics can be grouped**
- **Suitable for more geometric shapes.**

benefits of using vector graphics

- **Can resize it without pixilation**
- **Images are redrawn with each adjustment**
- **Smaller file size**
- **Storing commands not individual pixels**
- **Can be transferred quicker and download quicker.**

Vector Graphic Terms

Property : data about the shapes (Diameter), characteristics of a component

Drawing List : The list of shapes involved in an image (Circle), and the data required to create all the components in the graphics

Drawing Objects : The object made with different shapes (Pac Man), a component created using a formula

Describe the contents of a vector graphic drawing list ?

- **List of objects in the drawing**
- **A list that stores the command/description/equation required to draw each object**
- **Properties of each object e.g. the fill colour, line weight/colour**

Describe differences between vector graphics and a bitmap image ?

- **Bitmap is made up of Pixels**
- **Vector Graphics store a set of instructions about how to draw the image**
- **When Bitmap is enlarged the pixels get bigger and it pixelates.**
- **When vectors graphic is enlarged it is recalculated and redrawn and does not get pixelated.**
- **Bitmap files are usually bigger than vector graphics files because of the needs to store data about each pixel**
- **Vector graphics have smaller file size because they contain just the instructions to create the shape**
- **Bitmap image can be compressed with significant reduction in file size.**
- **Vector graphics images do not compress well because of the little redundant data and we can not compress the instructions.**

Prefixes

Binary Prefixes	Decimal Prefixes
Kibibyte	Kilobyte
Mebibyte	Megabyte
Gibibyte	Gigabyte
Tebibyte	Terabyte

Binary prefixes are based on powers of 2 (1 KiB = 1024 bytes), while decimal prefixes are based on powers of 10 (1 KB = 1000 bytes). The two exist because binary prefixes are more accurate for computing, while decimal prefixes are used in marketing and storage devices to make numbers look larger. This difference often leads to confusion when comparing file sizes or storage capacity.



- **Smallest Unit is Bit**
- **One byte contains 8 bits**
- **4 bits are known as nibble**
- **One Kilobyte contains 1000 bytes**
- **One Kibibyte contains 1024 bytes**
- **One Megabyte contains 1000 Kilobytes**
- **One Mebibyte contains 1024 Kilobytes.**

Exam Style Question

1 (a) Draw one line from each binary value to its equivalent (same) value on the right.

Binary value

8 bits

8000 bits

1000 kilobytes

1024 mebibytes

8192 bits

1 kibibyte

1 gigabyte

1 byte

1 kilobyte

1 gibibyte

1 megabyte

1 mebibyte

File Size Calculation

**Size = (Width Pixels) x (Height Pixels) x (Color Depth)
Unit (Bits)**



4 X 4 will give you total number of pixels in the image shown above (16 pixels) . And if the color depth is 2 bits per pixel and we have 16 pixels that means $16 \times 2 = 32$ bits.

Exam Style Question

A photograph is stored as a bitmap image.

- (a) The photograph has a resolution of 4000 pixels wide by 3000 pixels high. The bit depth is 4 bytes.

Calculate an estimate for the file size of the photograph in megabytes.

Show your working.

Working

.....

Answer megabytes

[2]

2(a)	<p>1 mark for working:</p> <ul style="list-style-type: none">• $4000 * 3000 * 4$ <p>1 mark for correct answer:</p> <ul style="list-style-type: none">• 48MB	2
------	--	---

(c) A bitmap image has a resolution of 2048 pixels wide and 1024 pixels high.

The image has a bit depth of 10 bits per pixel.

Estimate the file size of the bitmap image in mebibytes. Show your working.

Working

.....

.....

.....

.....

.....

.....

Estimated file size in mebibytes

[2]

6(c)	1 mark for answer, 1 mark for working Answer: 2.5 mebibytes Working: $(2048 \times 1024 \times 10) / (8 \times 1024 \times 1024)$	2
------	---	----------



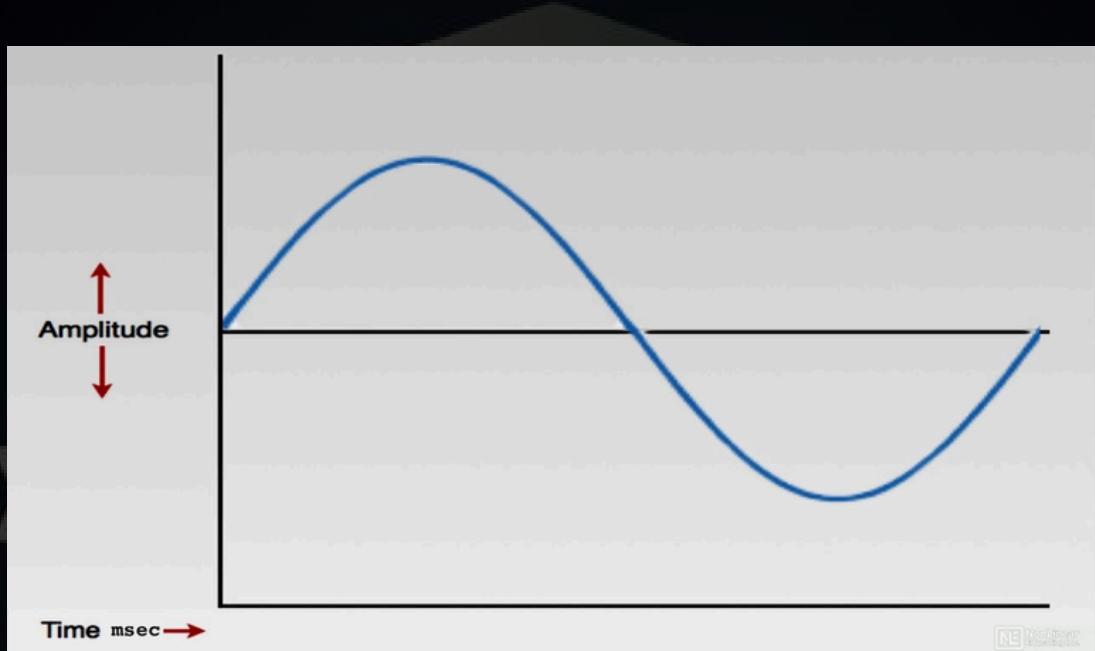
Sound

Digital Data : Data that has been stored as binary value which can be either 0 or 1

Analogue Data : Data values that are continuously changing

Sampling

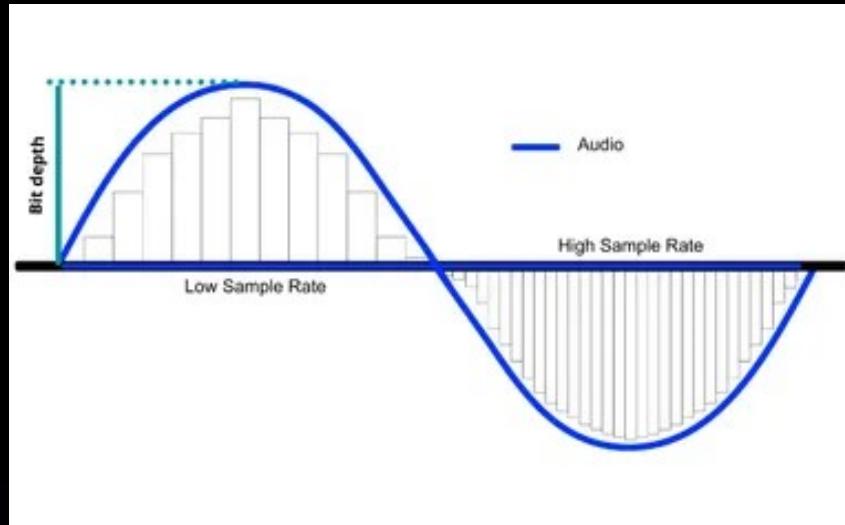
Taking measurement at regular time interval



Sampling : Taking measurement of sound at regular time interval

Sampling Rate : The number of samples taken per second measured in hertz.

Sampling Rate : The number of bits used to store each sample



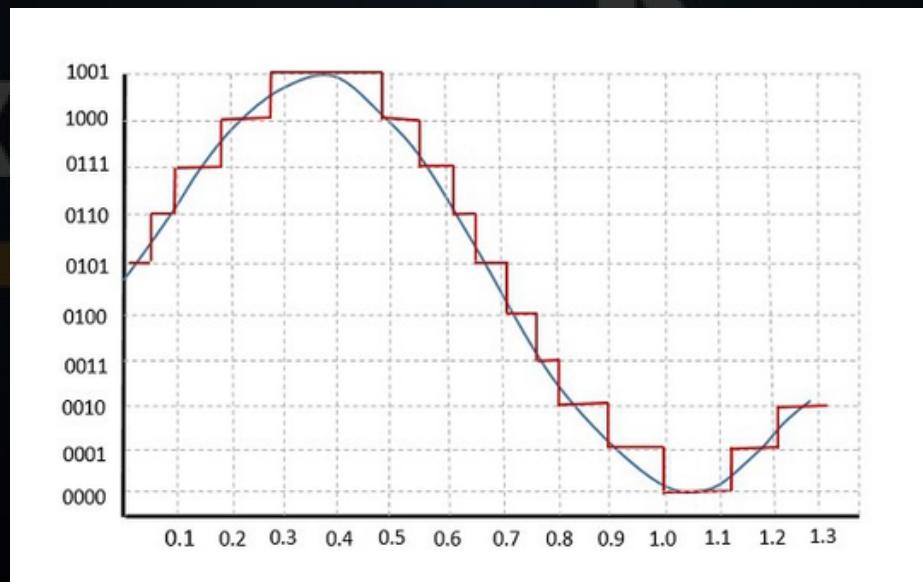
High Sample Rate = Higher Accuracy

How sampling is used to record the sound of clip

- The amplitude of the sound wave is determined
- at set time interval
- to get an approximation of the sound wave
- each amplitude is given a corresponding binary number
- The binary number of each amplitude is saved in sequence
- Increasing the sampling rate will improve the accuracy of the recording

Quantization Error

Analogue
Digital



Analogue - Digital = Quantization Error

Quantization Error is the difference between the analogue signal and the closest digital value at each sampling instant

Impacts Of Changing Sampling Rate And Sampling Resolution

Effects of increasing sampling rate

The greater the sampling rate, greater the accuracy but file size increases. Smaller gaps between so lesser Quantization Error. more accurate representation of sound and the digital waveform gets closer to original analogue waveform

Effects of increasing Sampling Resolution

- Increasing sampling resolution means more bits per sample
- Larger range of values means larger file size
- more accurate representation of sound and the digital waveform gets closer to original analogue waveform
- reduces quantization error
- greater range of values can be stored

Benefits of using higher Sampling Resolution

- Allow for large dynamic range
- More accurate representation

Drawbacks of using higher Sampling Resolution

- Bigger file so occupies more storage
- Longer to transmit data / download
- Greater processing power needed

A second video is recorded. The sound in the second video needs to be more precise.

Explain the reasons why increasing the sampling rate and the sampling resolution will improve the precision of the second recording.

Sampling rate

- There are smaller 'gaps' in the sound wave // sound is recorded more often
- Digital waveform is closer to the analogue waveform
- The quantization errors are smaller

Sampling resolution

- There are more bits per sample // a wider range of amplitudes can be stored
- Each binary amplitude/note (in the digital recording) is closer to the analogue amplitude/note
- Digital waveform is closer to the analogue waveform
- The quantisation errors are smaller

The digital camera has a microphone which is used to record the sound for the video.

The user changes the sampling rate that the microphone uses from 44.1 kHz to 88.2 kHz.

Describe how this change in sampling rate will affect the performance of the video doorbell.

- Data transmission to user's smartphone will take longer
- because there is more data to transmit
- The secondary storage device will fill faster
- fewer videos will be able to be stored long-term and videos are overwritten more often

A Explain the impact of changing the sampling resolution on the accuracy of a sound recording

Increase sampling resolution

- The number of bits used for each sample is increased
- there will be more values available to represent each sample and more amplitudes can be represented
- each binary amplitude in the digital recording is closer to the analogue amplitude
- quantization errors are reduced
- the digital soundwave is closer to the original analogue soundwave

Decrease sampling resolution

- The number of bits used for each sample is decreased
- fewer amplitudes can be stored
- each binary amplitude in the digital recording is further from the analogue amplitude
- quantization errors are increased
- the digital soundwave is less like the original analogue soundwave

Features Of Graphic Editing Software

- Edit start time or stop time
- Delete part of a clip
- Frequency of sound can be altered
- Fade in / Fade out of a clip
- Mix multiple sound tracks
- use of filters
- conversion between different audio file format

File Size Calculation

File Size (bits) = Sampling Rate x time x Sampling Resolution

Papers Dock

Multimedia

Question 1

1 Anya scans an image into her computer for a school project.

(a) The scanned image is a bitmapped image.

(i) Complete the following table to describe the two terms about graphics.

Term	Description
Pixel
File header

[2]

(ii) The image is scanned with an image resolution of 1024×512 pixels, and a colour depth of 8 bits per pixel.

Calculate an estimate for the file size, giving your answer in mebibytes. Show your working.

Working
.....
.....
.....

Answer mebibytes

[3]

Question 2

1 (a) Draw **one** line from each binary value to its equivalent (same) value on the right.

Binary value

8 bits

8000 bits

1000 kilobytes

1024 mebibytes

8192 bits

1 kibibyte

1 gigabyte

1 byte

1 kilobyte

1 gibibyte

1 megabyte

1 mebibyte

[5]

Question 3

- 7 Bobby is recording a sound file for his school project.
- (a) He repeats the recording of the sound several times, with a different sample rate each time.
- (i) Describe the reasons why the sound is closer to the original when a higher sample rate is used.

.....
.....
.....
.....

[2]

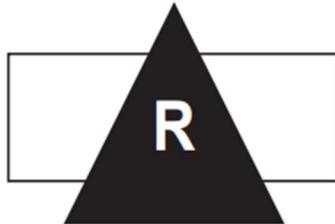
- (ii) Describe the reasons why the sound file size increases when a higher sample rate is used.

.....
.....
.....
.....

[2]

Question 4

- 5 Riya has created the following logo as a vector graphic.



- (a) Complete the table by writing a description of each vector graphic term **and** give an example for this logo.

Term	Description	Example from logo
Property		
Drawing list		

[4]

(b) Riya takes a photograph using a digital camera. The photograph is stored as a bitmap image.

(i) Describe **two** differences between a vector graphic and a bitmap image.

1

.....

.....

.....

2

.....

.....

.....

[4]

Question 5

1 Computers store data in binary form.

(a) State the difference between a tebibyte and a terabyte.

..... [1]

Question 6

- 1 (a) Draw **one** line from each image representation term to its correct definition.

Term	Definition
Pixel	The number of pixels wide by the number of pixels high
Bit depth	The smallest identifiable component of an image
Image resolution	Stores data about the image file, e.g. file format, number of bits per pixel, file size
File header	The number of bits used to represent each colour

[3]

- (b) The following section of a bitmap image is 10 pixels wide and 5 pixels high. In this example, each colour is represented by a letter, e.g. B is blue.

B	B	B	B	B	B	B	B	B	B
Y	Y	P	Y	Y	Y	P	Y	Y	Y
R	R	M	R	P	K	T	T	R	R
B	O	P	Y	Y	Y	P	G	P	P
R	O	R	P	P	P	R	R	R	R

The complete image can have up to 256 colours.

- (i) Identify the smallest number of bits that can be used to represent each colour in the complete bitmap image.

..... [1]

- (ii) Calculate an estimate for the file size of the section of the bitmap image shown, giving your answer in bytes. Use your answer from part (b)(i).

Show your working.

Working
.....
.....

Answer bytes

[2]

- (c) Describe how changing the colour depth of an image affects its file size.

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

Question 7

- (d) Sound samples are recorded and saved in a file.

- (i) State what is meant by **sampling rate**.

..... [1]

- (ii) Explain the effect of increasing the **sampling resolution** on the sound file.

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

Question 8

(b) The student records a sound file.

(i) Explain the effect of increasing the sampling rate on the accuracy of the sound recording.

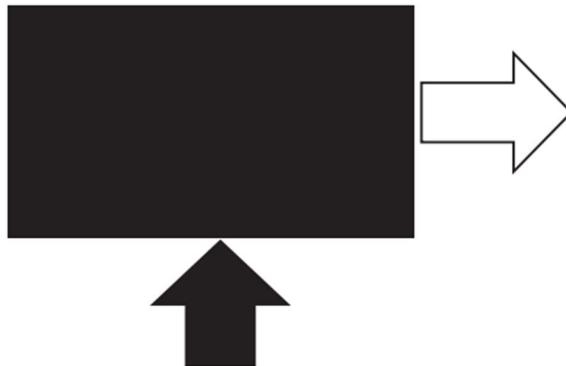
.....
.....
.....
..... [2]

(ii) Explain the effect of decreasing the sampling resolution on the file size of the sound recording.

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

Question 9

- 8 The following bitmap image has a resolution of 4096×4096 pixels and a colour depth of 24 bits per pixel.



The image is displayed on a monitor that has a screen resolution of 1920×1080 pixels.

- (a) Tick () **one** box in each row to identify the effect of each action on the image file size.

Action	Increases the file size	Decreases the file size	No change to the file size
Change the colour depth of the image file to 16 bits per pixel.			
Change the screen resolution to 1366×768 pixels.			
Change the colour of the rectangle from black to red.			

[2]

- (b) State **two** benefits of creating a vector graphic instead of a bitmap image.

1

.....

2

.....

[2]

Question 10

1 A digital audio message needs to be recorded.

- (a) Tick (\checkmark) **one** box in each row to identify the effect of each action on the accuracy of the recording.

Action	Accuracy increases	Accuracy decreases	Accuracy does not change
Change the sampling rate from 40 kHz to 60 kHz.			
Change the duration of the recording from 20 minutes to 40 minutes.			
Change the sampling resolution from 24 bits to 16 bits.			

[2]

- (b) The audio message is recorded with a sampling rate of 50 kHz and a sampling resolution of 16 bits.

The recording is 20 minutes in length.

Calculate the file size of the recording.

Give your answer in megabytes **and** show your working.

Working
.....
.....
.....

Answer megabytes

[2]

Question 11

- (e) The photographs are stored as bitmap images.

Complete the statements about bitmap images by writing the missing words.

The of a bitmap image is the number of bits that are used to store each pixel.

Metadata about the image is stored in the of the file.

[2]

Question 12

- 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

.....

.....

File size MB

[2]

Question 13

(d) The computer stores data in binary form.

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

.....

[1]

Question 14

(c) The video includes a sound recording.

(i) Describe how sound is represented in a computer.

.....
.....
.....
.....
..... [3]

(ii) A second video is recorded. The sound in the second video needs to be more precise.

Explain the reasons why increasing the sampling rate and the sampling resolution will improve the precision of the second recording.

Sampling rate

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.....
.....
.....

Sampling resolution

.....
.....
.....
.....

[4]

Question 15

- 1 (a) Draw **one** line from each vector graphic term to its most appropriate description.

Term	Description
drawing list	a component created using a formula
drawing object	defines one characteristic of a component
property	data required to create all components in the graphic

[2]

- (b) State what is meant by the **bit depth** of a bitmap image **and** explain how changing the bit depth affects the image.

Definition

.....

Explanation

.....

.....

[3]

Question 16

- (b) Explain the impact of changing the sampling resolution on the accuracy of a sound recording.

.....
.....
.....
.....
.....
..... [3]

- (c) A bitmap image has a resolution of 2048 pixels wide and 1024 pixels high.

The image has a bit depth of 10 bits per pixel.

Estimate the file size of the bitmap image in mebibytes. Show your working.

Working

.....
.....
.....
.....
.....
.....

Estimated file size in mebibytes

[2]

Question 17

- 1 (a) State what is meant by **analogue data**.

..... [1]

- (b) Draw **one** line from each term to its most appropriate description.

Term	Description
sampling	the number of samples taken per second
sampling rate	taking measurements at regular intervals and storing the values
sampling resolution	the number of bits used to store each sample

[2]

Question 18

- 2 (a) Describe the impact of increasing the image resolution on the quality of a bitmap graphic.

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

(b) Calculate the file size of a bitmap image using the following information:

- image resolution of 2048 pixels wide and 1024 pixels high
- bit depth of 16 bits.

Give your answer in kibibytes. Show your working.

Working

.....
.....
.....
.....

Answer in kibibytes

[2]

Question 19

(d) The digital camera has a microphone which is used to record the sound for the video.

The user changes the sampling rate that the microphone uses from 44.1 kHz to 88.2 kHz.

Describe how this change in sampling rate will affect the performance of the video doorbell.

.....
.....
.....
.....
.....
.....

[3]

Question 20

- (d) The computer can transmit a video made from bitmap images and vector graphic animations to the VR headset.

- (i) Describe how the data for a bitmapped image is encoded.

.....
.....
.....
.....
.....
..... [3]

- (ii) Describe the contents of a vector graphic drawing list.

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

Question 21

7 A computer stores binary data.

- (a) Tick (✓) one box only to identify the **largest** file size.

- 3300 kibibytes
 0.3 megabytes
 3 mebibytes
 3300 kilobytes

[1]

Question 22

- 1 (a) Complete the following description.

A kibibyte has a prefix. Three kibibytes is the same as bytes.

A megabyte has a prefix. Two terabytes is the same as gigabytes.

[4]

Question 23

- 2 A photograph is stored as a bitmap image.

- (a) The photograph has a resolution of 4000 pixels wide by 3000 pixels high. The bit depth is 4 bytes.

Calculate an estimate for the file size of the photograph in megabytes.

Show your working.

Working

.....
.....

Answer megabytes

[2]

9608 Topical Past Papers

Note : In 9608 there was no decimal and binary prefix so mark scheme will be different. Make sure you are following 9618 decimal and binary prefix.

Question 24

4) A digital camera takes a bitmap image. The image is 2000 pixels wide by 1000 pixels high with a colour depth of 24-bits.

(a) Calculate an estimate of the file size for the image. Give your answer in megabytes. Show your working.

Working

.....
.....
.....
.....
.....
.....

Answer..... MB [3]

(b) A second image is taken, this time in black and white. It has the same number of pixels, but the file size is smaller.

Explain why the file size is smaller.

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.....
.....
.....
.....

[2]

(c) The digital camera allows a user to add text to an image. The text is encoded as ASCII values.

The table shows the ASCII denary values for five characters.

Character	ASCII denary value
a	97
b	98
c	99
d	100
e	101

(i) Give the 8-bit binary value for the ASCII character 'b'.

.....
.....

[1]

(ii) Complete the table by writing the ASCII denary value for the character 't' and its hexadecimal equivalent.

Character	t
ASCII denary value	
Hexadecimal value	

Question 25

(1b) Samira uses a computer to draw a logo for her hotel and saves it as a vector graphic. The logo will be placed on the multimedia presentation and elsewhere, such as on signs at the entrance of the hotel.

Samira emails the logo to a company that prints signs, and other documentation for the hotel.

(i) Describe how the logo is represented by the computer.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

[3]

(ii) State **two** reasons why the hotel **logo** is saved as a vector graphic instead of a bitmapped graphic.

1

.....

2

.....

[2]

9608/12/M/J/20/1B

Question 26

2) Amir has created a sound file using his desktop computer.

(a) Complete the table by writing the missing definitions and term about sound.

Term	Definition
Sampling
.....	The number of samples per unit time
Sampling resolution

[3]

Question 27

7) Xiaoming created the following logo using bitmapped graphics software.



(a) Describe how **one** typical feature of bitmapped graphics software was used to create the logo.

.....
.....
.....
.....

[2]

(b) The finished logo is 160 pixels wide and 160 pixels high. The image has a colour depth of 3 bytes per pixel.

Calculate an estimate of the file size for the logo. Give your answer in kilobytes. Show your working.

Working
.....
.....

Answer KB

[3]

(c) Xiaoming needs to use his logo on his business card, on his website and on large display boards. He is told that he should have created a vector graphic logo instead of a bitmapped graphic logo.

Describe one benefit of creating a vector graphic logo instead of a bitmapped graphic logo.

.....
.....
.....
.....

[2]

Question 28

(d) A sound track is recorded for the video.

(i) Describe how a computer encodes the sound track.

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.....
.....
.....
.....
.....
.....

[3]

(ii) Explain how the sampling rate and sampling resolution affect the file size of the sound track.

Sampling rate

.....
Sampling resolution

[2]

9608/11/M/J/19/6

Question 29

5) Xander creates a presentation that includes images, video and sound.

(a) The images are bitmap images. A bitmap image can be made up of any number of colours. Each colour is represented by a unique binary number.

Draw one line from each box on the left, to the correct box on the right to identify the minimum number of bits needed to store each maximum number of colours.

Maximum number of colours

68

256

127

2

249

Minimum number of bits

1

2

3

7

8

9

[3]

(c) The sound track has a **sampling rate** of **88.2 kHz** and a **sampling resolution** of **32 bits**.

State what is meant by a sampling rate of 88.2 kHz and a sampling resolution of 32 bits.

Sampling rate of 88.2 kHz

.....
.....

Sampling resolution of 32 bits.....

.....
.....

[2]

9608/13/M/J/19

Question 30

(d) Dominic's tablet captures a video of Dominic to send to other people. The video is made of a sequence of images and a sound file.

(i) Describe how the images and sound are encoded into a digital form.

Images.....

.....
.....
.....

Sound.....

.....
.....
.....

[4]

Question 31

(2b) Leonardo uses the mobile phone to record his voice.

(i) Describe how sound sampling is used by the mobile phone to encode the sound.

.....
.....
.....
.....

[2]

(ii) Leonardo records his voice twice. Each recording is the same length and has the same sampling resolution. The first recording has a sampling rate of 44100Hz. The second recording has a sampling rate of 21000Hz.

Describe how the different sampling rates will affect the recording and the sound file.

.....
.....
.....
.....

[2]

(iii) Leonardo transfers the recordings to his laptop computer. He uses sound editing Software to delete some sections of the recordings, and copy and paste to replicate other sections.

Describe two other features of sound editing software Leonardo can use to edit the recordings.

1

.....

.....

.....

.....

..... [4]

Question 32

2) A logo is designed as a bitmap image.

(a) Describe what is meant by a bitmap image.

.....

.....

.....

..... [2]

(b) A black and white bitmap image is shown.



(i) Explain how a computer can store this bitmap image.

.....
.....
.....
.....

[2]

(c) The finished logo is 500 pixels by 1000 pixels and uses 35 different colours.

Estimate the file size for the logo. Give your answer in kilobytes. Show your working.

Working.....
.....
.....
.....
.....

Answer [4]

(d) The logo is redesigned as a vector graphic.

State two benefits of a vector graphic compared to a bitmap image. Give a reason for each benefit.

Benefit 1.....

.....

Reason 1.....

.....

Benefit 2

.....

Reason 2.....

[4]

9608/11/M/J/18

Question 33

5 A student has recorded a sound track for a short film.

(a) Explain how an analogue sound wave is sampled to convert it into digital format.

.....
.....
.....
.....
.....
.....

[3]

(b) Explain the effects of increasing the sampling resolution on the sound file.

.....
.....
.....
.....

[2]

(c) The original sound was sampled at 44.1 kHz. The sample rate is changed to 22.05 kHz.

Explain the effects of this change on the sound file.

.....
.....
.....
.....
.....
.....
.....

[3]

(d) The student uses sound editing software to edit the sound file.

Name two features of sound editing software the student can use to edit the sound file.

Describe the purpose of each feature.

Feature 1.....

Purpose.....
.....
.....

Feature 2

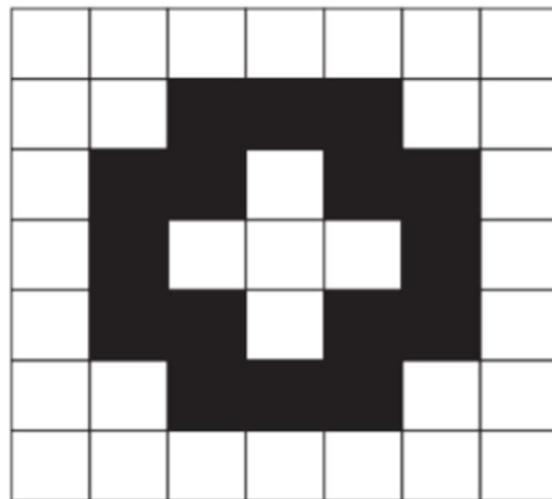
Purpose

[4]

9608/12/M/J/18

Question 34

- 6) A black and white bitmap image is shown.



- (a) State the **minimum** number of bits needed to represent each pixel in this image.

..... [1]

(c) An image has 30 different colours.

State the **minimum** number of bits needed to represent each pixel in the 30-colour image.

..... [1]

(d) When the image is saved, a header is added to the file.

State the purpose of the **file header**. Give **two** examples of the file header contents.

Purpose

.....

Example 1

.....

Example 2

.....

[3]

(e) Graphics software is used to edit a digital photograph.

Give **three** features of graphics software that can be used to edit the photograph.

Describe the effect each has on the photograph.

Feature 1

Effect

.....

.....

Feature 2

Effect

.....

.....

Feature 3

Effect

.....

.....

[6]

9608/13/M/J/1

Question 35

(b) An analogue-to-digital converter uses sampling to encode the sound.

Explain how different sampling resolutions affect the sound file and the sound it represents.

.....
.....
.....
.....
.....
.....
.....

[3]

(c) The student needs to edit the sound file.

Describe **two** features of sound editing software that can be used to edit the sound file.

Feature 1

.....
.....
.....

Feature 2

.....
.....
.....

[4]

Question 36

1) A company is designing a website.

(a) The company creates a 4-colour bitmap image for the website as shown.

Each colour is represented by a letter, for example, G = grey, K = black.

G	R	G	K	W	R
G	R	G	K	W	R
G	R	G	K	W	R
G	R	G	K	W	R
G	G	G	K	K	R
W	W	W	W	K	R

(i) State the minimum number of bits needed to represent each pixel in the image in part (a).

..... [1]

(ii) Calculate the minimum file size of the image shown in part (a). Show your working.

Working
.....
.....
.....

File size [3]

(b) The company takes a photograph of their office to put on the website. The photograph has a resolution of 1000 pixels by 1000 pixels. Two bytes per pixel are used to represent the colours.

(i) Estimate the file size of the photograph in megabytes. Show your working.

Working
.....
.....
.....

Estimated file size

[4]

(c) The company has created a logo for the website. The logo is a vector graphic.

Describe **two** reasons why a vector graphic is a sensible choice for the logo.

Reason 1

.....

.....

Reason 2

.....

.....

.....

[4]

Question 37

1) A product designer is creating a poster.

(a) The designer creates a 6-colour bitmap image for the poster as shown.

Each colour is represented by a letter, for example, R = red, B = blue.

R	R	P	P	P	G
B	R	R	P	G	G
B	W	B	B	O	O
B	W	W	P	P	O
B	B	R	P	G	O
B	R	R	P	G	O

(i) State the minimum number of bits needed to represent each pixel in the image in part (a).

..... [1]

(ii) Calculate the minimum file size of the image shown in part (a). Show your working.

Working

.....

.....

File size

[3]

(b) (i) The designer takes a photograph to put on the poster. The photograph has a resolution of 50000 pixels by 50000 pixels. The colours are represented using 4 bytes per pixel.

Estimate the file size of the photograph in gigabytes. Show your working.

Working

.....

.....

Estimated file size [4]

Question 38

3 (a) A computer has a microphone and captures a voice recording using sound recording software.

Before making a recording, the user can select the sampling rate.

Define the term **sampling rate**. Explain how the sampling rate will influence the accuracy of the digitised sound.

Sampling rate

.....

.....

Explanation

.....

.....

[2]

(b) The computer also has bitmap software.

(i) Define the terms pixel and screen resolution.

Pixel

.....

Screen resolution

..... [2]

(ii) A picture has been drawn and is saved as a monochrome bitmap image.

State how many pixels are stored in one byte?

..... [1]

(iii) A second picture has width 2048 pixels and height 512 pixels. It is saved as a 256-colour image.

Calculate the file size in kilobytes.

Show your working.

.....
.....
.....
.....
.....

[3]

(iv) The actual bitmap file size will be larger than your calculated value.

State another data item that the bitmap file stores in addition to the pixel data.

.....
.....

[1]

Question 39

3 (a) A computer has a microphone and captures a voice recording using sound editing software.

The user can select the **sampling resolution** before making a recording.

Define the term sampling resolution. Explain how the sampling resolution will affect the accuracy of the digitised sound.

Sampling resolution.....

.....
.....

Explanation

..... [3]

(b) The computer also has bitmap software.

(i) Define the term image resolution.

.....
..... [1]

(ii) A picture is drawn and is saved as a 16-colour bitmap image.

State how many bits are used to encode the data for one pixel.

..... [1]

(iii) A second picture has width 8192 pixels and height 256 pixels. It is saved as a 256-colour bitmap.

Calculate the file size in kilobytes.

Show your working.

.....
.....
.....
.....

..... [3]

(iv) The actual bitmap file size will be larger than your calculated value as a bitmap file has a file header.

State two items of data that are stored in the file header.

1

2 [2]

Question 40

3 (a) A computer has a microphone and captures a voice recording using sound recording software.

Before making a recording, the user can select the sampling rate.

Define the term sampling rate. Explain how the sampling rate will influence the accuracy of the digitised sound.

Sampling rate

.....
.....

Explanation

..... [2]

(b) The computer also has bitmap software.

(i) Define the terms pixel and screen resolution.

Pixel

.....

Screen resolution.....

..... [2]

(ii) A picture has been drawn and is saved as a monochrome bitmap image.

State how many pixels are stored in one byte.

..... [1]

(iii) A second picture has width 2048 pixels and height 512 pixels. It is saved as a 256-colour image.

Calculate the file size in kilobytes.

Show your working.

.....
.....
.....
.....
.....
.....

(iv) The actual bitmap file size will be larger than your calculated value.

State another data item that the bitmap file stores in addition to the pixel data.

.....
..... [1]

Question 41

- 4 A group of students broadcast a school radio station on a website. They record their sound clips (programmes) in advance and email them to the producer.

- (a) Describe how sampling is used to record the sound clips.

.....
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.....
.....

[3]

Question 42

- (b) The images contained in the magazines are produced using either bitmap or vector graphics software.

Give **four** differences between bitmap and vector graphics.

1

2

3

4

[4]

Question 43

2 (a) Sound can be represented in a computer in a digital format.

(i) Give the definition of the term sampling.

.....
.....
.....

[1]

(ii) Give one reason why 16-bit sampling is used in an audio compact disc (CD).

.....
.....

[1]

(iii) Explain what is meant by the term sampling resolution.

.....
.....
.....

[2]

(iv) Give one benefit and one drawback of using a higher sampling resolution.

Benefit

Drawback

[2]

(b) Describe two typical features found in software for editing sound files.

- 1.....
.....
- 2.....
.....

[2]

Question 44

- 8 (a) Six computer graphics terms and seven descriptions are shown below.

Draw a line to link each term to its correct description.

Term	Description
Bitmap graphic	Measured in dots per inch (dpi); this value determines the amount of detail an image has
Image file header	Picture element
Image resolution	Image made up of rows and columns of picture elements
Pixel	Image made up of drawing objects. The properties of each object determine its shape and appearance.
Screen resolution	Specifies the image size, number of colours, and other data needed to display the image data
Vector graphic	Number of samples taken per second to represent some event in a digital format

[6]

- (b) (i) A black and white image is 512 pixels by 256 pixels.

Calculate the file size of this image in kilobytes (KB) (1 KB = 1024 bytes).
Show your working.

.....
.....
.....
.....

[2]

- (ii) Give a reason why it is important to estimate the file size of an image.

.....
.....
.....

[1]

Question 45

- 3 A touch screen has three squares where a selection can be made:



The x-coordinate of the centre of the three squares is held in three memory locations:

	Address	Memory contents
S	40	0000 1011 0100
T	41	0010 0101 0100
U	42	0100 0110 1100

Question 46

- 4 (a) Sound can be represented digitally in a computer.

Explain the terms sampling resolution and sampling rate.

Sampling resolution

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.....
.....
.....

Sampling rate

.....
.....
.....
.....

[4]

- (b) The following information refers to a music track being recorded on a CD:

- music is sampled 44 100 times per second
- each sample is 16 bits
- each track requires sampling for left and right speakers

- (i) Calculate the number of bytes required to store one second of sampled music.
Show your working.

.....
.....
.....
.....

[2]

- (ii) A particular track is four minutes long.

Describe how you would calculate the number of megabytes required to store this track.

.....
.....
.....
.....

[2]

Answer

Answer 1

1(a)(i)	<p>1 mark for each description</p> <p>Pixel:</p> <ul style="list-style-type: none">• A single square of one colour• The smallest addressable element in an image <p>File header:</p> <ul style="list-style-type: none">• Data about the bitmap image (e.g. number of colours)	2
1(a)(ii)	<p>1 mark per bullet point for working, 1 mark for answer</p> <p>Working:</p> <ul style="list-style-type: none">• $1024 \times 512 = 524\,288$ pixels/bytes• $524288 / 1024 / 1024$ <p>Answer:</p> <p>0.50 mebibytes</p>	3

Answer 2

1(a)	<p>1 mark for each correct line</p> <p>5</p>
------	---

Answer 3

7(a)(i)	<p>1 mark per bullet point</p> <ul style="list-style-type: none"> • Smaller time gaps between the samples • Makes the digital sound wave more accurate • Smaller quantisation errors 	2
7(a)(ii)	<p>1 mark per bullet point</p> <ul style="list-style-type: none"> • More samples/data are taken/recorded • ... so more bits are stored altogether 	2

Answer 4

5(a)	<p>1 mark for each description, 1 mark for each valid example</p> <table border="1"> <thead> <tr> <th>Term</th><th>Description</th><th>Example from logo</th></tr> </thead> <tbody> <tr> <td>Property</td><td>data about the shapes // defines one aspect of the appearance of the drawing object</td><td>e.g. black line // white fill // black fill //solid (line) // font of letter // colour of triangle</td></tr> <tr> <td>Drawing list</td><td>the list of shapes involved in an image // a list that stores the command/description required to draw each object</td><td>e.g. triangle // capital letter R // rectangle // line</td></tr> </tbody> </table>	Term	Description	Example from logo	Property	data about the shapes // defines one aspect of the appearance of the drawing object	e.g. black line // white fill // black fill //solid (line) // font of letter // colour of triangle	Drawing list	the list of shapes involved in an image // a list that stores the command/description required to draw each object	e.g. triangle // capital letter R // rectangle // line	4
Term	Description	Example from logo									
Property	data about the shapes // defines one aspect of the appearance of the drawing object	e.g. black line // white fill // black fill //solid (line) // font of letter // colour of triangle									
Drawing list	the list of shapes involved in an image // a list that stores the command/description required to draw each object	e.g. triangle // capital letter R // rectangle // line									

5(b)(i)	<p>1 mark for each bullet point to max 2 for each difference</p> <ul style="list-style-type: none"> • Bitmap made up of pixels // bitmap is made of colours stored for individual pixels • Vector graphic store a set of instructions about how to draw the shape • When bitmap is enlarged the pixels get bigger and it pixelates • When vector is enlarged it is recalculated and does not pixelate • Bitmap files are usually bigger than vector graphics files because of the need to store data about each pixel • Vector graphics have smaller file size because they contain just the instructions to create the shapes • Bitmap images can be compressed with significant reduction in file size • Vector graphic images do not compress well because of little redundant data 	4
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Answer 5

1(a)	1 mark for: one tebibyte is 1024 gibibytes and one terabyte is 1000 gigabytes	1
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Answer 6

1(a)	<p>1 mark for 1 correct line 2 marks for 2 or 3 correct lines 3 marks for all 4 correct lines</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; padding-bottom: 10px;">Term</th><th style="text-align: center; padding-bottom: 10px;">Definition</th></tr> </thead> <tbody> <tr> <td style="border: 1px solid black; padding: 5px;">Pixel</td><td style="border: 1px solid black; padding: 5px;">The number of pixels wide by the number of pixels high</td></tr> <tr> <td style="border: 1px solid black; padding: 5px;">Bit depth</td><td style="border: 1px solid black; padding: 5px;">The smallest identifiable component of an image</td></tr> <tr> <td style="border: 1px solid black; padding: 5px;">Image resolution</td><td style="border: 1px solid black; padding: 5px;">Stores data about the image file, e.g. file format, number of bits per pixel, file size</td></tr> <tr> <td style="border: 1px solid black; padding: 5px;">File header</td><td style="border: 1px solid black; padding: 5px;">The number of bits used to represent each colour</td></tr> </tbody> </table>	Term	Definition	Pixel	The number of pixels wide by the number of pixels high	Bit depth	The smallest identifiable component of an image	Image resolution	Stores data about the image file, e.g. file format, number of bits per pixel, file size	File header	The number of bits used to represent each colour	3
Term	Definition											
Pixel	The number of pixels wide by the number of pixels high											
Bit depth	The smallest identifiable component of an image											
Image resolution	Stores data about the image file, e.g. file format, number of bits per pixel, file size											
File header	The number of bits used to represent each colour											
1(b)(i)	8	1										
1(b)(ii)	<p>1 mark for working • $10 * 5 * 8 \text{ (bits)} / 8 // = 50 \text{ (pixels)} * 8 \text{ (bits)} / 8$</p> <p>1 mark for answer • 50 (bytes)</p>	2										

1(c)	<p>1 mark per point</p> <ul style="list-style-type: none"> • Increasing the colour depth results in increased <u>file size</u> // Decreasing the colour depth results in smaller <u>file size</u> • Increasing the colour depth means more bits per pixel and hence more data stored // Decreasing the colour depth means fewer bits per pixel and hence less data stored 	2
------	--	---

Answer 7

1(d)(i)	the number of samples taken per unit time / per second	1
1(d)(ii)	<p>1 mark for each bullet point (max 2):</p> <ul style="list-style-type: none"> • increases the number of bits per sample // larger range of values • which means that the file size increases • makes the sound file more accurate //digital waveform closer to original (analogue) waveform • smaller quantisation errors 	2

Answer 8

6(b)(i)	<p>1 mark for each bullet point (max 2):</p> <ul style="list-style-type: none"> • improves the accuracy of the sound file • ... because (digital) waveform more closely resembles the analogue waveform • quantization errors are reduced • increases the amount of detail stored 	2
6(b)(ii)	<p>1 mark for each bullet point:</p> <ul style="list-style-type: none"> • decreases the file size of the sound file • ... because fewer bits are used to store each sample 	2

Answer 9

8(a)	<p>1 mark one or two correct row(s). 2 marks for all three correct rows.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Action</th><th>Increases the file size</th><th>Decreases the file size</th><th>No change to the file size</th></tr> </thead> <tbody> <tr> <td>Change the colour depth of the image file to 16 bits per pixel.</td><td></td><td style="text-align: center;">✓</td><td></td></tr> <tr> <td>Change the screen resolution to 1366×768 pixels.</td><td></td><td></td><td style="text-align: center;">✓</td></tr> <tr> <td>Change the colour of the rectangle from black to red.</td><td></td><td></td><td style="text-align: center;">✓</td></tr> </tbody> </table>	Action	Increases the file size	Decreases the file size	No change to the file size	Change the colour depth of the image file to 16 bits per pixel.		✓		Change the screen resolution to 1366×768 pixels.			✓	Change the colour of the rectangle from black to red.			✓	2
Action	Increases the file size	Decreases the file size	No change to the file size															
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Change the screen resolution to 1366×768 pixels.			✓															
Change the colour of the rectangle from black to red.			✓															
8(b)	<p>1 mark for each bullet point (max 2). For example:</p> <ul style="list-style-type: none"> • can be enlarged without pixelation / loss of quality • individual components of the image can be edited • generally a smaller file size 	2																

Answer 10

1(a)	<p>1 mark for one or two correct ticks, 2 marks for three correct ticks.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Action</th><th>Accuracy increases</th><th>Accuracy decreases</th><th>Accuracy does not change</th></tr> </thead> <tbody> <tr> <td>Change the sampling rate from 40 kHz to 60 kHz.</td><td style="text-align: center;">✓</td><td></td><td></td></tr> <tr> <td>Change the duration of the recording from 20 minutes to 40 minutes.</td><td></td><td></td><td style="text-align: center;">✓</td></tr> <tr> <td>Change the sampling resolution from 24 bits to 16 bits.</td><td></td><td style="text-align: center;">✓</td><td></td></tr> </tbody> </table>	Action	Accuracy increases	Accuracy decreases	Accuracy does not change	Change the sampling rate from 40 kHz to 60 kHz.	✓			Change the duration of the recording from 20 minutes to 40 minutes.			✓	Change the sampling resolution from 24 bits to 16 bits.		✓		2
Action	Accuracy increases	Accuracy decreases	Accuracy does not change															
Change the sampling rate from 40 kHz to 60 kHz.	✓																	
Change the duration of the recording from 20 minutes to 40 minutes.			✓															
Change the sampling resolution from 24 bits to 16 bits.		✓																
1(b)	<p>1 mark for answer; 1 mark for working. Working: $\begin{aligned} \text{Size} &= 50\text{KHz} * (20 \times 60) * 16 \text{ bits} \\ &= 50\ 000 * 1200 * 16 \text{ bits} // 50\ 000 * 1200 * 2 \text{ bytes} \\ &= 960\ 000\ 000 \text{ bits} \\ &= 120\ 000\ 000 \text{ bytes} \\ &= 120\ 000 \text{ kilobytes} \\ &= 120 \text{ megabytes} \end{aligned}$ Answer = 120 megabytes</p>	2																

Answer 11

2(e)	<p>1 mark for each correctly completed term;</p> <p>The <u>bit depth</u> of a bitmap image is the number of bits that are used to store each pixel.</p> <p>Metadata about the image is stored in the <u>header</u> of the file.</p>	2
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Answer 12

1(a)	<p>1 mark for each correct definition</p> <table border="1"><thead><tr><th>Term</th><th>Definition</th></tr></thead><tbody><tr><td>Drawing list</td><td>All the drawing objects in an image // a list that stores the commands required to draw each object</td></tr><tr><td>Pixel</td><td>The smallest part of the image // one square / dot of one colour</td></tr><tr><td>Colour depth</td><td>The number of bits per pixel // determines the number of colours that can be represented in the image</td></tr></tbody></table>	Term	Definition	Drawing list	All the drawing objects in an image // a list that stores the commands required to draw each object	Pixel	The smallest part of the image // one square / dot of one colour	Colour depth	The number of bits per pixel // determines the number of colours that can be represented in the image	3
Term	Definition									
Drawing list	All the drawing objects in an image // a list that stores the commands required to draw each object									
Pixel	The smallest part of the image // one square / dot of one colour									
Colour depth	The number of bits per pixel // determines the number of colours that can be represented in the image									
1(b)(i)	<p>1 mark each</p> <p>Examples:</p> <ul style="list-style-type: none">• Confirmation that it is a bitmap // file type• Compression type• Location/offset of data within the file• Dimensions e.g. 100×100 pixels	2								
1(b)(ii)	<p>1 mark for working; 1 mark for answer</p> <ul style="list-style-type: none">• Working: $(1500 * 3000 * 8) / 1000 / 1000$• Answer: 36 MB	2								

Answer 13

3(d)(i)	1 mark from <ul style="list-style-type: none">• Kibibyte is 1024 bytes and kilobyte is 1000 bytes• Kibibyte is binary prefix and kilobyte is denary prefix	1
---------	--	---

Answer 14

3(c)(i)	1 mark each <ul style="list-style-type: none">• The amplitude is recorded a set number of times a second• Each (instance of an) amplitude is given a corresponding binary number• The binary number (of each amplitude) is saved in sequence	3
3(c)(ii)	1 mark each; max 2 for rate and max 2 for resolution <p>Sampling rate</p> <ul style="list-style-type: none">• There are smaller 'gaps' in the sound wave // sound is recorded more often• Digital waveform is closer to the analogue waveform• The quantisation errors are smaller <p>Sampling resolution</p> <ul style="list-style-type: none">• There are more bits per sample // a wider range of amplitudes can be stored• Each binary amplitude/note (in the digital recording) is closer to the analogue amplitude/note• Digital waveform is closer to the analogue waveform• The quantisation errors are smaller	4

Answer 15

<p>1(a)</p> <p>2 marks for all 3 lines correct 1 mark for 1 line correct</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; padding-bottom: 10px;">Term</th><th style="text-align: center; padding-bottom: 10px;">Description</th></tr> </thead> <tbody> <tr> <td style="border: 1px solid black; padding: 5px;">drawing list</td><td style="border: 1px solid black; padding: 5px;">a component created using a formula</td></tr> <tr> <td style="border: 1px solid black; padding: 5px;">drawing object</td><td style="border: 1px solid black; padding: 5px;">defines one characteristic of a component</td></tr> <tr> <td style="border: 1px solid black; padding: 5px;">property</td><td style="border: 1px solid black; padding: 5px;">data required to create all components in the graphic</td></tr> </tbody> </table>	Term	Description	drawing list	a component created using a formula	drawing object	defines one characteristic of a component	property	data required to create all components in the graphic	<p>2</p>
Term	Description								
drawing list	a component created using a formula								
drawing object	defines one characteristic of a component								
property	data required to create all components in the graphic								
<p>1(b)</p> <p>1 mark for the definition</p> <ul style="list-style-type: none"> • The number of bits used to represent each colour <p>1 mark for each bullet point for the explanation</p> <ul style="list-style-type: none"> • Increase in bit depth means the image has a greater range of colours // Decrease in bit depth means the image has a smaller range of colours • Increase in bit depth makes the image closer to the original / more realistic // Decrease in bit depth makes the image less like the original / less realistic 	<p>3</p>								

Answer 16

6(b)	<p>1 mark for each bullet point (max 3)</p> <p>Increase sampling resolution</p> <ul style="list-style-type: none"> • ... the number of bits used for each sample is increased • ... there will be more values available to represent each sample // more amplitudes can be represented • ... each binary amplitude/note in the digital recording is closer to the analogue amplitude/note • ... quantisation errors are reduced • ... the digital soundwave is closer to the original analogue soundwave <p>Decrease sampling resolution</p> <ul style="list-style-type: none"> • ... the number of bits used for each sample is decreased • ... there will be fewer values available to represent each sample // fewer amplitudes can be stored • ... each binary amplitude/note in the digital recording is further from the analogue amplitude/note • ... quantisation errors are increased • ... the digital soundwave is less like the original analogue soundwave 	3
6(c)	<p>1 mark for answer, 1 mark for working</p> <p>Answer: 2.5 mebibytes</p> <p>Working: $(2048 \times 1024 \times 10) / (8 \times 1024 \times 1024)$</p>	2

Answer 17

1(a)	<p>1 mark for:</p> <ul style="list-style-type: none"> • data values that are continuously changing // variable // any value 	1								
1(b)	<p>1 mark for 1 correct line 2 marks for 3 correct lines</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; padding-bottom: 5px;">Term</th> <th style="text-align: center; padding-bottom: 5px;">Description</th> </tr> </thead> <tbody> <tr> <td style="border: 1px solid black; padding: 5px; text-align: center;">sampling</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">the number of samples taken per second</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px; text-align: center;">sampling rate</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">taking measurements at regular intervals and storing the values</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px; text-align: center;">sampling resolution</td> <td style="border: 1px solid black; padding: 5px; text-align: center;">the number of bits used to store each sample</td> </tr> </tbody> </table>	Term	Description	sampling	the number of samples taken per second	sampling rate	taking measurements at regular intervals and storing the values	sampling resolution	the number of bits used to store each sample	2
Term	Description									
sampling	the number of samples taken per second									
sampling rate	taking measurements at regular intervals and storing the values									
sampling resolution	the number of bits used to store each sample									

Answer 18

2(a)	1 mark for each bullet point: <ul style="list-style-type: none">• more pixels can be stored / are available• the image is sharper / less pixelated	2
2(b)	1 mark for answer. 1 mark for working Answer: 4096 kibibytes Working: File size = $(2048 \times 1024 \times 16) / (8 \times 1024)$	2

Answer 19

2(d)	1 mark each to max 3: <ul style="list-style-type: none">• Data transmission to user's smartphone will take longer• ... because there is more data to transmit• The secondary storage device will fill faster• ... fewer videos will be able to be stored long-term // videos are overwritten more often	3
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Answer 20

2(d)(i)	1 mark each: <ul style="list-style-type: none">• Image is made of pixels and each pixel has one colour• Each colour has a unique binary code• Code for the colour of each pixel is stored in sequence	3
2(d)(ii)	1 mark each to max 2: <ul style="list-style-type: none">• List of objects in the drawing• A list that stores the command/description/equation required to draw each object• Properties of each object e.g. the fill colour, line weight/colour	2

Answer 21

7(a)	1 mark for: 3300 kibibytes	1
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Answer 22

1(a)	<p>1 mark for each correct answer:</p> <ul style="list-style-type: none">• binary• 3072• denary/decimal• 2000 <p>A kibibyte has a binary prefix. Three kibibytes is the same as 3072 bytes. A megabyte has a decimal/denary prefix. Two terabytes is the same as 2000 gigabytes.</p>	4
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Answer 23

2(a)	<p>1 mark for working:</p> <ul style="list-style-type: none">• $4000 * 3000 * 4$ <p>1 mark for correct answer:</p> <ul style="list-style-type: none">• 48MB	2
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Answer 24

4(a)	<p>1 mark per bullet point</p> <ul style="list-style-type: none">• $2000 * 1000 * 24 = 48\ 000\ 000$ bits• $48\ 000\ 000 / 8 / 1024 / 1024$• = 6 MB or 5.7 MB	3						
4(b)	<p>1 mark per bullet point to max 2</p> <ul style="list-style-type: none">• Only 1 bit needed to store the colour of each pixel ...• ... so number of pixels * bit depth is $2000 * 1000 * 1$ (rather than $2000 * 1000 * 24$)• ... so the calculation (in part 4(a)) results in smaller figure for file size	2						
4(c)(i)	0110 0010	1						
4(c)(ii)	<p>1 mark for each correct line</p> <table border="1"><tr><td>Character</td><td>t</td></tr><tr><td>ASCII denary value</td><td>116</td></tr><tr><td>Hexadecimal value</td><td>74</td></tr></table>	Character	t	ASCII denary value	116	Hexadecimal value	74	2
Character	t							
ASCII denary value	116							
Hexadecimal value	74							

Answer 25

1(b)(i)	1 mark per bullet point to max 3 <ul style="list-style-type: none">• It is a series of (geometric) shapes / lines / objects• Stored coordinates• Contains a drawing list• Commands / formulae for creating each individual object• and the attributes/property for that object• E.g. the colour, thickness of line etc.	3
1(b)(ii)	1 mark per bullet point to max 2 <ul style="list-style-type: none">• Needs to be large for the signs without becoming pixelated.• Smaller file size means faster transfer rates are possible.• Smaller file size reduces storage requirements when stored many times (on multiple documents).	2

Answer 26

2(a)	1 mark for each correct term/definition <table border="1"><thead><tr><th>Term</th><th>Definition</th></tr></thead><tbody><tr><td>Sampling</td><td>The amplitude of the analogue sound wave is recorded at regular/set intervals</td></tr><tr><td>Sampling rate</td><td>The number of samples per unit time</td></tr><tr><td>Sampling resolution</td><td>The number of bits used to store each sample</td></tr></tbody></table>	Term	Definition	Sampling	The amplitude of the analogue sound wave is recorded at regular/set intervals	Sampling rate	The number of samples per unit time	Sampling resolution	The number of bits used to store each sample	3
Term	Definition									
Sampling	The amplitude of the analogue sound wave is recorded at regular/set intervals									
Sampling rate	The number of samples per unit time									
Sampling resolution	The number of bits used to store each sample									

Answer 27

7(a)	<p>1 mark for each feature and 1 mark for further related expansion to max 2</p> <ul style="list-style-type: none">• Colour select• Select all pixels of the same colour• Add text• To show the name of the company• Resize the star shape• To fit the space available in the box• Fill an area with colour• To shade the side of the box• Select• 'Grab' a number of pixels to perform a task with/to• Copy• Replicate a number of pixels	2
7(b)	<p>1 mark per bullet point</p> <ul style="list-style-type: none">• $160 * 160 (= 25600 \text{ pixels})$• $25600 * 3 (= 76800 \text{ bytes})$• 75 KB (divide by 1024) or 76.8 KB (divide by 1000)	3
7(c)	<p>1 mark per bullet point to max 2</p> <ul style="list-style-type: none">• The logo can be enlarged without becoming pixelated• because the instructions to create the logo are stored or• (Usually) smaller file size• only coordinates and calculations stored instead of individual pixels	2

Answer 28

6(d)(i)	<p>1 mark per bullet point to max 3</p> <ul style="list-style-type: none"> o The amplitude of the wave is measured /sound wave is sampled o At <u>set/regular</u> time intervals o Each sample is stored as a binary number o Samples are stored in order in a file 	3
6(d)(ii)	<p>1 mark per bullet point to max 1 for each</p> <p>Sample rate:</p> <ul style="list-style-type: none"> o Increasing the sample rate means more samples per second hence more bits per second <u>and</u> larger file size o Decreasing the sample rate means fewer samples per second hence fewer bits per second <u>and</u> smaller file size <p>Sample resolution:</p> <ul style="list-style-type: none"> o A higher sampling resolution means more bits per sample <u>and</u> a larger file size o A lower sampling resolution means fewer bits per sample. a smaller file size 	2

Answer 29

5(a)	<p>1 mark for each correctly linked box on the right</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; width: 50%;">Maximum number of colors</th><th style="text-align: center; width: 50%;">Minimum number of bits</th></tr> </thead> <tbody> <tr> <td style="text-align: center;">68</td><td style="text-align: center;">1</td></tr> <tr> <td style="text-align: center;">256</td><td style="text-align: center;">2</td></tr> <tr> <td style="text-align: center;">127</td><td style="text-align: center;">3</td></tr> <tr> <td style="text-align: center;">2</td><td style="text-align: center;">7</td></tr> <tr> <td style="text-align: center;">249</td><td style="text-align: center;">8</td></tr> <tr> <td></td><td style="text-align: center;">9</td></tr> </tbody> </table>	Maximum number of colors	Minimum number of bits	68	1	256	2	127	3	2	7	249	8		9	3
Maximum number of colors	Minimum number of bits															
68	1															
256	2															
127	3															
2	7															
249	8															
	9															

5(c)	<p>1 mark per bullet</p> <p>88.2 kHz</p> <ul style="list-style-type: none"> ∞ The sound wave is sampled <u>88200</u> times per second <p>32 bits</p> <ul style="list-style-type: none"> ∞ Each sample is stored as a 32-bit binary number 	2
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Answer 30

6(d)(i)	<p>1 mark per bullet point to max 4</p> <p>Max 3 for image</p> <p>Max 3 for sound</p> <p>Images</p> <ul style="list-style-type: none"> • The images are stored as bitmaps • Each image is made up of pixels • ... each pixel is of a single colour • Each colour has a unique binary number • Store the sequence of binary numbers for each image / frame // store the binary value of each pixel <p>Sound</p> <ul style="list-style-type: none"> • Measure the height/amplitude of the sound wave • A set number of times per second // at regular time intervals • Each amplitude has a unique binary number • Store the sequence of binary numbers for each sample 	4
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Answer 31

2(b)(i)	<p>1 mark per bullet point to max 2</p> <ul style="list-style-type: none"> • The amplitude of the wave is measured • ... at set, regular time intervals • The value is stored as a binary number 	2
2(b)(ii)	<p>1 mark per bullet point</p> <ul style="list-style-type: none"> • Sampling resolution of 44100 Hz takes more samples per second, so the file size will be larger // Sampling resolution of 21000 Hz takes fewer samples per second, so the file size will be smaller • At a resolution of 44100 Hz, the sound recording is a closer / more accurate representation of Leonardo's voice // At a resolution of 21000 Hz, the sound recording is a less accurate representation of Leonardo's voice 	2

2(b)(iii)	<p>1 mark for naming a feature, 1 mark for description, max 2 marks for each feature</p> <p>e.g.</p> <ul style="list-style-type: none"> • Amplify • ... Increase the volume of a section of sound • Change pitch • ... Increase/decrease frequency of section(s) • Change sampling resolution • ... to change the accuracy of the sound / file size 	4
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Answer 32

2(a)	<p>1 mark per bullet, max 2</p> <ul style="list-style-type: none"> • Made up of pixels • Each pixel has one colour • Colour of each pixel stored as a binary number 	2
2(b)(i)	<p>1 mark per bullet, max 2</p> <ul style="list-style-type: none"> • Each pixel requires only one bit (as there are only two colours) • Black represented by 1 and white by 0 (or vice versa) • Bits are stored for each pixel in sequence • 11111 01010 01010 01010 01010 	2
2(c)	<p>1 mark per bullet</p> <ul style="list-style-type: none"> • Number of pixels $500 \times 1000 (= 500\ 000)$ • 35 colours require 6 bits per pixel • Number of bytes $(500\ 000 \times 6) / 8 = 3\ 000\ 000 / 8 (= 375\ 000)$ • = 375 Kb 	4
2(d)	<p>1 mark per bullet to max 2 marks per benefit</p> <ul style="list-style-type: none"> • Can resize it without pixilation • Image is redrawn/recalculated with each adjustment • Smaller file size • Storing points/equations/commands etc., not individual pixels 	4

Answer 33

5(a)	1 mark per bullet to max 3 <ul style="list-style-type: none">• Amplitude (of the sound wave) measured• At <u>set / regular</u> time intervals / per time unit / time period• Value of the sample is recorded as a binary number	3
5(b)	1 mark per bullet to max 2 <ul style="list-style-type: none">• (Increasing the sampling resolution means) more bits per sample // larger range of values• Larger file size• More accurate representation of sound	2
5(c)	1 mark per bullet to max 3 <ul style="list-style-type: none">• Fewer samples (per unit time)• File size will decrease• Larger gaps / spaces between samples // Greater quantization errors• Sound accuracy will reduce // not as close to original sound	3
5(d)	1 mark for naming feature/tool, 1 mark for description. Max 2 features e.g. <ul style="list-style-type: none">• Fading• Change the volume of a section of the sound for it get louder/quieter• Removing sound / elements• Delete sections of the sound wave, for example, background noise• Copy• Repeat elements of the sound wave	4

Answer 34

6(a)	1	1
6(c)	5	1
6(d)	1 mark for purpose <ul style="list-style-type: none">• Stores data about the file contents/image/metadata Max 2 marks for examples of contents <ul style="list-style-type: none">• <u>Confirmation</u> that the file is a BMP // confirmation of file type• File size• Location / offset of image data within the file• Dimensions of the image (in pixels) // <u>image</u> resolution• Colour depth (bits per pixel, 1, 4, 8, 16, 24 or 32)• Type of compression used (if any)	3

6(e)	<p>1 mark for naming tool, 1 mark for describing effect on the photograph</p> <p>e.g.</p> <ul style="list-style-type: none"> • Resize • Increase / decrease the size of the image • Crop • Remove part of the image • Blur • Reduce the focus • Red eye reduction • Reduces red (light reflected from human eyes) 	6
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Answer 35

1(b)	<p>1 mark per bullet point</p> <ul style="list-style-type: none"> • The sampling resolution number of bits used to store each <u>sample</u> • Increasing the (sampling) resolution means a larger file size // Decreasing the (sampling) resolution means a smaller file size • Increasing the (sampling) resolution gives a more accurate representation of the analogue sound // Decreasing the (sampling) resolution gives a less accurate representation of the analogue sound • Increasing the (sampling) resolution means a greater range of values can be stored // Decreasing the (sampling) resolution gives a smaller range of values that can be stored • Increasing the (sampling) resolution reduces the quantization errors // Decreasing the (sampling) resolution causes greater quantization errors 	3
1(c)	<p>For 2 features</p> <p>1 mark for identifying feature, 1 mark for describing what it does.</p> <p>For example:</p> <ul style="list-style-type: none"> • Cut/delete • ... Remove part of the sound file • Copy and paste • ... Replicate part of the sound • Amplify • ... Increase the volume of a section of sound 	4

Answer 36

1(a)(i)	2	1
1(a)(ii)	<p>1 mark per bullet point</p> <ul style="list-style-type: none"> • Number of pixels: $6 \times 6 // 36$ • Number of bits: Number of pixels (36) $\times 2 \dots$ • ... = 72 <u>bits</u> // 9 <u>bytes</u> 	3
1(b)(i)	<p>1 mark per bullet point</p> <ul style="list-style-type: none"> • Number of pixels: $1000 \times 1000 // 1\ 000\ 000$ • Number of bytes: Number of pixels (1 000 000) $\times 2 // 2\ 000\ 000 //$ Number of bits: Number of pixels (1 000 000) $\times 16 // 16\ 000\ 000$ • Conversion to <u>megabytes</u> • 2 (MB) // 1.91 (MB) 	4
1(c)	<p>1 mark per bullet point. Max 2 marks for each reason.</p> <ul style="list-style-type: none"> • Smaller file size • Can be transferred quicker/downloaded quicker • Enlarges without pixilation • Needs to be used on different screens / devices / resolutions 	4

Answer 37

1(a)(i)	3	1
1(a)(ii)	<p>1 mark per bullet point</p> <ul style="list-style-type: none"> • Number of pixels: $6 \times 6 = 36$ • Number of bits: Number of pixels (36) $\times 3$ • 108 bits / 13.5 bytes 	3
1(b)(i)	<p>1 mark per bullet point</p> <ul style="list-style-type: none"> • Number of pixels: $50\ 000 \times 50\ 000 = 2\ 500\ 000\ 000$ • Number of bytes: Number of pixels (2 500 000 000) $\times 4 //$ 10 000 000 000 // Number of bits: Number of pixels (2 500 000 000) $\times 32 //$ 80 000 000 000 • Conversion to gigabytes • 10 GB / 9.3 GB 	4

Answer 38

3(a)	<p><i>Sampling rate</i> The number of samples taken per unit time // the number of times the amplitude is measured per unit time Increasing the sampling rate will increase the accuracy / precision of the digitised sound // Increasing the sampling rate will result in smaller quantisation errors.</p>	2
3(b)(i)	<p><i>Pixel</i> Smallest picture element which can be drawn <i>Screen resolution</i> The number of pixels which can be viewed horizontally and vertically on the screen // or by example - A typical screen resolution is 1680 pixels × 1080 pixels.</p>	2
3(b)(ii)	8	1
3(b)(iii)	<p><i>Working:</i> Max two from:</p> <ul style="list-style-type: none"> o Number of pixels is 2048×512 o One pixel will be stored as one byte o Number of kilobytes = $(2048 \times 512) / 1024$ <p><i>Answer:</i> One mark: Number of kilobytes = 1024 KB</p>	3
3(b)(iv)	<p>One from:</p> <ul style="list-style-type: none"> o Confirmation that the file is a BMP o File size o Location/offset of image data within the file o Dimensions of the image in pixels // image resolution o Colour depth (bits per pixel) o Type of compression used, if any 	1

Answer 39

3(a)	<p>Definition: Max two from:</p> <ul style="list-style-type: none"> o The number of distinct values available to encode/represent each sample o Specified by the number of bits used to encode the data for one sample o Sometimes referred to as bit depth <p>Explanation: Max two from:</p> <ul style="list-style-type: none"> o A larger sampling resolution will mean there are more values available to store each sample o A larger sampling resolution will improve the accuracy of the digitised sound // A larger sampling resolution will decrease the distortion of the sound o Increased sampling resolution means a smaller quantization error 	Max 3
3(b)(i)	<p>One from:</p> <ul style="list-style-type: none"> o The <u>number of pixels</u> per <u>unit measurement</u> o The number of pixels in an image o The number of pixels wide by the number of pixels high o Number of pixels per row by the number of rows 	1
3(b)(ii)	4	1
3(b)(iii)	<p>Working: Max two from:</p> <ul style="list-style-type: none"> o Number of pixels is 8192×256 o One pixel will be stored as one byte o Number of kilobytes = $(8192 \times 256) / 1024$ <p>Answer: One mark: Number of kilobytes = 2048 KB</p>	3
3(b)(iv)	<p>Two from:</p> <ul style="list-style-type: none"> o Confirmation that the file is a BMP o File size o Location/offset of image data within the file o Dimensions of the image (in pixels) // image resolution o Colour depth (bits per pixel, 1, 4, 8, 16, 24 or 32) o Type of compression used, if any 	Max 2

Answer 40

Question	Answer	Marks
3(a)	<p><i>Sampling rate</i> The <u>number of samples taken per unit time</u> // the number of times the amplitude is measured <u>per unit time</u> Increasing the sampling rate will increase the accuracy / precision of the digitised sound // Increasing the sampling rate will result in smaller quantisation errors.</p>	2
3(b)(i)	<p><i>Pixel</i> Smallest picture element which can be drawn <i>Screen resolution</i> The number of pixels which can be viewed horizontally and vertically on the screen // or by example - A typical screen resolution is 1680 pixels × 1080 pixels.</p>	2
3(b)(ii)	8	1
3(b)(iii)	<p><i>Working:</i> Max two from:</p> <ul style="list-style-type: none"> o Number of pixels is 2048×512 o One pixel will be stored as one byte o Number of kilobytes = $(2048 \times 512) / 1024$ <p><i>Answer:</i> One mark: Number of kilobytes = 1024 KB</p>	3
3(b)(iv)	<p>One from:</p> <ul style="list-style-type: none"> o Confirmation that the file is a BMP o File size o Location/offset of image data within the file o Dimensions of the image in pixels // image resolution o Colour depth (bits per pixel) o Type of compression used, if any 	1

Answer 41

4 (a) **Three** from: [3]

- The height/amplitude of the (sound) wave is determined.
- At set (time) intervals // by example of sensible time period.
- To get an approximation of the sound wave
- And encoded as a sequence of binary numbers // and converted to a digital signal.
- Increasing the sampling rate will improve the accuracy of the recording.

Answer 42

(b) Four from:

- Bitmap is made up of pixels
// Vector graphic store a set of instructions about how to draw the shape
- Bitmap files are usually bigger than vector graphics files // Take up more memory space
- Enlarging a bitmap can mean the image is pixelated
// vector graphic can be enlarged without the image becoming pixelated
- Bitmap images can be compressed (with significant reduction in file size)
// Vector graphic images do not compress well
- Bitmaps are suitable for photographs / scanned images
// Vector graphics are suitable for more geometric shapes
- Bitmap graphics use less processing power than vector graphics
- Individual elements of a bitmap cannot be grouped
// Individual elements of a vector graphic can be grouped
- Vector graphics need to be 'rasterised' in order to display or print

[4]

Answer 43

2 (a) (i) Any one from:

- amplitude of sound wave taken at different points in time
- measurement of value of analogue signal at regular time intervals/a point in time [1]

(ii) Any one from:

- bit depth/sampling resolution sufficient for good quality sound
- higher bit depth/sampling resolution would mean bigger files
- ...hence less (music) content on each CD
- can represent dynamic range of about 90 dB
- 90 dB is basically the maximum dynamic range of human hearing
- compromise between quality and reasonable file size

[1]

(iii) Any two from:

- resolution is the number of distinct values available to encode/represent each sample
- specified by the number of bits used to store/record each sample
- sometimes referred to as bit depth
- the higher the sampling resolution, the smaller the quantization error
- a higher sampling resolution results in less distortion of the sound
- usually 8 bit, 16 bit, 24 bit or 32 bit

[2]

(iv) 1 mark for benefit and 1 mark for drawback.

benefit

- allows for larger dynamic ranges
- ...as dynamic range is approximately six times the bit depth
- more accurate representation/crisper sound quality

drawback

- bigger files/occupies more memory/storage
- longer to transmit data/download music
- greater processing power needed

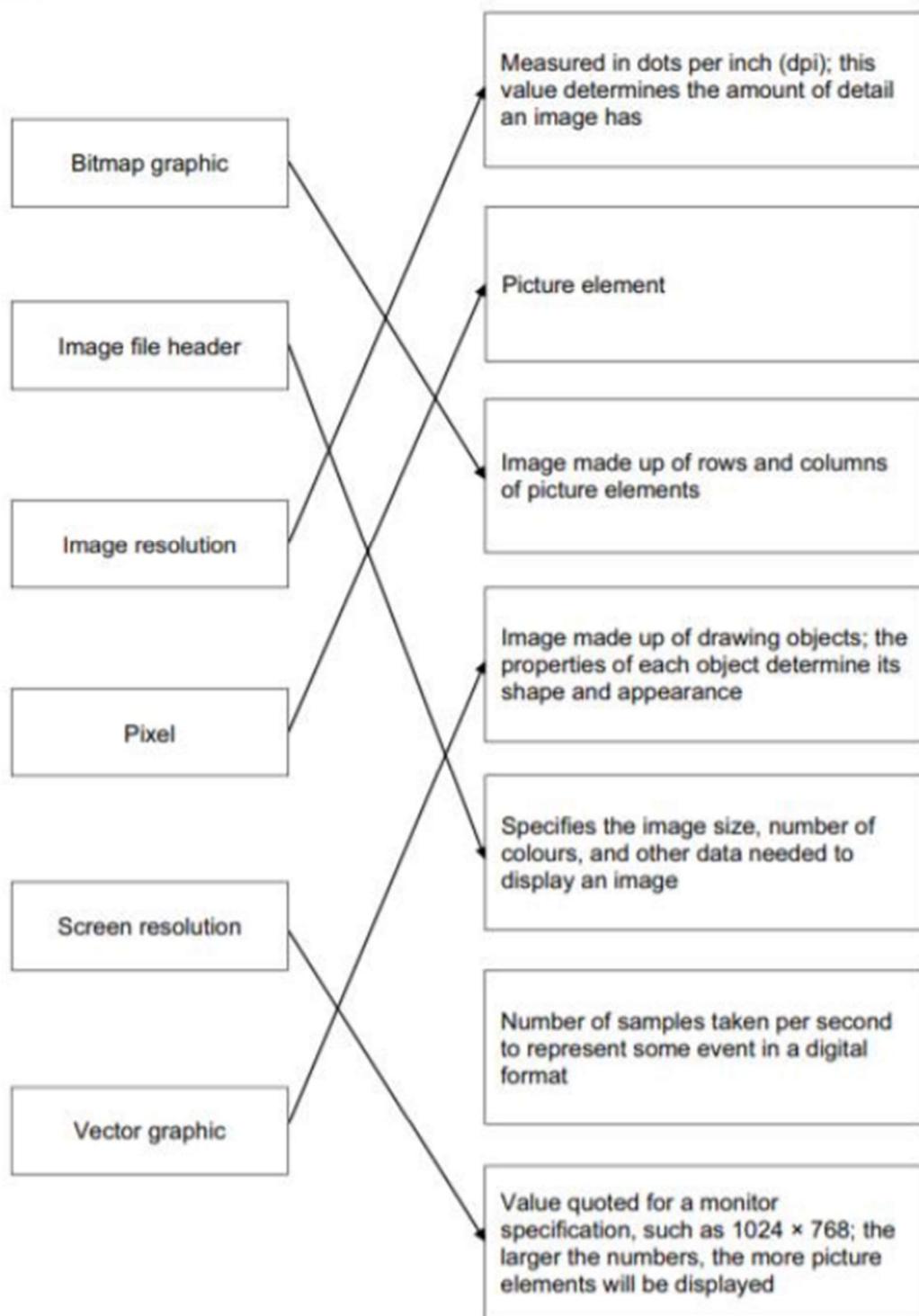
[2]

(b) Any two from:

- edit start time, stop time and duration of any sound/timeline
- extract/delete/save part of a clip
- frequency, amplitude, pitch alteration
- fade in/out of a clip
- mix/merge multiple sound sources/tracks
- combine different sources at various volume levels
- pan between tracks/channels
- use of filters
- playback to speakers, processors or recording medium
- conversion between different audio file formats
- etc...

Answer 44

8 (a)



1 mark for each correct line, two lines from one box is incorrect

[6]

(b) (i) $\frac{512 \times 256}{8 \times 1024} = 16 \text{ KB}$

1 mark for numerator + 1 mark for denominator

[2]

- (ii) so it is possible to estimate how many images can be stored / to decide if it can be sent as an email attachment [1]

Answer 45

(b) (i) 1 bit [1]

- (ii)
- 8 bits are needed
 - Each colour is represented by one of 256 values
 - values 0 to 255/0000 0000 to 1111 1111
 - $256 = 2^8$

[2]

Answer 46

4 (a) Sampling resolution (two marks)

- representation used to write samples in digital sound recording
- resolution is the number of distinct values available to encode/represent each sample
- specified by the number of bits used to store/record each sample
- sometimes referred to as bit depth
- the higher the sampling resolution the smaller the quantization error
- a higher sampling resolution results in less distortion of the sound
- usually 8 bit, 16 bit, 24 bit or 32 bit

Sampling rate (two marks)

- number of times that the amplitude of (analogue) sound wave is taken/measured
- per unit time/per second
- higher sampling rate results in more accurate digital representation

[4]

(b) (i) **one mark** for correct calculation, **one mark** for the answer

$$\frac{44100 \times 16 \times 2}{8} \quad (1 \text{ mark})$$

$$176\,400 \text{ bytes} \quad (1 \text{ mark})$$

[2]

(ii) Allow follow through from part (i) on 176400

$$\frac{4 \times 60 \times 176400}{1024 \times 1024} \quad \begin{array}{l} \text{one mark for numerator} \\ \text{one mark for denominator} \end{array}$$

[2]