Past-paper walk-through

1.2.1 Multimedia

A-Level Computer Science

Questions in this set

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- // separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = "or words to that effect" – the wording need not match.

Question 1

9618/13 N25 ▪ Q1 ▪ 7 marks

A student creates sound recordings.

Question 1

A student creates sound recordings

(a) Making changes to a sound recording may impact the accuracy of the resulting sound file or the size of the file.
Draw **two** lines from each change to the impacts it has on the sound file.

Change	Impact
increase the duration of the recording	the file size gets bigger
	no change in the file size
increase the sampling rate	the file size gets smaller

Question 1

A student creates sound recordings

(a) Making changes to a sound recording may impact the accuracy of the resulting sound file or the size of the file.
Draw **two** lines from each change to the impacts it has on the sound file.

Change	Impact
	the accuracy of the sound file improves
decrease the sampling resolution	no change to the accuracy of the sound file
	the accuracy of the sound file worsens

Question 1

[3]

Question 1

A student creates sound recordings

(b) The file names of the sound recordings are stored using the ASCII character set.

Explain how text is represented by the ASCII character set. **[2]**

Question 1

A student creates sound recordings

(c) Give **two** differences between the ASCII and UNICODE character sets.

1. 2. **[2]**

Solution 1

(a) Worked steps

Every one of these lines is decided by the same equation, so write it down before you draw anything:

file size = sampling rate × sampling resolution × duration

The *accuracy* of the recording is a separate matter, and it depends on only two of those three: how often you sample, and how finely you measure each sample. **Duration does not affect accuracy at all** — a longer recording is not a more faithful one.

Take each change and read it off the equation:

Solution 1

- **Increase the duration** — duration is a factor in the size, so *the file size gets bigger*; it is not a factor in accuracy, so *no change to the accuracy of the sound file*.
- **Increase the sampling rate** — more samples per second, so *the file size gets bigger*, and the samples follow the waveform more closely, so *the accuracy of the sound file improves*.
- **Decrease the sampling resolution** — fewer bits per sample, so *the file size gets smaller*, and each sample is rounded more coarsely, so *the accuracy of the sound file worsens*.

Solution 1

Each change earns one mark, and it earns it only when **both** its lines are right. The trap is the duration row: it is the only change of the three that touches size without touching accuracy, so "no change to the accuracy" has to be chosen deliberately rather than left over.

Mark scheme

- 1 mark for each correctly connected change box, max 3 marks

Solution 1

(b)

Mark scheme

1 mark per bullet point, max 2 marks

- Each character has a unique code
- Each character in the text is replaced sequentially / in order by its code

Solution 1

(c)

Mark scheme

1 mark per bullet point, max 2 marks

- ASCII uses 7 / 8 bits Unicode can use many more / up to 32 bits
- Unicode can represent a wider range of characters including different languages
- 2 increase the duration of the recording decrease the sampling resolution increase the sampling rate the file size gets bigger no change in the file size the file size gets smaller the accuracy of the sound file improves no change to the accuracy of the sound file the accuracy of the sound file worsens

Question 7

9618/13 N25 ▪ Q7 ▪ 7 marks

A digital video camera records students in a classroom. The data is transferred from the digital video camera over the internet to a server. Artificial Intelligence (AI) is used to analyse the video on the server to identify when students are interacting with the lesson and the teacher.

(a) Describe **one** ethical impact of this use of AI in the classroom. **[2]**

(b) A video is made of many bitmap images called frames. 30 frames are recorded every second.

Each frame is 4000 pixels wide by 3000 pixels high. The video records using 16-bit colour depth.

Calculate an estimate for the file size for **one** second of the video in gigabytes.

Show your working. **[2]**

Question 7

(c) Identify **and** describe **one** method of data verification that can be used when transferring data from the digital video camera to the server. **[3]**

Solution 7

(a) Mark scheme

1 mark per point, max 2 marks e.g.

- The learning experience could be improved
- ... by identifying students who are struggling
- .... and employing more personalised learning
- There could be early Intervention
- ... to determine which students require extra support
- Teachers and students could understand the challenges better
- ...and identify optimal times for learning
- There could be privacy concerns

Solution 7

- …. students / teachers could be uncomfortable with constant surveillance
- … students might not want their data / actions passed to third parties
- There could be Mental Health concerns
- …. due to constant monitoring and pressure
- …. contributing to student stress and anxiety

Solution 7

(b) Worked steps

A video is just a stack of bitmaps, so start from the size of one frame and multiply up.

- **Pixels in one frame:** $4000 \times 3000 = 12\,000\,000$
- **Pixels in one second:** $12\,000\,000 \times 30 = 360\,000\,000$
- **Bits:** $360\,000\,000 \times 16 = 5\,760\,000\,000$
- **Bytes:** $5\,760\,000\,000 \div 8 = 720\,000\,000$
- **Gigabytes:** $720\,000\,000 \div 1000^3 = \mathbf{0.72\ GB}$

Solution 7

One mark is for the working and one for the answer, so set the whole calculation out on one line before evaluating it:

```
(4000 * 3000 * 30 * 16) / (8 * 1000 * 1000 * 1000)
```

Solution 7

Two habits protect the marks. Divide by 8 **once**, at the point where bits become bytes — folding it in early is where the factor-of-eight errors come from. And answer in the unit the question asked for: the working ends in bytes, and the question wants gigabytes.

Mark scheme

1 mark for the working; 1 mark for the correct answer

- Working:
- (4000*3000*30*16) / (8*1000*1000*1000)
- //(4000*3000*30*2) / (1000*1000*1000)
- Answer: 0.72 gigabytes

Solution 7

(c) Mark scheme

1 mark for the name 2 marks for the matching description, max 3 marks

- Parity Byte Check
- a parity bit is added to each byte to make the number of 1s match the parity, odd or even
- each byte can be checked on receipt and request to be resent if the byte does not match parity
- Parity Block Check
- a bit is added to each byte, but a parity byte is also set for each block
- the location of an error can be found using vertical and horizontal parity
- Checksum

Solution 7

- A calculation is made from the data and transmitted with the data
- The receiver performs the same calculation and compares with received checksum to see if they match

Question 3

9618/11 J25 ▪ Q3 ▪ 7 marks

A computer stores images and text files.

Question 3

A computer stores images and text files

Statement	Answer
the term for the smallest element that makes up an image	
the largest number of different colours that can be represented with a bit depth of 8 bits	
the term for the dots per inch (dpi) when an image is displayed	

[3]

Question 3

A computer stores images and text files

(a) One of the images is a bitmapped image.
Complete the table by writing the answer for each statement.

Statement	**Answer**
the term for the smallest element that makes up an image	
the largest number of different colours that can be represented with a bit depth of 8 bits	
the term for the dots per inch (dpi) when an image is displayed	

[3]

Question 3

A computer stores images and text files

Statement	Answer
the term for the smallest element that makes up an image	
the largest number of different colours that can be represented with a bit depth of 8 bits	
the term for the dots per inch (dpi) when an image is displayed	

[3]

Question 3

A computer stores images and text files

(b)(i) Give **two** advantages of using the Unicode character set instead of using the ASCII character set.

1. 2. **[2]**

(b)(ii) The Unicode character '⟨' has the binary value: 0010 0111 0110 1110

Convert the binary value for the character '⟨' into denary. **[1]**

(b)(iii) The Unicode character '$\sum$' has the hexadecimal value 2140

Convert the hexadecimal code for the character '$\sum$' into denary. **[1]**

Question 3

A computer stores images and text files

Statement	Answer
the term for the smallest element that makes up an image	
the largest number of different colours that can be represented with a bit depth of 8 bits	
the term for the dots per inch (dpi) when an image is displayed	

[3]

Solution 3

(a) Mark scheme

1 mark for each correct answer

- Statement
- The term for the smallest element that makes up an image.
- pixel
- The largest number of different colours that can be represented with a bit depth of 8 bits.
- 256 // 28
- The term for the dots per inch (dpi) when an image is displayed.
- Screen resolution

Solution 3

(b)(i)

Mark scheme

1 mark each to max 2

- A wider range of characters can be represented
- so characters from more languages can be represented
- and symbols such as emojis can be used

Solution 3

(b)(ii) Worked steps

Sixteen bits is a long column of place values, so convert **through hexadecimal** rather than adding sixteen powers of two.

- Split into nibbles: `0010 0111 0110 1110`
- Each nibble is one hex digit: 2, 7, 6, `E`
- Now expand base 16, whose place values are 4096, 256, 16, 1:
  $2 \times 4096 + 7 \times 256 + 6 \times 16 + 14 \times 1$
- $= 8192 + 1792 + 96 + 14 = \mathbf{10\,094}$

Solution 3

Four multiplications instead of sixteen, and far fewer places to slip. Remember `E` is 14 — the hex digits run A = 10 through F = 15.
Adding the binary place values directly gives the same answer, but the ones are at positions 8192, 1024, 512, 256, 128, 64, 32, 8, 4 and 2, and missing one of them is the usual error.

Mark scheme

1 mark for:

- 10,094

Solution 3

(b)(iii) Worked steps

Already in hexadecimal, so this is one expansion.

- 2140 in base 16: $2 \times 4096 + 1 \times 256 + 4 \times 16 + 0 \times 1$
- $= 8192 + 256 + 64 + 0 = \mathbf{8512}$

Write the four place values 4096, 256, 16, 1 above the digits before you start — they are 16^3 down to 16^0, and getting them from memory is where four-digit hex conversions go wrong.

Solution 3

The zero still occupies a column. Dropping it turns 2140 into the three-digit 214 and the answer into 532.

Mark scheme

1 mark for:

- 8,512

Question 1

9618/13 J25 ▪ Q1 ▪ 14 marks

A student paints a picture in an art class.

Description	Term
the number of times the amplitude is measured per time interval	
the number of bits used to store each amplitude measurement	
the type of sound wave before it is recorded by a computer	

[3]

Question 1

A student paints a picture in an art class

Character	Denary	8-bit Binary	Hexadecimal
!	33		21
L		01001100	4C
ü	252	11111100	

[3]

Question 1

A student paints a picture in an art class

(a)(i) Calculate the file size of the image created by the digital camera in megabytes (MB).

Show your working. **[2]**

(a)(ii) The student takes a second photograph with a lower bit depth.

Explain the effect of decreasing the bit depth on the image and on the image file.

Effect on image

Effect on image file **[4]**

Question 1

A student paints a picture in an art class

Description	Term
the number of times the amplitude is measured per time interval	
the number of bits used to store each amplitude measurement	
the type of sound wave before it is recorded by a computer	

[3]

Question 1

A student paints a picture in an art class

Character	Denary	8-bit Binary	Hexadecimal
!	33		21
L		01001100	4C
ü	252	11111100	

[3]

Question 1

A student paints a picture in an art class

(b) A teacher records an audio file of the student playing the piano during a music lesson.

Complete the table by giving the term for each description about sound representation on a computer.

Description	**Term**
the number of times the amplitude is measured per time interval	
the number of bits used to store each amplitude measurement	
the type of sound wave before it is recorded by a computer	

[3]

Question 1

A student paints a picture in an art class

Description	Term
the number of times the amplitude is measured per time interval	
the number of bits used to store each amplitude measurement	
the type of sound wave before it is recorded by a computer	

[3]

Question 1

A student paints a picture in an art class

Character	Denary	8-bit Binary	Hexadecimal
!	33		21
L		01001100	4C
ü	252	11111100	

[3]

Question 1

A student paints a picture in an art class

(c)(i) The computer uses the Unicode character set.
Give **two** characteristics of the Unicode character set.
1. 2. **[2]**

(c)(ii) Some of the school's computers use the extended ASCII character set.
The table gives some characters from the extended ASCII character set, their denary, 8-bit binary and hexadecimal numbers.
Complete the table by filling in the missing numbers.

Character	Denary	8-bit Binary	Hexadecimal
!	33		21
L		01001100	4C
ü	252	11111100	

Question 1

[3]

Question 1

A student paints a picture in an art class

Description	Term
the number of times the amplitude is measured per time interval	
the number of bits used to store each amplitude measurement	
the type of sound wave before it is recorded by a computer	

[3]

Question 1

A student paints a picture in an art class

Character	Denary	8-bit Binary	Hexadecimal
!	33		21
L		01001100	4C
ü	252	11111100	

[3]

Solution 1

(a)(i) Worked steps

File size is the number of pixels times the bits per pixel, converted to the unit asked for.

- Bits: $2\,000\,000 \times 16$
- Bytes: divide by 8.
- Megabytes: divide by 1000×1000.

Set the whole thing out on one line before evaluating it — one mark is for the working:

```
2000000 * 16 / (8 * 1000 * 1000)
```

Solution 1

- $= \frac{32\,000\,000}{8\,000\,000} = \mathbf{4}$ MB

Divide by 8 **once**, at the point where bits become bytes; folding it in early is where the factor-of-eight errors come from. And answer in the unit the question names — the working ends in bytes and the question wants megabytes.

Mark scheme

1 mark for correct working:; 1 mark for answer:

- e.g.
- 2000000 * 16 / (8 * 1000 * 1000)
- 4MB

Solution 1

(a)(ii)

Mark scheme

1 mark each

- Image:
- There will be fewer shades of colour available
- so the image does not match the original as detail is lost
- Image file:
- Fewer bits are used to store each pixel
- so less data is stored, therefore the file size is reduced

Solution 1

(b)

Mark scheme

1 mark for each correct term:

- Description
- Sound term the number of times the amplitude is measured per time interval
- Sampling rate the number of bits used to store each amplitude measurement
- Sampling resolution the type of sound wave before it is recorded by a computer
- Analogue

Solution 1

(c)(i)

Mark scheme

1 mark each to max 2

- 8 / 16 / 32 / bits per character
- Represents 28 / 216 / etc. characters
- Represents every language and other characters such as emojis

Solution 1

(c)(ii) Worked steps

Each row of the table is the same value written three ways, so fill any gap from whichever column is already there.

- ! — denary 33, so binary 0010 0001 and hex 21.
- L — denary 76, so binary 0100 1100 and hex 4C.
- ü — denary 252, so binary 1111 1100 and hex FC.

Solution 1

The quickest route in both directions is through the **nibbles**: split the eight bits into two groups of four, and each group is one hex digit. `1111 1100` is `F` and `C`; going the other way, `4C` is `0100` and `1100`.

Two marks are lost more often than any others here. Keep the binary **eight bits** wide, padding with leading zeros — 33 is `0010 0001`, not `100001`. And use uppercase letters for the hex digits above 9, with `C` = 12 and `F` = 15.

A quick check on the last row: 252 is four short of 256, and `1111 1100` is `1111 1111` minus 3 — that is $255 - 3 = 252$. **Mark scheme**

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1 mark for each correctly completed space

- Character
- Denary
- 8–bit Binary

Solution 1

- Hexadecimal
- !
- 33
- 0010 0001
- 21
- L
- 76
- 0100 1100
- 4C ü
- 252
- 1111 1100

Solution 1

- FC

Question 7

9618/12 N24 ▪ Q7 ▪ 7 marks

A student takes a photograph of a science experiment.

(a)(i) Define the following bitmap terms. **[2]**

(a)(ii) Explain why changing the image resolution will affect the image quality and file size. **[2]**

(a)(iii) Identify **one** lossless method of compressing an image. **[1]**

(b) The student draws a picture on paper that is scanned into the computer and saved as a vector graphic.

Define the vector graphic terms property and drawing list. **[2]**

Solution 7

(a)(i)

Mark scheme

1 mark for each correct definition

- Colour depth:
- the number of bits used to represent a colour // the number of colours that can be represented in an image
- File header:
- stores data about the image file / metadata

Solution 7

(a)(ii) Mark scheme

1 mark for each correct explanation

- Image quality:
- Decreasing resolution means details within the image are lost because there are fewer pixels // Increasing resolution means the image is more detailed because there are more pixels
- File size:
- Decreasing the resolution will decrease the file size because there are fewer pixels therefore less data // Increasing the resolution will increase the file size because there are more pixels therefore more data

Solution 7

(a)(iii)

Mark scheme

1 mark for correct method

- For example:
- Run-Length Encoding

Solution 7

(b) Mark scheme

1 mark for each correct definition

- Property:
- an attribute of a drawing object // data about a shape // defines one aspect of the appearance of a drawing object
- Drawing list:
- all the drawing objects/shapes in an image // stores the commands/descriptions / mathematical equations required to draw each object
- 2

Question 2

9618/12 J24 ▪ Q2 ▪ 7 marks

2 A computer game is being designed that users will be able to play using a virtual reality (VR) headset.

Question 2

9618/12 J24 ▪ Q2 ▪ 7 marks

(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.

Question 2

9618/12 J24 ▪ Q2 ▪ 7 marks

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

Question 2

9618/12 J24 ▪ Q2 ▪ 7 marks

(iii) The bitmap video is **not** compressed before transmission to the VR headset.

Give **two** reasons why the video does **not** need to be compressed.

Question 2

9618/12 J24 ▪ Q2 ▪ 7 marks

[2]

Solution 2

(d)(i)

Mark scheme

1 mark each:

- 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

Solution 2

(d)(ii) **Worked steps**

A vector file does not store pixels. It stores the **instructions for drawing the picture**. Two marks from:

- A **list of the objects** in the drawing.
- For each object, the **command, description or equation** needed to draw it.
- The **properties** of each object — fill colour, line weight, line colour.

Solution 2

The consequence worth stating, and the reason this is asked at all: because the file holds equations rather than a grid of pixels, the image can be scaled to any size without losing quality, and the file size depends on how many objects there are rather than on the resolution.

Mark scheme

1 mark each to max 2:

- 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
- May/June 2024

Solution 2

(d)(iii) Worked steps

The question asks why compression is *unnecessary* here, so give reasons specific to this link. Two marks from:

- The headset has a **dedicated connection** — it is not sharing bandwidth with anything else.
- That connection is **already fast enough** to carry the data without slowing the display.
- The video may **already be small enough** that reducing it further gains nothing.
- The video is **not saved**, so storage space in the headset is not a consideration.

Solution 2

Compression buys two things: less bandwidth and less storage. Each of the reasons above says that one of those is not scarce in this situation — which is the shape the answer has to take. Saying "compression reduces quality" is true of lossy compression but does not answer why it is *unnecessary*.

Mark scheme

1 mark each to max 2:

- Dedicated connection to the headset // not sharing bandwidth
- Already fast connection that can transmit the data without slowing
- Video may already be a small file size and does not need further
- reduction
- Video is not saved so storage is not an issue in the headset
- 2