**Representation of Images and Sound**

Handout 1 – Representation of Images and Sound

Task 1 - Representation of Images - Answers

**Q1:** What is a bitmap image made up of?

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| * Made up of tiny elements, called pixels. |

**Q2:** What does each pixel in an image contain?

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| * Each pixel stores an individual colour which will be represented by a specific/unique binary value. |

**Q3:** What does pixelated mean?

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| * You can see individual pixels. The image may look ‘blurry’ to the user. |

**Q4:** What is Metadata and why does it need to be included in the file?

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| * To store data / information about the image / data. Metadata is used so that the image can be reproduced accurately. |

**Q5:** Explain the effects of colour depth and resolution have on the image quality and size of the file.

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| **Colour depth** = more bits per pixel so more colours are available to use = better quality (more realistic colour representation) images = larger file size  **Resolution** = more pixels = better quality (more realistic detail) images = larger file size |

**Q6:** State what is meant by the term image resolution.

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| * Number of pixels (in an image) * Height and width (of an image) |

**Q7:** Identify three pieces of metadata that is often stored with an image.

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| Height; Width; bit depth; Date taken; Geolocation; File size; File type; Compression type, Author |

**Q8:** Calculate the file size for the following bitmap images. Final size in KB.

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| Width = 64x, Height = 64px, Colour depth = 16bits   * **64x 64 = 4096pixels x 16 = 65536bits** * **65536 / 8 = 8192bytes** * **8192/1000 = 81.92 KB**   Width = 100px, Height = 100px, Colour depth = 16bits   * **100 x 100 = 10000 pixels x 16 = 160000 bits** * **160000 / 8 = 20000 bytes** * **20000 / 1000 = 20KB** |

**Task 2 – Representation of Sound**

**Q1:** Explain how sound is stored digitally.

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| The height (Amplitude) of the **analogue sound wave** isrecorded by taking **samples at regular intervals** which are then converted into **binary** so the computer can process it. |

**Q2:** Calculate the size of the sound file

Sample rate – 3Hz

Bit depth – 2 bits

Length – 2 mins and 30 seconds

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| 3 x 2 x 150 (2mins and 30seconds in seconds) = 900 bits  900/8 = 112.5 bytes |

**Q3:** Calculate the size of the sound file

Sample rate – 44100Hz

Bit depth – 16bits

Length – 2 mins and 30 seconds

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| 44100 x 16 x 150 (2mins and 30seconds in seconds) = 105,840,000 bits  105,840,000 / 8 = 13,230,000 bytes  13,230,000 / 1000 = 13.230 KB  13,230 / 1000 = 13.23 MB |

**Q4:** Explain how the relationship between the sample rate and the file size.

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| Increase sample rate = better quality sound as it reflects the original sound wave = increased file size because you are storing more data(more bits) |

**Task 3 - Compression**

**Q1:** What are the two types of compression?

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| The two types of compression are lossy and lossless.  You could mention run time encoding/Huffman encoding if you are an **AQA** student, but this is a type of lossless compression. |

**Q2:** If I wanted to reduce the size of a book, what type of compression would I use and why?

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| If I wanted to reduce the size of a book I would need to use lossless compression. If I used lossy compression on a book, then parts of the original book would be lost, and I wouldn’t be able to re-create the original. With lossless compression, I would have words repeated in the text which I could replace with a number. This is an example of dictionary encoding(lossless) compression - **AQA**. |

**Q3:** If I was sending a large video file across the internet, what type of compression might I use? Justify your reasons

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| Video files have a large capacity and therefore require a large amount of bandwidth to be sent across the internet. Hence, I would want to use lossy compression as it significantly reduces the size of the file. I would do this without making it noticeable to humans. A reduced file size would require a reduced bandwidth speed to send the fil file across the internet. |

**Q4:** Imran is discussing with a friend the benefits of compression. Imran thinks lossless compression is better than lossy compression. Discuss with an image file which type of compression you think is better and why. [6]

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| **Knowledge:** **Lossy compression** is where you remove parts of the original file to significantly reduce its size. Once you perform this type of compression you CAN’T recreate the original file.  **Lossless compression** is where you use repetition techniques to reduce the size of the file. Lossless compression does not reduce the size of the file as much as lossy compression. It is however the only compression that works with text files or code files. Lossless compression is used where you want to be able to recreate the original file after it’s been compressed.  **Application:** **Lossy compression** would be useful with an image. This is because image files have a large file size/capacity on secondary storage. Using lossy compression on an image would give a significant reduction of the file size. Lossy compression could reduce the colour depth to a point where it’s not noticeable to a human being.  **Lossless compression** could be used where you want to be re-create the original file. An example could be sending the image over the internet or on image app. This means the original quality would be kept as you can re-create the original file with lossless compression. You could use a way to represent series of pixels that are the same colour. **AQA** students could mention Huffman encoding and explain how it could be applied here.  **Summary/Evaluation:** You would need to come up with a suitable summary for this scenario. You could go for either option if you fully justify your answer.  **1 to 2 Marks** – If you only mention knowledge but no application.  **2 to 3 marks** – If you have some application and some balance to your answer covering both types.  **4 to 5 marks** – You have a balance with points that are applied to both types. You have a clear conclusion to your answer that is clear why one would be preferred in this case.  Remember: Your spelling, punctuation and grammar are assessed on longer worded questions. |