



Level 1 Digital Technologies CAT, 2018
**91887 Demonstrate understanding of compression
coding for a chosen media type**

Credits: Three

INSTRUCTIONS

Put your identification information in a header

Choose ONE option:

- 1. School Sports Day**
- OR**
- 2. School Rock Band**

Use the information from your chosen option to answer the questions to produce a short report. You must write about the option you have chosen. You may use this information and additional information and examples from your course.

You cannot use information from the Internet. You cannot position links in your answer.

Your answer may be sampled and compared with answers from other candidates to ensure it is your own work.

You should aim to write between 600 and 1000 words. You can expand (or reduce) the text boxes as needed.

Save your work with the file name schoolcode-yourNSN-91887.pdf.

Your teacher will tell you where to save this file.

Excellence

08

1. School Sports Day



As head of the school student media team, you have been asked to organise photography for the school sports day. You have a team of photographers to assist you with this task. All of them will be using digital SLR cameras. All files will be downloaded from the cameras to a shared drive on the school network.

Required outputs

1. Photographs for the school magazine
2. Photographs for the school newsletter (online and printed)
3. Photographs for the school website and Facebook page, including a gallery page with thumbnail links to full size images.
4. Photographs of athletics champions or students who break school athletics records will be printed and framed (A3 size)
5. The school archives also require photographs, where they will be stored on the school network for future use.

Questions

1. **What format would you have the cameras set on, RAW or JPG? Explain your answer in detail.**

I would have the cameras set on the RAW file format. This is because the RAW format does not compress the image so it keeps all of the original data from the camera. The 2 biggest downsides to RAW images is the large file size and the fact you have to use more specialized software to edit them or save them as a different file format. However as I am the head of the team I will be able to edit and export them myself and as the images are saved over multiple drives on a server with a large amount of storage space the file size will not be an issue.

The reason I wouldn't use JPG is because the JPG file format uses lossy compression and JPGs have less colour depth. Lossy compression means it removes some of the original data to reduce file size each time it is edited and saved. The lower colour depth means the image will have less possible colours and colour transitions will be less smooth. This means that the JPG format has worse image quality than the RAW format with the only benefit being the reduced file size which we do not need on a large server.

2. Explain how uncompressed files are represented using bits.

Uncompressed files will store the colour for each individual pixel. This means if the image is using 1 bit colour there is 1 bit for every pixel that represents what colour the pixel is. If you are using 24 bit colour this means every pixel has 24 bits that dictate what colour it is.

For 24 bit colour there is usually 8 bits dedicated to the amount of red in a pixel, 8 bits for the green and 8 bits for the blue. This is because screens have 3 sections in each pixel: the red, the green and the blue which can each have a different brightness to make different colours. This means if a colour in a 24 bit image is the brightest green possible it will have the code 000000001111111100000000, with a 1 or 0 being a bit. For a 10 by 10 pixel uncompressed image in 24 bit colour there would be $24 * 10 * 10$ bits representing the colour for the image or 2400 bits.

For a simpler example let's use 3 bit colour. This would give us 2^3 or 8 different possible colours. We can assign the first digit to whether or not the pixel has red, the second digit green and the third digit blue.

White	111	Blue	001
Black	000	Yellow	110
Red	100	Purple	101
Green	010	Turquoise	011

Here is what an 8 bit image's code would look like:

Code	Image
100 110 010 011	
110 010 011 001	
010 011 001 101	
011 001 101 100	

File types can have different amount of bits dedicated to colour in a pixel. The amount of possible colours a pixel can have is called colour depth. For JPGs the colour depth is 24 bits or around 16 million (2^{24}) however file formats such as TIFF can have more with 32 bits of colour depth or around 4 billion different colours (2^{32}) and formats such as GIF can have less with 8 bits or 256 different colours.

3. Explain how compression affects the image from a viewer's perspective.

If we use lossy compression the viewer will start to see artifacts form as the compression level goes up. This is seen as distinct blocks of colour with different patterns. This is because of how lossy compression works. Lossy compression works by removing some of the original image's data and using calculations to fill in the missing data. When the compression levels rise the calculations get simpler resulting in clear patterns forming visible square shapes in the image.

However if the lossy compression is used at a medium to low level on a fairly complex image the viewer might not even notice. This is because our brain can skip over small inconsistencies to make the image look normal. This means if you use the right amount of lossy compression the user will not be able to tell the difference. This has the result of having seemingly the same image quality while reducing file size more than lossless compression (on more complex images such as nature). This reduces the file size and therefore the transfer and download times. This is especially helpful for websites as images will load faster.

If we are using lossless compression the viewer will not affect the image from the viewer's perspective. This is because of how lossless compression works. It works by reducing file size without getting rid of the original data. This means when uncompressed the image will look the same as the original. It achieves this by removing redundant data. One form of this is run length encoding. This is when an image will record a colour and how many pixels in a row have that colour. This means the bits used for storing the same colour in a row are removed and instead replaced by how many of a colour is in a row.

4. For *two* of the school's output requirements, (see above) state what type of compression you would use ensuring that you:
- (b) explain why you would use lossless or lossy compression, outlining the advantages and disadvantages of each compression type for the specific output.
 - (a) justify your decision for each output, explaining why your chosen type of compression would be the most appropriate

**** You may add information from your own course work to support your answers****

School output requirement 1

Photographs for the school website and Facebook page, including a gallery page with thumbnail links to full size images.

I would use lossy compression for this in the form of JPGs. I would use lossy compression as for images that don't have big blocks of colour lossy compression is much better at reducing file size. This is because it removes some of the original images data. This decreases load times as there is less data to transfer. The main downside to lossy compression is the artifacts that generate. This is because to get rid of data JPGs have to calculate the gaps. This means that with higher compression visible patterns start forming that reduce image quality. However if the compression is kept at a medium or low the artifacts will become much less noticeable (especially as it is on a screen which likely has a low PPI) resulting in a much smaller file size with little to no consequences. In addition I would also use a PPI of 72 as most screens will only have a resolution of about 72 PPI however more importantly an image with a lower PPI will have a smaller file size than one of the same image size but higher PPI.

School output requirement 2

Photographs of athletics champions or students who break school athletics records will be printed and framed (A3 size)

I would use lossless compression in the form of high resolution TIFFs. I would use lossless compression as in print media small inconsistencies are more easily noticed so small artifacts would be visible fairly easily. This means that lossy compression would be a compromise on image quality. I would use TIFFs as they have a high colour depth (the possible colours a pixel or dot can be) resulting in smoother colour transitions. I would use 300+ DPI as print media can look fuzzy with anything less resulting in a subpar product. The main downside to the high resolution, TIFF file format and the lossless compression is the larger file size however as the images are for athletes that break records there will be very few of them. This means that while the file size is extremely large as there are only a few of these photos the impact on storage space will not be that large. As stated before lossy compression would reduce image quality however a JPG also has a lower colour depth. This means each pixel has less possible colours so transitions between colours will appear less smooth.

Excellence Exemplar 2018

Subject	Level 1 Digital Technologies CAT 2018	Standard	91887	Total score	08
Q	Grade score	Annotation			
1		The student has provided a clear justification for their camera setting.			
2		The student has explained, with examples, how uncompressed images are represented using bits.			
3		The student has provided a detailed explanation of compression types with reference to users' perspectives.			
4		The student has discussed the appropriate compression type for each output outlining the advantages and disadvantages for each. They have justified their decision.			