MERIT EXEMPLAR 2022

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COMMON ASSESSMENT TASK

Level 1 Digital Technologies 2022

91887 Demonstrate understanding of compression coding for a chosen media type

Credits: Three

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of compression coding for a chosen media type.	Demonstrate in-depth understanding of compression coding for a chosen media type.	Demonstrate comprehensive understanding of compression coding for a chosen media type.

Type your School Code and 9-digit National Student Number (NSN) into the space below. (If your NSN has 10 digits, omit the leading zero.) It should look like "123-123456789-91887".

The task in this assessment is in FOUR parts.

Answer parts (a), (b), and (c), and then choose ONE of parts (d), (e), or (f).

You should aim to write **800–1500 words** in total.

Your answers should be presented in 12pt Times New Roman font, within the expanding text boxes, and may include only information you produce during this assessment session. Internet access is not permitted.

Save your finished work as a PDF file with the file name used in the header at the top of this page ("SchoolCode-YourNSN-91887.pdf").

By saving your work at the end of the assessment, you are declaring that this work is your own. NZQA may sample your work to ensure this is the case.

INSTRUCTIONS

The assessment task requires you to discuss compression methods for one or more media types (image, video, or audio).

You must answer parts (a), (b), and (c).

Choose only ONE of parts (d), (e), or (f) on lossless compression:

- (d) Huffman coding
- (e) Run-length encoding
- (f) LZW.

You may copy and paste (snip and / or screengrab) relevant information from the following resources to support your answers.

Read all parts of the assessment task before you begin.

RESOURCE A: Images

Fig. 1

RESOURCE B: Audio

Fig. 2

RESOURCE C: Video

Fig. 3

Fig. 4

Acknowledgements
Material from the following sources has been adapted for use in this assessment:
https://helpx.adobe.com/photoshop/key-concepts/compression.html
https://boomspeaker.com/320kbps-vs-flac/
https://aws.amazon.com/blogs/media/part-1-back-to-basics-gops-explained/

ASSESSMENT TASK

(a) Referring to ONE media type (image, video, or audio), explain the reasons why files of this media type might be compressed.

Media type: Image

Images these days are starting to take up more and more storage per image. With higher resolution images captured from DSLR cameras, and even mobile phones, storage can be used up very quickly. The majority of people in the later years typically only take photos on their smartphones, which the majority have only a fixed amount of storage. Most people also have their phones on their person most of the time, meaning more photos are likely to be taken. With new technology like long exposure images, and live photos (a common photo feature amongst new smartphones) these are starting to take up more and more space on your phones internal storage. Smartphones are changing with the times, offering higher and higher amounts of storage, however these cost a premium, and a lot of people wouldn't want to upgrade their whole phone to get a bump in storage. A simple solution to this is to simply use compression on your images. Most modern phones, computers and the like offer compression in the settings in the device, making it easier, and more simple to save space than ever before.

One last factor that makes image compression enticing is the factor that it makes images load faster. A lot of people in the world have very patchy, slow internet access, such as at the school. This means having smaller files can drastically decrease the time taken to view images. With the smaller file size of compressed images, when downloading images, it can also save you money. People that are trying to download images over mobile data, or people who pay for amount of internet they use instead of being on an unlimited plan can benefit from the smaller file sizes, causing less people money to be spent, and less data to be used.

(b) Give examples of times when you have used either lossy or lossless compression. Why was it appropriate to use this compression method in these cases?

I have run into the storage problem before as I'm sure many people have. On my old iPhone, I had 64gb of storage, which was enough at first, but that starts to fill up quick when you start taking photos, downloading apps, etc. It got too a point where I couldn't take new photos, videos, or download anything simply because I had no storage. I did some research, and instead of paying thousands of dollars for a whole new phone with more storage, I instead found out that Apple (the brand of phone) offers a compression service on your images for free. In the settings you could turn this on, and I decided to use lossy compression to save the most space. The good part about this, is that along with saving space, I could still have access to the full resolution image (without compression) if needed, as apple backs up the full resolution images to the cloud. I only had to do this a few times in the years that I had that phone, as most of the time on the 6.1inch smartphone screen you couldn't actually notice any drop in quality of the image, or any artifacts.

SCENARIO: Sharing school photos

You are the head of your school's digital media team and have taken photos, video, and audio of the kapa haka group's latest performance. Because your school is small and in a rural area, internet access can be patchy. The principal would like to share the recordings with whānau and the community. There are two options available to the principal: • Emailing the files as attachments and / or • Storing them on the school's server and emailing a link to download them.

(c) Consider the scenario above. You may also include snips from Resources A, B, and C on pages 2 and 3.

Select ONE of the media types (photos, video, or audio) and recommend an option to the principal. Refer to the scenario in your recommendation. You may select the same media type as you discussed in part (a).

Media type: Image Storing the images on the schools server and emailing a link to them would be the most appropriate method.

(i) What would be the most appropriate compression method for the scenario?

Lossy for emailing the files Lossless for storing them on the schools server and emailing a link.

(ii) Explain why this method would be more suitable than another compression method. Justify your choice by comparing and contrasting it with another compression method.

If the principle is hoping to email the attachments, an appropriate method of compression would be to use lossy compression on the images. The file type I would use is JPEGThis is because the majority of email providers (Gmail, Outlook, iCloud etc.) all have a cap on how big files are that you can upload. At the Kapa Haka performance, me and the rest of the school media team took many photos, all of which would not fit in just one email. With lossless compression, the files would still take up too much space, and would probably have to be spaced across many emails. This is because Lossy compression reduced the size of the file a lot more that lossless compression does. With lossy compression you should be able to send all the images in just one email. If the principle were to choose to store the images in the school's server and email a link to them, I would use Lossless compression on the images. I would use high quality TIF files. This is because the school servers are very big, and thus the images don't have as big of a storage constraint. This would also be beneficial to the parents and people who are looking for higher quality images. With patchy internet, it could take a bit longer for family and friends to download the images than it would with lossy compression, but I think having high quality images that people could print out, view on bigger screens like TV's, and share around without any quality drop, blurriness, or artifacts is more important than having to

wait for the files to download.

(iii) Explain how this method would affect the output from the end user's perspective.

From the parents, family, and friends' perspective, downloading the files from the school servers via a link sent out to them could be a little tedious depending on their internet speed. It is likely that out in the more rural area they may not have high speed fiber, meaning slower download times. However once the end user gets past the hurdle of having to wait for the download, they would have high quality images, without any quality drops, artifacts, or blurriness. This would be beneficial, as the end user could look at the photo on big screens like TV's, print out the photos and hang them up, or share around the photos to other friends and family. If Lossy compression was used, you would often see artifacts, and a noticeable drop in quality for these use cases. Artifacts is when parts of your images can form into box/squares, making it look "janky".

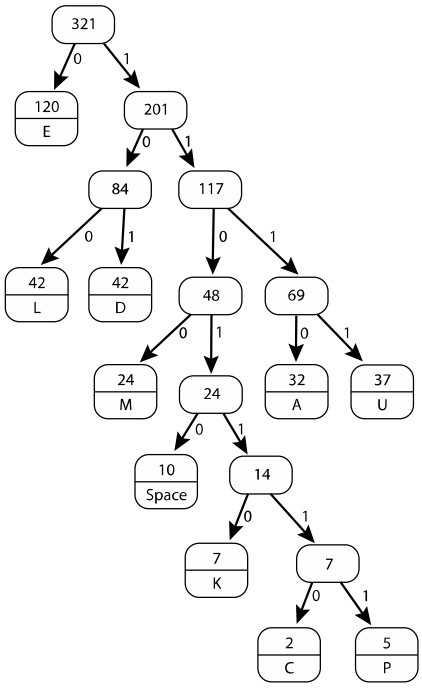
Below is an example of artifacts, where the image on the left is lossless compression and the image on the right in lossy. At this size there is no noticeable difference, but when you zoom in, crop, or view the image on a bigger screen, you can start to see that the lossy compressed image looks a lot less smooth, and is much blurrier. You can also see a lot of squares in the image, which are called artifacts. This only occurs in lossy compression.

Lossless compression

Answer EITHER part (d) Huffman coding OR part (e) Run-length encoding OR part (f) LZW

(d) **Huffman coding**

Note: If you are answering this part, don't answer parts (e) or (f).



(i) Using the Huffman tree above, decode the code 1100 1111 1101110 110110

MUCK

(ii) Using the Huffman tree above, encode the word DAME

101 1110 1100 0

(iii) If the phrases A MUDDLED MEAL and PACK UP A CUP are encoded with the Huffman tree above; which phrase will be compressed by more? Justify your answer.

The following is working A – 1110 SPACE - 11010 M – 1100 U – 1111 D – 101

D – 101

L – 100

E – 0

D – 101

SPACE – 11010

M – 1100

E – 0

A – 1110

L – 100

C – 1101110

K – 110110

P – 1101111

Answer starts here.

The following is the code for the two phrases.

A muddled meal – 1110 11010 1100 1111 101 101 100 0 101 11010 1100 0 1110 100

Pack up a cup – 1101111 1110 1101110 110110 11010 1111 1101111 11010 1110 11010 1101110 1111 1101111

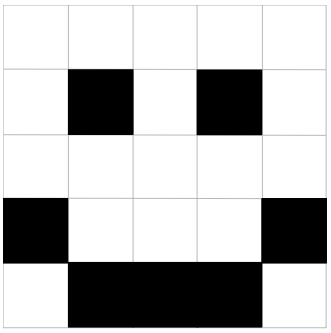
We can see that even though “A MUDDLED MEAL” is a longer phrase than “PACK UP A CUP”, it has a shorter code. The code for the phrase “PACK UP A CUP” has a character (without the spaces in the code (the code includes the spaces in the phrase)) count of 72, whereas “A MUDDLED MEAL” only has 47 characters. This is because Huffman encoding works by finding the most occurring letters (or subjects (could be pixels in an image)) and sorting them to the left of the tree. This gives them a smaller (less characters) code. We can see this in the tree where the letter E is given the code ‘0’ and the letter P is given the code ‘1101111’. This means that the letter E appears much more frequently than the letter P

We can deduct from this, that the phase “A MUDDLED MEAL” contains letters that appear much more frequent than the phrase “PACK UP A CUP”

(e) **Run-length encoding**

Note: If you are answering this part, don't answer parts (d) or (f).

(i) Encode this image using run-length encoding.



(ii) Decode the code below by filling in any 'black' boxes with a cross (X).

0, 5
1, 3, 1
2, 1, 2
2, 1, 2
5

(iii) Consider the two 13×13 images below. Which of these will result in a larger file size than the original when compressed using run-length encoding? Justify your answer.

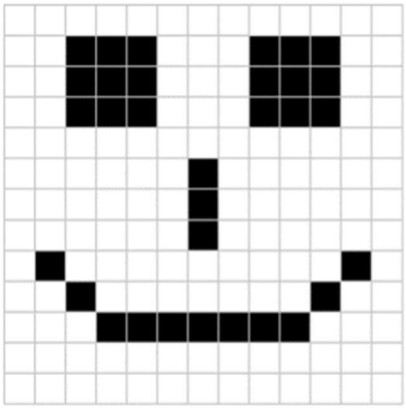


Image A

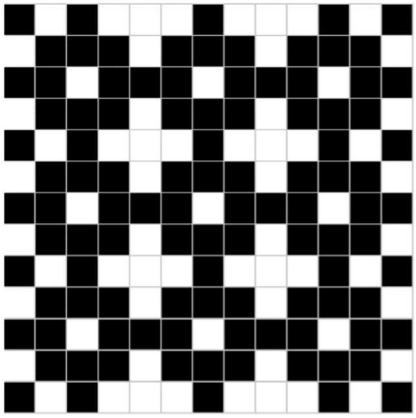


Image B

(f) **LZW**

Note: If you are answering this part, don't answer parts (d) or (e).

Code	Character string	Code	Character string
0	Just drift away	5	day
1	,	6	Day
2	yeah	7	dreaming
3	(	8	so sweet
4	)	9	.

(i) Use the dictionary above to encode the following song lyrics.

Just drift away, yeah
Just drift away (day dreaming, so sweet, yeah)
Just drift away (day dreaming, so sweet, yeah)
Day dreaming, so sweet, yeah
Just drift away

(ii) Use the dictionary above to decode the following code.

0 9 6 7 1 8 1 2 9

(iii) How could the dictionary above be changed to improve the compression of the message in (i)? Justify your answer.

Merit Exemplar 2022

Subject	Digital Technologies Level 1	Standard	91887	Total score	06

Q	Grade score	Annotation
1	M6	The candidate has identified multiple reasons why compression might be used and has explained the benefits of using compression in each case. The candidate has given one example of when they have used lossy compression. To show greater understanding, they could have given another example, and contrasted their choice of using lossy with the advantages/disadvantages of using lossless compression. They have been able to apply their understanding to the scenario, selecting the lossy compression method. Their selection is justified by explaining the benefits and contrasting these against lossless. There is no mention of the fact that JPG files could be compressed by different amounts to balance file size with quality, nor do they explain why lossy compression can lead to a decrease in quality. They have demonstrated that they can use Huffman Trees, both encoding and decoding files. Their explanation of how they work and why a particular phrase will compress more shows good understanding.