IGCSE COMPUTER SCIENCE

DATA REPRESENTATION

LOSSY & LOSSLESS COMPRESSION

Please prepare your BYOD

for our KWYK & KWYL Activity

Pay attention & listen attentively

STARTER

KNOWING WHAT YOU KNOW (KWYK)

Go to:

https://joinmyquiz.com

Join Code: _____

LINKING

Today we will be discussing on Lossy and Lossless compression based on the Scheme of Work as a topic presentation for 1 period.

21-Oct	25-Oct	11	Parents Conference	Single 1.3	21	Single count of Rest of Chapter 1 1.3 Data storage and compression	The purpose of and need for data compression Lossy and lossless file compression methods
					22	7. Algorithm design and problem solving + PC on Programming	Loops

Grade 09 | Computer Science	
No.	**Topic**
1	Converting text to binary
	Character set - ASCII, UNICODE
2	Converting image to binary
	Pixel, Resolution, Metadata, Colour depth
3	Converting sounds to binary
	Sound sampling, Sample rate, Sampling resolution
4	Measuring data storage
	Bytes, KB & KiB, MB & MiB, GB & GiB
5	Calculating size of a file
6	Data Compression
	Lossy, Lossless, RLE Algorithm

This is the continuation link part of DATA REPRESENTATION unit.

LESSON OBJECTIVES

- Understand what lossy and lossless compression is
- Explain the importance of compressing files that are transmitted on the Internet
- Describe the difference between lossy and lossless compression

YOUR SUCCESS CRITERIA

- You MUST understand what lossy and lossless compression is
- You SHOULD explain the importance of compressing files that are transmitted on the internet.
- You COULD describe the difference between lossy and lossless compression.

MAIN TOPIC

Compression Techniques

- Reduce file size
- Mostly used with sound, image and video file types
- Two types:
  - Lossy compression (JPG, GIF, MP3, MP4)
  - Lossless compression (PNG, TIF, SVG)

ACTIVITY FOR ALL: HA / MA / LA

Objective: Understand what lossy and lossless compression is

LOSSY COMPRESSION

What lossy compression is?

ACTIVITY FOR ALL: HA / MA / LA

Objective: Understand what lossy and lossless compression is

Lossy compression

- Permanently removes some data
- Recreates the file using the remaining data and uses algorithms to guess the removed content
- Uncompressed data is **not** the same as the original

```
# S CTIO  2
w ile gues    =    rr ctPas  or :
    guess = i put "Try to guess t     sswor    ")
    g   ses   gue  es + 1

 rint("Pa swor   uessed c r  ctly
```

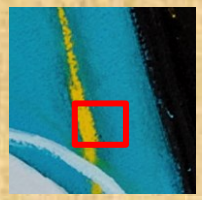
Would this technique work for compressing a computer program?

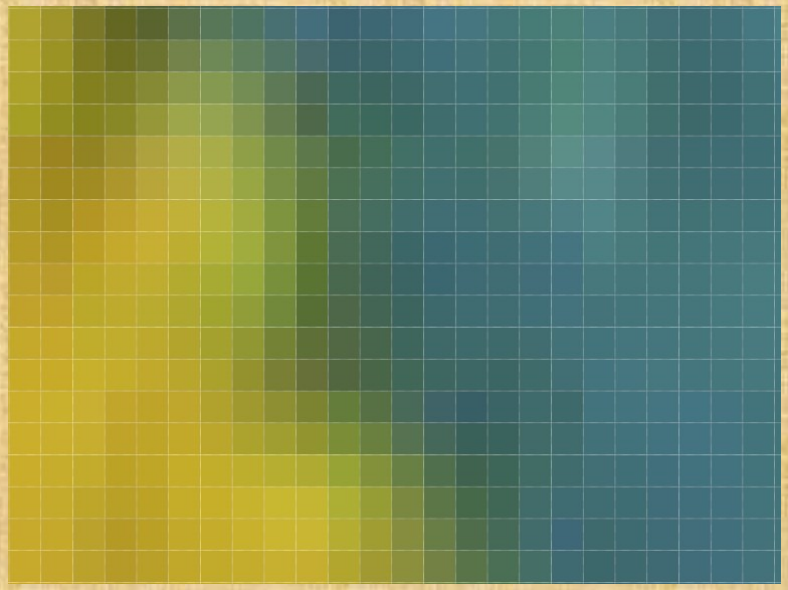
ACTIVITY FOR ALL: HA / MA / LA

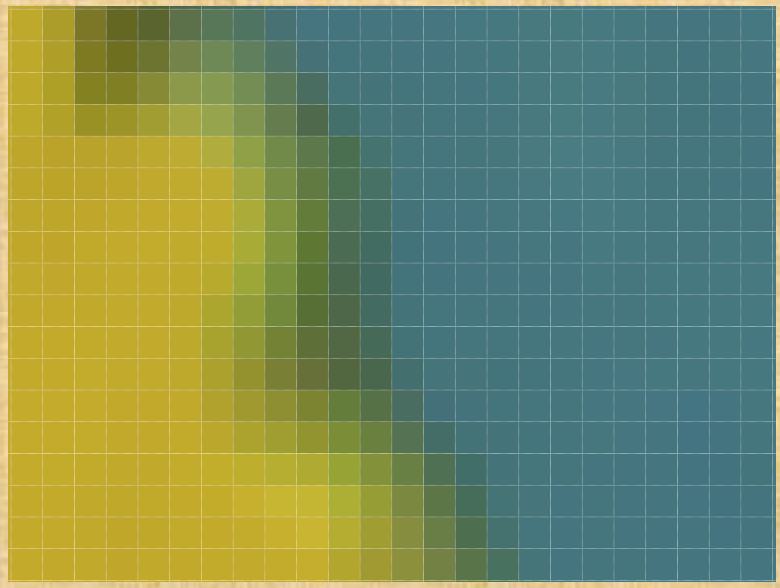
Objective: Understand what lossy and lossless compression is

How lossy compression works

- Similarly coloured pixels are all made the same







ACTIVITY FOR ALL: HA / MA / LA

Objective: Objective: Understand what lossy and lossless compression is

LOSSLESS COMPRESSION

What lossless compression is?

ACTIVITY FOR ALL: HA / MA / LA

Objective: Objective: Objective: Understand what lossy and lossless compression is

Lossless image compression

- Finds groups of repeating data and records the data only once along with the number of times it was repeated

= 12 x  + 6 x 

- When data is uncompressed it is restored exactly as it was in the original

ACTIVITY FOR ALL: HA / MA / LA

Objective: Objective: Understand what lossy and lossless compression is

Lossless text compression

- Finds patterns in the original text
- Encodes each pattern in a dictionary

An eye for an eye,

a tooth for a tooth

Dictionary

.	0	0000
An_	1	0001
eye	2	0010
for	3	0011
an_	4	0100
,_	5	0101
a_	6	0110
tooth	7	0111

ACTIVITY FOR ALL: HA / MA / LA

Objective: Understand what lossy and lossless compression is

Lossless text compression

- 38 Characters including spaces = 38 bytes (assuming an 8-bit ASCII table is used)
- 48 bits = 12 bytes = 32% of original size (plus codes)

Dictionary

.	0	0000
An_	1	0001
eye	2	0010
for	3	0011
an_	4	0100
,_	5	0101
a_	6	0110
tooth	7	0111

An eye for an eye,

a tooth for a tooth

1	2	3	4	2	5	6	7	3	6	7	0
0001	0010	0011	0100	0010	0101	0110	0111	0011	0110	0111	0000

ACTIVITY FOR ALL: HA / MA / LA

Objective: Understand what lossy and lossless compression is

What's the difference ?

Identify the statement to describe if either it is Lossy or Lossless compression

LOSSY **LOSSLESS**

A. Uncompressed image data is stored exactly to its original text.

B. It finds pattern in the original text and encode it in a dictionary

C. Permanently remove some data

D. Uncompressed data is not the same as the original

E. Recreates the file using the remaining data and uses algorithms to guess the removed content

ACTIVITY FOR ALL: MA / LA

Objective: Describe the difference between lossy and lossless compression

What's the difference ?

Identify the statement to describe if either it is Lossy or Lossless compression

A. Uncompressed image data is stored exactly to its original text. **LOSSLESS**

B. It finds pattern in the original text and encode it in a dictionary

C. Permanently remove some data

D. Uncompressed data is not the same as the original

E. Recreates the file using the remaining data and uses algorithms to guess the removed content

ACTIVITY FOR ALL: MA / LA

Objective: Describe the difference between lossy and lossless compression

What's the difference ?

Identify the statement to describe if either it is Lossy or Lossless compression

A. Uncompressed image data is stored exactly to its original text. **LOSSLESS**

B. It finds pattern in the original text and encode it in a dictionary **LOSSLESS**

C. Permanently remove some data

D. Uncompressed data is not the same as the original

E. Recreates the file using the remaining data and uses algorithms to guess the removed content

ACTIVITY FOR ALL: MA / LA

Objective: Describe the difference between lossy and lossless compression

What's the difference ?

Identify the statement to describe if either it is Lossy or Lossless compression

A. Uncompressed image data is stored exactly to its original text. **LOSSLESS**

B. It finds pattern in the original text and encode it in a dictionary **LOSSLESS**

C. Permanently remove some data **LOSSY**

D. Uncompressed data is not the same as the original

E. Recreates the file using the remaining data and uses algorithms to guess the removed content

ACTIVITY FOR ALL: MA / LA

Objective: Describe the difference between lossy and lossless compression

What's the difference ?

Identify the statement to describe if either it is Lossy or Lossless compression

A. Uncompressed image data is stored exactly to its original text.	**LOSSLESS**
B. It finds pattern in the original text and encode it in a dictionary	**LOSSLESS**
C. Permanently remove some data	**LOSSY**
D. Uncompressed data is not the same as the original	**LOSSY**
E. Recreates the file using the remaining data and uses algorithms to guess the removed content	

ACTIVITY FOR ALL: HA / MA / LA

Objective: Describe the difference between lossy and lossless compression

What's the difference ?

Identify the statement to describe if either it is Lossy or Lossless compression

A. Uncompressed image data is stored exactly to its original text. **LOSSLESS**

B. It finds pattern in the original text and encode it in a dictionary **LOSSLESS**

C. Permanently remove some data **LOSSY**

D. Uncompressed data is not the same as the original **LOSSY**

E. Recreates the file using the remaining data and uses algorithms to guess the removed content **LOSSY**

ACTIVITY FOR ALL: MA / LA

Objective: Describe the difference between lossy and lossless compression

RUN LENGTH ENCODING

- Run length encoding (**RLE**) is a form of lossless data compression algorithm that **condenses identical elements into a single value** with a count
- For a text file, "**AAAABBBCCDAA**" is compressed to "**4A3B2C1D2A**"
- The string has patterns of **four 'A's**, followed by **three 'B's**, **two 'C's**, **one 'D'**, and **two 'A's** that is indexed according to instance with their position.
- RLE algorithm is used in **bitmap images** to compress **sequences of the same colour**
- For example, a line in an image with 5 red pixels followed by 3 blue pixels could be represented as "**5R3B**"

ACTIVITY FOR ALL: MA / LA

Objective: Describe the difference between lossy and lossless compression

Check Point Question

Describe how lossless compression compresses text file.

(ii) Describe how lossless compression compresses the text file.

.....

.....

.....

.....

.....

.....

.....

..... [4]

ACTIVITY FOR ALL: HA / MA

Objective: Describe the difference between lossy and lossless compression

Check Point Answer

Describe how lossless compression compresses text file.

Any **four** from:

- A compression algorithm is used
- … such as RLE/run length encoding
- **Repeating** words/characters/phrases are identified // Patterns are identified
- … and indexed
- … with number of occurrences
- … with their position

ACTIVITY FOR ALL: HA / MA

Objective: Describe the difference between lossy and lossless compression

Worksheet Activity

- Complete **Task 1** – Lossless compression

ACTIVITY FOR ALL: HA / MA / LA

Objective: Understand what lossy and lossless compression is

Importance of Compressing Files

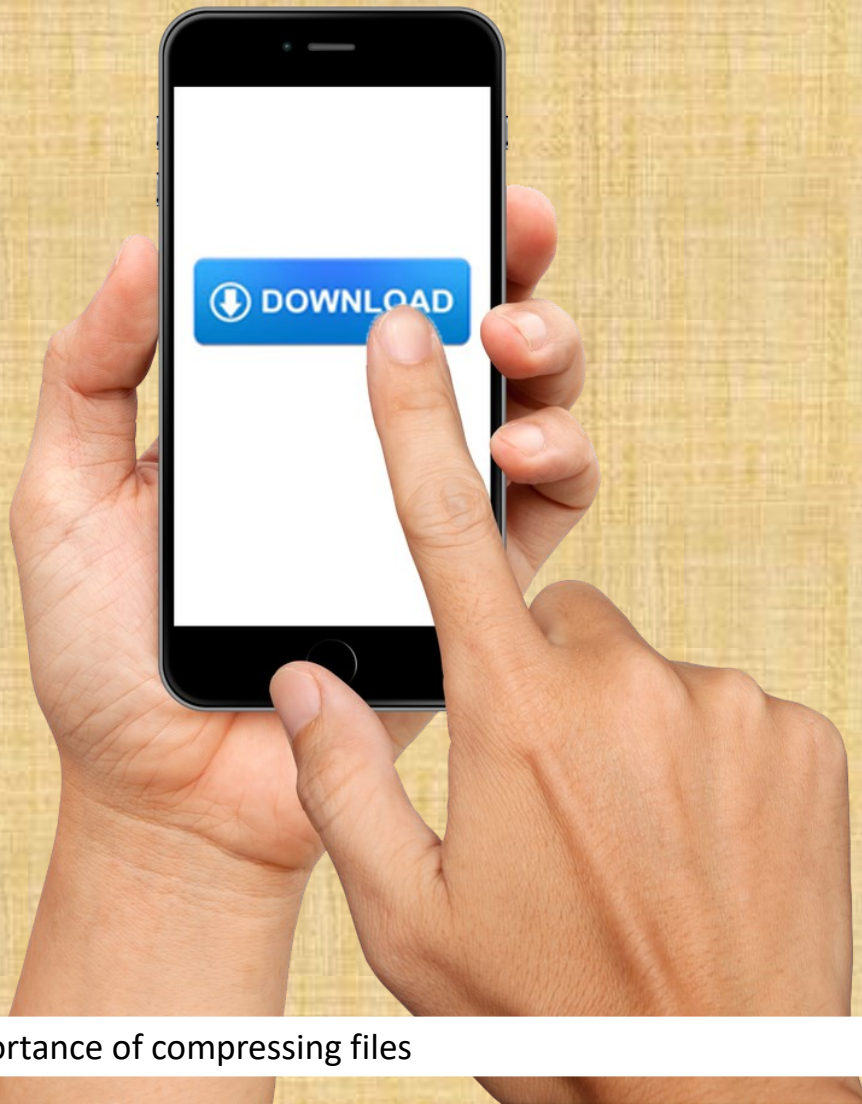
What purpose of and need for data compression ?

ACTIVITY FOR ALL: HA / MA / LA

Objective: Explain the importance of compressing files

Transmission of data over IP

- Why use compression?
  - Download speeds are increased
  - Data allowances are reduced
  - Voice can be transmitted fast enough to keep up with speech



ACTIVITY FOR ALL: HA / MA / LA

Objective: Explain the importance of compressing files

Downloading a music track

- Dancing Queen by ABBA = 3m 51sec = 231 seconds
- MP3 quality = 128kbps
- CD quality = 1411kbps
  - 231 x 128kbps = 29,568kbs / 1024 / 8 = 3.6MB

  OR:

  - 231 x 1411kbps = 325,941kbs / 1024 / 8 = 39.79MB
- 11.5 times faster with a compressed file
- 36 MB less download data used

COMPARISON NOTES:
128 kbps = 128000 bps
1.411 Mbps = 1,411 kbps = 1,411,000 bps

ACTIVITY FOR ALL: HA / MA / LA

Objective: Explain the importance of compressing files

Worksheet Activity

- Complete **Task 2**

Comparison Notes:
128 kbps = 128000 bps
1.411 Mbps = 1,411 kbps = 1,411,000 bps

ACTIVITY FOR ALL: HA / MA / LA

Objective: Explain the importance of compressing files

COMPRESSION BENEFITS & COMMON STANDARDS

What are the compression benefits and common standards?

ACTIVITY FOR ALL: HA / MA / LA

Objective: Explain the importance of compressing files

Benefits of compression

- Smaller files = fewer packets = faster transmission
  - Quicker to complete
  - Reduces traffic over the Internet
  - Less chance of collisions or transmission errors
- Improves download speed of video, sound (including speech used for VOIP systems) and image files
- Speeds up download of webpages that use images
- Reduces space on disk / servers
- Enables better streaming of music and video

ACTIVITY FOR ALL: HA / MA / LA

Objective: Explain the importance of compressing files

Buffering

Video or music streaming causes buffering if the download speed is slower than the playback speed

ACTIVITY FOR ALL: HA / MA / LA

Objective: Explain the importance of compressing files

Buffering

- Video or music streaming causes buffering if the download speed is slower than the playback speed

DEEP & PROFOUND QUESTION

How could you reduce the chances of people experiencing buffering if you were the website owner?

ACTIVITY FOR ALL: HA / MA / LA

Objective: Explain the importance of compressing files

Common file standards

- PDF – Fixed layout document that maintains its original appearance regardless of the software used to view it (Portable Document Format)
- JPG – Lossy compressed files commonly used for website images (Joint Photographic Expert Group)
- GIF – Lossy compressed images using only 256 colours, used for simple web graphics (Graphic Interchange Format)
- PNG – Lossless compressed format using an alpha channel to preserve transparent backgrounds (Portable Network Graphic)
- MP3 / MP4 – Lossy music / video formats

ACTIVITY FOR ALL: HA / MA / LA

Objective: Explain the importance of compressing files

PLENARY

KNOWING WHAT YOU LEARNED (KWYL)

Go to:

https://joinmyquiz.com

Join Code: _____

ACTIVITY FOR ALL: HA / MA / LA

Objective: Explain the importance of compressing files

EXTENSION TASK

Answer extension task in your worksheet

ACTIVITY FOR ALL: HA / MA

This activity is for fast learners that will give them more challenge in their learning

REFLECTION AND SUPPORT

Let me know about your learning by doing the reflection and support survey posted on my website.

Navigate through the menu

https://febstar.com

→featured-updates

→student-achievements

→learning-reflection-and-support

NOTES

THANK YOU VERY MUCH