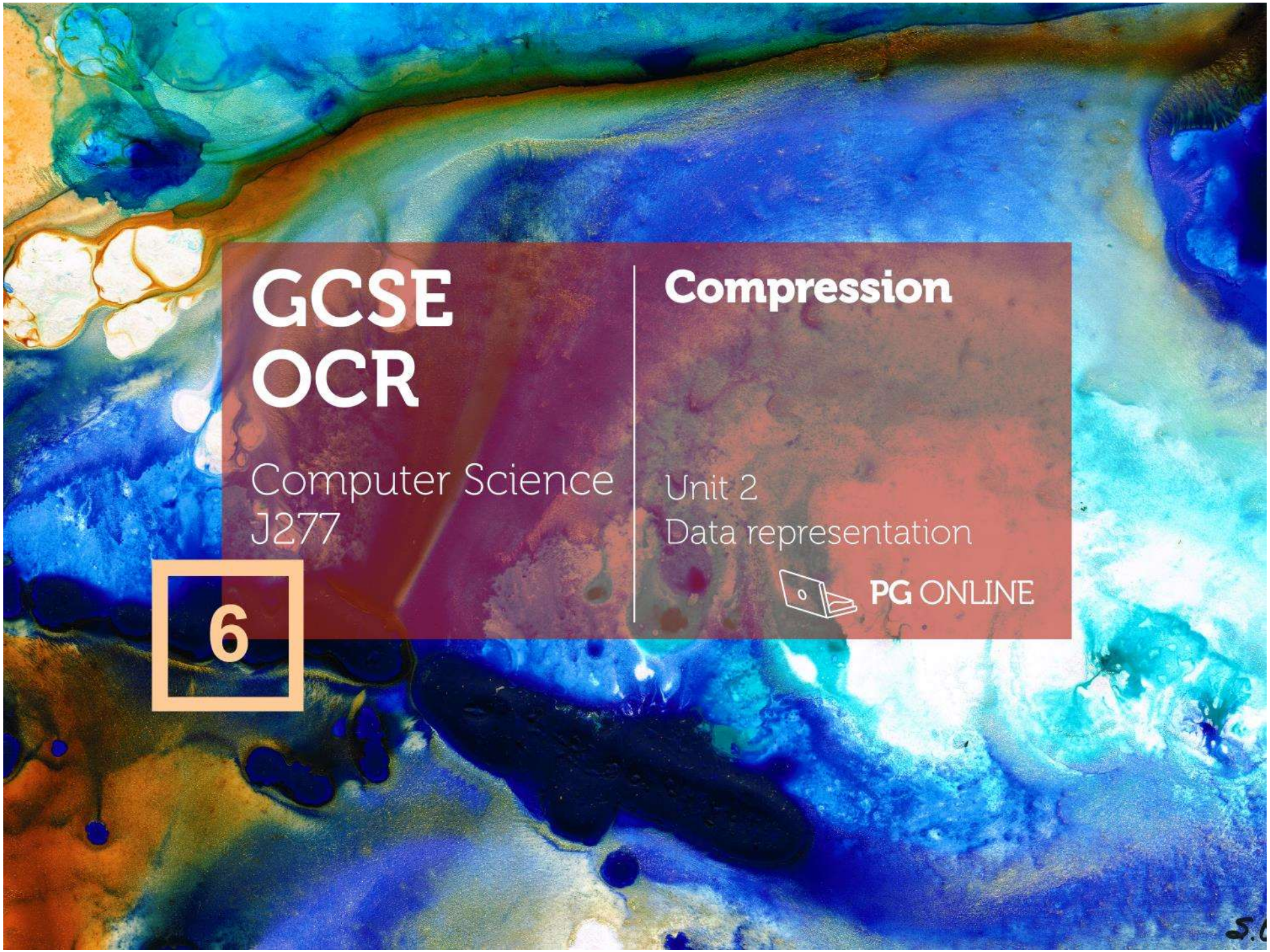

GCSE
OCR
Computer Science
J277
Compression
Unit 2
Data representation
PG ONLINE
6

Objectives

- Explain the need for compression
- Describe the difference between lossy and lossless compression

Starter

- HD TV has a resolution of 1920px x 1080px
  - This results in 2.1 megapixels per frame
  - Each pixel uses 24-bit colour
  - This means each frame needs about 50 megabits
  - There are 25 frames per second resulting in a total amount of data being 1.25 gigabits per second
- How can we possibly stream this through internet connections that are typically under 70 Mb/s in the UK?

Compression techniques

- Compression is the name given to algorithms which reduce file sizes
  - Decompression is the process where compressed data is restored to its original format
- Compression is heavily used with sound, image and video files
- There are two types of compression:
  - Lossy compression (JPG, GIF, MP3)
  - Lossless compression (PNG, TIFF)

Lossy compression

- Lossy compression permanently loses some data
  - Would a lossy compression algorithm work for compressing a computer program?

```
# 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
```

Lossy compression artefacts

- Lossy compression results in small mistakes known as ‘digital artefacts’ appearing in images and video
  - Noise can often be seen where there are contrasting colours
  - Blocks can often result from lossy compression

Lossless image compression

- Lossless image compression will not lose any of the original data
  - The algorithm finds groups of repeating data and records the data once along with the number of repetitions

= 12 x , 6 x

- When data is uncompressed it is restored exactly as it was in the original
  - Which image file format uses this technique?

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

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

Dictionary compression

- 38 Characters including spaces = 38 bytes (assuming an 8-bit ASCII table is used)
- 48 bits = 6 bytes = 16% of original size (plus codes)

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

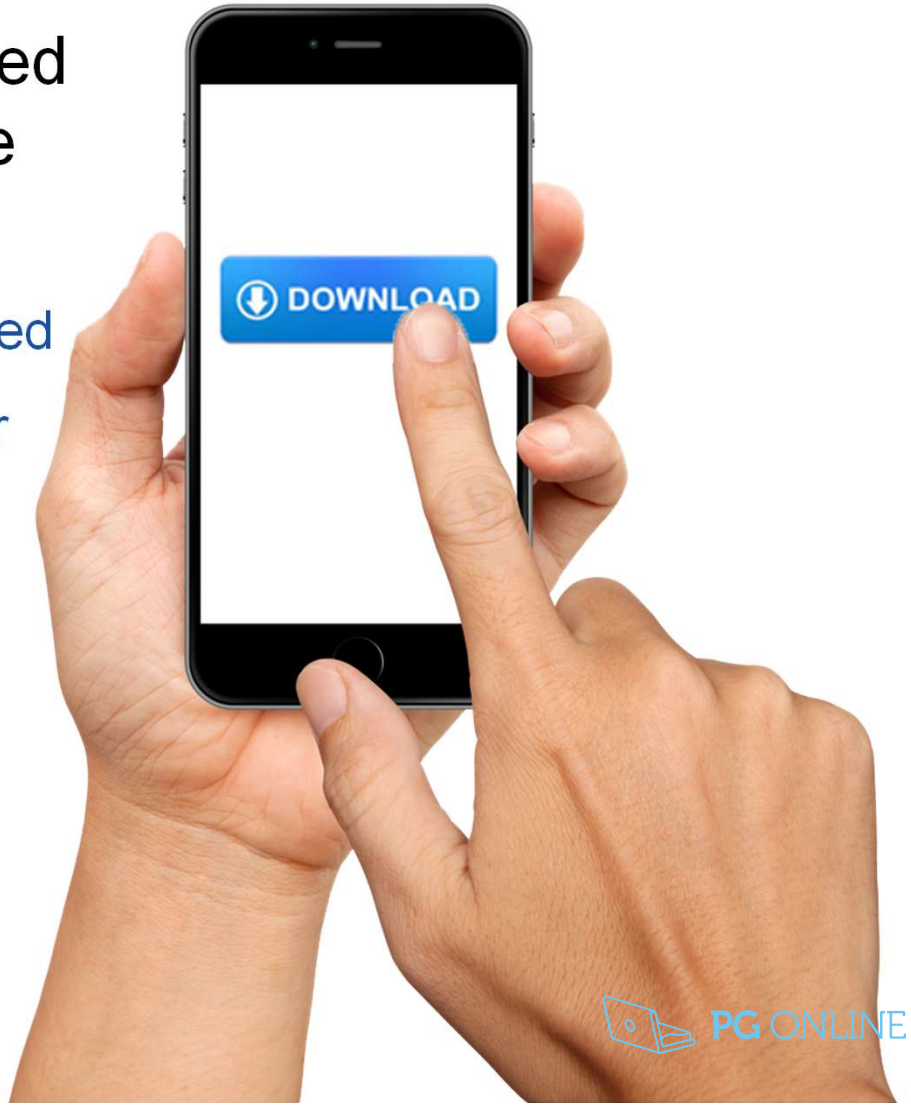
1	2	3	4	2	5	6	7	3	6	7	0
0001	0010	0011	0100	0010	0101	0110	0111	0011	0110	0111	0000

Worksheet 6

- Complete **Task 1** on **Worksheet 6**

Using compression

- Compression is often used for files and data that are sent via the internet
  - Download times are reduced
  - Data allowances go further
  - It is possible to transmit video and music data streams as fast as they are playing



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 = 39.8MB
- 11.5 times faster with a compressed file
  - 36MB less download data used

Worksheet 6

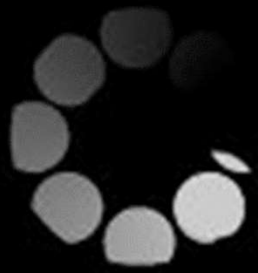
- Complete **Task 2** on **Worksheet 6**

Benefits of compression

- Smaller files = fewer packets = faster transmission time
  - Quicker to complete transmission
  - Reduces traffic over the Internet
- Reduces download times of video, sound (including speech used for VOIP systems) and image files
  - Streaming is also possible as the data can be sent as fast as the rate it is played
- Images inside web pages appear faster
- Reduces space on disk / servers

Buffering

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



loading

- How could you reduce the chances of people experiencing buffering when they are playing video?

Video streaming

Answers

- The files for video streaming are compressed
  - The TV or computer needs to decompress the data as it is playing the video
  - Before the video begins playing, it will buffer a sufficient amount to allow for the network occasionally being slow
  - If the website or server detects that the connection is slow, it may be able to start sending an alternative lower quality file

File formats

- What are five compressed file formats used for images, sound, video or documents?
  - Which are lossy and which are lossless?

Common file standards

Answers

File format	Type of compression	File usage
JPEG	Lossy	Photos
PNG	Lossless	Images/photos, may include transparency
ZIP	Lossless	Document compression
GIF	Lossless	Simple images, may include animation
MP4	Lossy	Video file format
MP3	Lossy	Music format
FLAC / ALAC	Lossless	Lossless Music format (Free / Apple)

Worksheet 6

- Complete **Task 3** on **Worksheet 6**

Plenary

- With a partner, take it in turns to explain the following:
  - The need for compression
  - Lossy compression
  - Some of the effects of lossy compression on images and sound files
  - Lossless compression

Plenary

Answers

- The need for compression
  - Compression reduces the size of files, which makes them smaller to store and transmit – this enables services such as streaming music and video
- Lossy compression
  - The compression technique will lose some of the original information
  - Noise at edges and blocks are digital artefacts from lossy compression
- Lossless compression
  - No data is lost by using a lossless compression algorithm

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