4] Compression Techniques

* Introduction
- Data compression reduces file size for efficient storage and transmission.
- Two types:
a) Lossless - No data loss (eg. ZIP, PNG)
b) Lossy - some data lost for higher compression (eg MP3, JPEG)

1) Run length Encoding (RLE)
- stores consecutive repeating data as a single value and count.

Eg
Data: AAAAAABBBBCC
Encoded: 6A4B2C

2) Huffman Coding.
- Assigns shorter binary codes to frequent symbols.
- Used in ZIP, JPEG.

Eg
Symbols: A(0.4), B(0.3), C(0.2), D(0.1)
Codes:
A - 0
B - 10
C - 110
D - 111

3) Lempel - Ziv - Welch (LZW)
- Builds a dictionary of substrings
- Used in GIF and PDF formats.

4) Arithmetic Coding
- Represents the entire message as a single fractional number between 0 and 1.
- More efficient than Huffman for long data sequences.

* Applications
- File Compression (ZIP, RAR)
- Audio / Video compression (MP3, MP4)
- Cloud storage, streaming platforms.

* Conclusion
Compression saves space and bandwidth, enabling faster data transfer and efficient storage.