Compression Worksheet — Run-Length Encoding

Name: _____ **Date:** _____

Part 1: Understanding RLE

RLE replaces runs of repeated values with a count and the value.

Format: `(count, value)` — e.g., `(3,0)` means three zeros.

Example: `0 0 0 1 1 1 1 0 0` → RLE: `(3,0)(4,1)(2,0)` → Original: 9 values. RLE: 6 numbers. Compression ratio: 9/6 = **1.5:1**

Practice — encode these sequences:

a) `1 1 1 1 1 1 1 1` → RLE: _____ Original: 8, RLE: ___, Ratio: ___

b) `0 1 0 1 0 1 0 1` → RLE: _____ Original: 8, RLE: ___, Ratio: ___

c) `0 0 0 0 1 1 0 0` → RLE: _____ Original: 8, RLE: ___, Ratio: ___

Which of a, b, c compresses best? Which compresses worst? Why?

Part 2: Encode the Checkerboard (Image 3) in RLE

Row 1 binary: ■□■□■□■□ = ,,,,,,,

Row 1 RLE: _____

How many RLE numbers for Row 1? ___

Total RLE numbers for the full checkerboard (all 8 rows): ___

Original bits: 64. **RLE numbers needed:** ___. **Compression ratio:** ___:1

Is this good compression? ___

Part 3: Encode the Solid Block (Image 4) in RLE

Row 1 binary: □□□□□□□□ = ,,,,,,, → RLE: _____ (numbers needed: ___)

Row 2 binary: □■■■■■■□ = ,,,,,,, → RLE: _____ (numbers needed: ___)

How many unique row types are there in this image? ___

Total RLE numbers for the full solid block (all 8 rows): ___

Compression ratio: 64 / ___ = ___:1

Part 4: Comparison

Image	Original bits	RLE numbers needed	Compression ratio
Checkerboard	64		
Solid Block	64		

Which image compressed better? _____

What type of image compresses well with RLE? _____

What type of image compresses poorly? _____

Part 5: Real World

Why do photos of blank documents (like a printed page) transmit quickly by fax?

Why does JPEG compression work better on landscape photos than on photos of a TV showing static?

RLE is "lossless" — the original can be perfectly reconstructed. What would "lossy" compression mean? Can you think of an example?