

GCSE COMPUTING: DATA REPRESENTATION WORKBOOK

Core Data Units & Storage Architecture Practice Worksheet

Student Name: _____

Date: _____

SECTION 1: DATA STORAGE CAPACITY CALCULATIONS



Reference: The Data Size Hierarchy Ladder (Smallest to Largest)

Unit Name	Abbreviation	Equivalent Value	Example Scale Context
Bit	b	Single 0 or 1 value	A single physical switch status
Nibble	-	4 bits (Half a Byte)	A single Hex value character (e.g., C)
Byte	B	8 bits	A single character typed on a keyboard
Kilobyte	KB	1,000 Bytes	A small, plain half-page textual document
Megabyte	MB	1,000 KB	An average 3-minute high-quality audio file
Gigabyte	GB	1,000 MB	A 1-hour high-definition media stream
Terabyte	TB	1,000 GB	A massive corporate backup server disk pack



Direct Calculation Rules:

- **Moving DOWN the ladder (To a smaller unit):** MULTIPLY by 1,000 (or multiply by 8 if going from Bytes to bits).
- **Moving UP the ladder (To a larger unit):** DIVIDE by 1,000 (or divide by 8 if going from bits to Bytes).
- *Always convert your storage units to match each other before performing division!*

Worked Problem: An 8 GB drive holds files that are 4 MB each. How many tracks fit?

Working: Step down GB to MB: $8\text{ GB} \times 1,000 = 8,000\text{ MB}$. Then perform group division: $8,000\text{ MB} \div 4\text{ MB} = \mathbf{2,000}$ items.

1. A smartphone has 16 GB of free storage. A high-definition movie is 2 GB in size. How many full movies can be stored?

Final Answer: _____

2. An MP3 player has 8 GB of storage. Each song has an average file size of 4 MB. How many songs can it hold?

Final Answer: _____

3. A photographer's SD card has 32 GB of space. Each photo takes up 5 MB. How many images fit?

Final Answer: _____

4. A backup drive has 2 TB of total space. A system image file is 50 GB. How many full backups can be saved?

Final Answer: _____

5. A cloud storage limits folder sizes to 1 GB. If documents are 250 KB each, how many documents fit?

Final Answer: _____

6. An email attachment boundary is 20 MB. If home assignments are 4,000 KB each, how many can be sent?

Final Answer: _____

7. A user server allocation is 500 MB. If a student programming script folder is 25 KB, how many fit?

Final Answer: _____

8. An SSD partition contains 120 GB of empty space. A game install requires 15 GB. How many copies can be saved?

Final Answer: _____

9. A network stream needs to process 3 GB of logs. If handled in chunks of 300 MB, how many blocks are verified?

Final Answer: _____

10. A floppy disk holds 1.4 MB. If a text configuration entry file is 200 KB, how many complete profiles fit?

Final Answer: _____

SECTION 2: BINARY TO DENARY CONVERSION

Worked Example: Convert 10101100 to Denary

128	64	32	16	8	4	2	1
1	0	1	0	1	1	0	0

Add together headers where a '1' is active: $128 + 32 + 8 + 4 = 172$

1. 00001011 → _____

2. 00010100 → _____

3. 00111100 → _____

4. 01000001 → _____

5. 10001010 → _____

6. 11000011 → _____

7. 01110110 → _____

8. 10111001 → _____

9. 11110000 → _____

10. 11111111 → _____

SECTION 3: DENARY TO BINARY CONVERSION

Worked Example: Convert 83 to Binary (The Light Switch Method)

Imagine 8 magical light switches labeled 128 down to 1. Decide which switches must be turned **ON (1)** or **OFF (0)** to total exactly 83 without crossing over.

- **Switch 128:** Too large for 83. Leave it **OFF (0)**.
- **Switch 64:** Fits! Turn it **ON (1)**. (Remaining target: $83 - 64 = 19$)
- **Switch 32:** Too large for 19. Leave it **OFF (0)**.
- **Switch 16:** Fits! Turn it **ON (1)**. (Remaining target: $19 - 16 = 3$)
- **Switch 8 & 4:** Too large for 3. Leave both **OFF (0)**.
- **Switch 2:** Fits! Turn it **ON (1)**. (Remaining target: $3 - 2 = 1$)
- **Switch 1:** Fits! Turn it **ON (1)**. (Remaining target: $1 - 1 = 0$)

128	64	32	16	8	4	2	1
0 (OFF)	1 (ON)	0 (OFF)	1 (ON)	0 (OFF)	0 (OFF)	1 (ON)	1 (ON)

Resulting Byte: 01010011

1. 14 → [_____]

2. 27 → [_____]

3. 45 → [_____]

4. 64 → [_____]

5. 99 → [_____]

6. 128 → [_____]

7. 155 → [_____]

8. 210 → [_____]

9. 242 → [_____]

10. 255 → [_____]

SECTION 4: BINARY TO HEXADECIMAL CONVERSION



Worked Example: Convert 11010011 to Hexadecimal

Split byte into 4-bit nibbles: 1101 and 0011.

Left nibble = $8 + 4 + 1 = 13$ (→ letter **D**) | Right nibble = $2 + 1 = 3$ (→ digit **3**) → Answer: **D3**

1. 00001101 → Hex: _____

2. 00100101 → Hex: _____

3. 01011010 → Hex: _____

4. 01111111 → Hex: _____

5. 10000011 → Hex: _____

6. 10011100 → Hex: _____

7. 10111110 → Hex: _____

8. 11000111 → Hex: _____

9. 11100001 → Hex: _____

10. 11111111 → Hex: _____

SECTION 5: HEXADECIMAL TO BINARY CONVERSION

1. 0F → [_____]

2. 14 → [_____]

3. 3C → [_____]

4. 52 → [_____]

5. 7B → [_____]

6. 88 → [_____]

7. 9A → [_____]

8. C4 → [_____]

9. E1 → [_____]

10. FF → [_____]

TEACHER SOLUTION & MARKING KEY

Section 1: Capacity Solutions

- | | |
|--------------------|----------------|
| 1. 8 movies | 2. 2,000 songs |
| 3. 6,400 photos | 4. 40 backups |
| 5. 4,000 files | 6. 5 pages |
| 7. 20,000 projects | 8. 8 installs |
| 9. 10 blocks | 10. 7 entries |

Section 3: Denary to Binary Answers

- | | |
|-------------|--------------|
| 1. 00001110 | 2. 00011011 |
| 3. 00101101 | 4. 01000000 |
| 5. 01100011 | 6. 10000000 |
| 7. 10011011 | 8. 11010010 |
| 9. 11110010 | 10. 11111111 |