Image and Text Representation Worksheet - Advanced

Name: _____ **Date:** _____

Section A: Text Representation in Depth

1. Analyze the limitations of ASCII and explain how Unicode addresses these limitations. Include in your answer:

- The specific bit patterns used in both systems
- How many characters each can represent (calculate the exact number)
- Different Unicode encoding methods (UTF-8, UTF-16, UTF-32) and their applications

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2. Decode the following binary message using ASCII:

01000011 01101111 01101101 01110000 01110101 01110100 01100101 01110010 00100000 01010011 01100011 01101001 01100101 01101110 01100011 01100101 00100000 01101001 01110011 00100000 01100110 01110101 01101110 00100001

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3. Create your own encoded message using ASCII binary that is at least 10 characters long. Include the binary code and the decoded message.

Binary code:

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Decoded message:

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4. Research and explain how non-Latin scripts like Arabic, Chinese, or Hindi are represented in Unicode. What challenges exist in representing these languages digitally?

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Section B: Advanced Image Representation

5. A digital camera offers three resolution settings:

- Low: 1920×1080 pixels
- Medium: 3840×2160 pixels
- High: 7680×4320 pixels

a) Calculate the total number of pixels for each setting.

Low: _____

Medium: _____

High: _____

b) If each pixel uses 24-bit color (8 bits each for R, G, and B), calculate the uncompressed file size in megabytes for each setting. (1 byte = 8 bits, 1 MB = 1,048,576 bytes)

Low: _____

Medium: _____

High: _____

c) If the camera has 64GB of storage, approximately how many photos could be stored at each resolution? (Assume no compression)

Low: _____

Medium: _____

High: _____

6. Explain how hexadecimal values are used to represent colors in the RGB system. Convert the following hex color codes to their binary and decimal RGB equivalents:

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a) #FF0000

Binary: _____

RGB: _____

b) #00FF00

Binary: _____

RGB: _____

c) #0000FF

Binary: _____

RGB: _____

d) #FFFFFF

Binary: _____

RGB: _____

e) #800080

Binary: _____

RGB: _____

7. Analyze how changing the following parameters affects an image file, explaining the technical reasons for each effect:

Parameter Change	Effect on Image Quality	Effect on File Size	Technical Explanation
Increasing resolution	_____	_____	_____ _____ _____
Decreasing color depth	_____	_____	_____ _____ _____
Converting from color to grayscale	_____	_____	_____ _____ _____
Applying lossy compression	_____	_____	_____ _____ _____

Section C: Practical Problem Solving

8. Design a simple 10×10 black and white image and represent it as a binary matrix (using 1s and 0s). Then:

Your binary matrix (draw your design using 1s and 0s):

a) Calculate its uncompressed file size in bits

b) Apply a simple run-length encoding compression to your image and show the compressed data

c) Calculate the compressed file size and the compression ratio

9. A website needs to display high-quality photographs but also needs fast loading times. As the web developer, you need to make decisions about image formats and optimization.

a) Research and compare three different image file formats (e.g., JPEG, PNG, GIF, WebP) in terms of:

- Color depth capabilities
- Compression methods used
- Suitable applications
- Advantages and disadvantages

Format 1: _____

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Format 2: _____

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Format 3: _____

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b) For a website gallery containing 20 photographs (each originally 4000×3000 pixels with 24-bit color depth), propose and justify a strategy for optimizing these images for web use while maintaining acceptable quality.

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10. Advanced Challenge: Metadata and Steganography

a) Research what EXIF data is and list five types of metadata that might be stored in a digital photograph's EXIF data.

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b) Briefly explain the concept of steganography and how it relates to hiding data within images.

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c) Describe how you could theoretically hide a short text message within an image file by manipulating the least significant bits of color values. What effect would this have on the visible appearance of the image?

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