

**CMPS 230**

**DIGITAL MEDIA PROGRAMMING**

**FINAL SPRING 2014**

NAME \_\_\_\_\_

ID \_\_\_\_\_

SECTION \_\_\_\_\_

### INSTRUCTIONS

The exam is formed of 6 problems + one Bonus question and 9 pages. Make sure you have all of them.

Answer questions in the space provided.

The questions are not necessarily ordered according to difficulty.

**Your handwriting should be readable so it can be graded.**

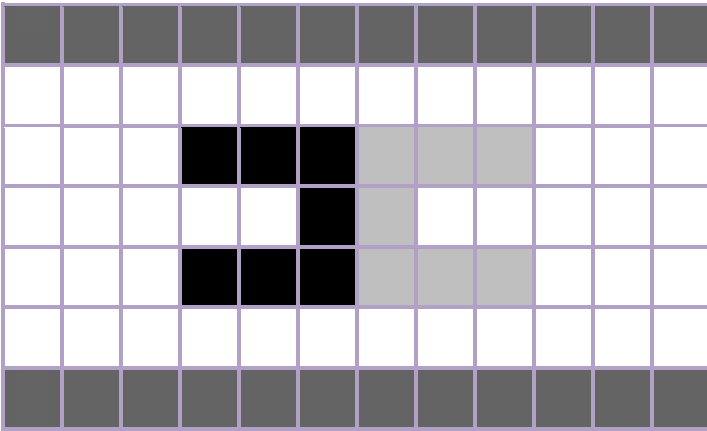
**Any course related material must be completely out of sight.**

**Cellphones are absolutely prohibited during exam.**

	Points	Your points
<b>Problem 1</b>	<b>25</b>	
<b>Problem 2</b>	<b>10</b>	
<b>Problem 3</b>	<b>10</b>	
<b>Problem 4</b>	<b>20</b>	
<b>Problem 5</b>	<b>20</b>	
<b>Problem 6</b>	<b>15</b>	
<b>Bonus</b>		
<b>Total</b>	<b>100</b>	

**Problem One: Image Compression (25 pts)**

Assume you have the following 12 x 7 image, encoded as 8bbp grayscale image: (10 pts)

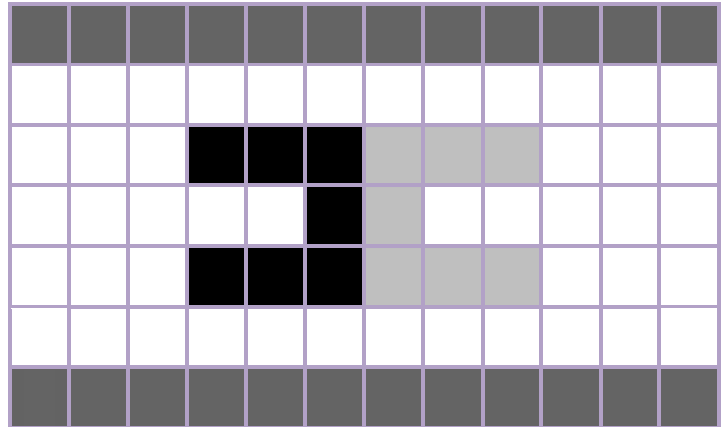


Colors Used:	
Dark grey	100
Light grey	191
Black	
White	

1. What is the original size of the image in bits?
  
2. Apply Run Length Encoding compression to the image.
  - A. What will be the compressed output?
  
  - B. Is Run Length Encoding a fixed length or variable length encoding? Explain.
  
  - C. What is the size of the compressed file? Show all your calculations.
  
  - D. What is the compression ratio?

3. Compress the image using Huffman Encoding. (10 pts)

A. Is Huffman Encoding fixed length or variable length encoding? Explain.



B. Generate the frequency table and the Huffman tree.

C. Generate the codes for each color.

D. Calculate the size of the compressed image. What is the compression ratio?

4. Do you think these methods offered a good compression ratio? Explain why based on the nature of the image. (5 pts)

**Problem Two: Image Decompression (10 pts)**

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An RGB image was compressed using LZW compression method with the following initial dictionary:

green	yellow	blue	red	White
0	1	2	3	4

Part of the compressed output was: **0 5 0 1 2 3 6**.

**1. Decompress the output to get the original image, while filling the following dictionary:**

G	Y	B	R	W							
0	1	2	3	4							

**Original Image:**

**Problem Three: Image Dithering (10 pts)**

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Assume you have the following 6 x 3 grayscale image:

100	200	200	255	255	0
200	100	150	200	200	250
150	200	150	250	250	100

1. **Give a situation where you have to apply dithering for an image. Explain.**

**2. Apply pattern dithering to the grayscale image using the following 3x3 mask:**

8	3	4
6	1	2
7	5	9

Dithering Mask

100	200	200	255	255	0
200	100	150	200	200	250
150	200	150	250	250	100

Original Image



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***Problem Five: Audio Dithering and Noise Shaping (20 pts)***

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**1. What is audio dithering? What is it used for?**

**2. What is noise shaping and what is its main incentive?**

**3. Assume you have the following audio samples amplitude values:**

**$F_{in} = \{60, 70, 90, 70\}$ . Apply (random) audio dithering then noise shaping to these values (to calculate  $F_{out}$ ).**

**Take the following random numbers consecutively:  $\{0.4, -0.2, 0.6, 0.7\}$ . Choose one as the constant. Assume, for quantization, you are taking the floor of the values.**





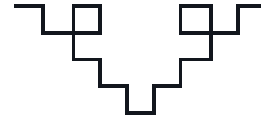
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***Problem Seven: Fractals (BONUS)***

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1. Create an L-System to generate the following fractal.

State what are the rules, what each character means, and what are the conditions.



At the beginning, you will start by a line: 

In the first iteration, you will have:



**Good Luck!!**