

## EE1F2 Multimedia Data

### Laboratory Exercise 2: Image Compression Exercise

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#### 1. Using the compression Programs

##### 1.1 Creating the folder:

```

C:\WINDOWS\system32\command.com
Microsoft(R) Windows DOS
(C)Copyright Microsoft Corp 1990-2001.
Y:\>cd 1f2
Y:\1F2>cd lab2
Y:\1F2\LAB2>
    
```

##### 1.2 Testing the commands

```

C:\WINDOWS\system32\command.com
Y:\1F2\LAB2>gs mouse.raw_
    
```



##### 1.3 Viewing multiple images

```

C:\WINDOWS\system32\command.com
Y:\1F2\LAB2>gs mouse.raw cheetah.raw lisaw.raw_
    
```



### 1.4 Comparing two images with gsdiff and getting the RMS error

```
C:\WINDOWS\system32\command.com
Y:\1F2\LAB2>gsdiff mouse.raw cheetah.raw
```



```
C:\WINDOWS\system32\command.com
RMS error between mouse.raw and cheetah.raw is 86.442908
Y:\1F2\LAB2>_
```

## 2. Lossless Compression

### 2.1 Compressing images using the Lossless-Huffman method

```
C:\WINDOWS\system32\command.com

Y:\1F2\LAB2>huff-c mouse.raw mhuffc.raw
Compressing mouse.raw to mhuffc.raw
Using static order 0 model with Huffman coding
.....
Input bytes:      64000
Output bytes:     45195
Compression ratio: 30%

Y:\1F2\LAB2>huff-c cheetah.raw chuffc.raw
Compressing cheetah.raw to chuffc.raw
Using static order 0 model with Huffman coding
.....
Input bytes:      64000
Output bytes:     56320
Compression ratio: 12%

Y:\1F2\LAB2>huff-c lisaw.raw lhuffc.raw
Compressing lisaw.raw to lhuffc.raw
Using static order 0 model with Huffman coding
.....
Input bytes:      64000
Output bytes:     53049
Compression ratio: 18%

Y:\1F2\LAB2>
```

2.2 Compressing images using the Lossless-LempelZiv'77 method

```

C:\WINDOWS\system32\command.com
Y:\1F2\LAB2>lzss-c mouse.raw mlzss.raw
Compressing mouse.raw to mlzss.raw
Using LZSS Encoder
.....
Input bytes:      64000
Output bytes:    31754
Compression ratio: 51%

Y:\1F2\LAB2>lzss-c cheetah.raw clzss.raw
Compressing cheetah.raw to clzss.raw
Using LZSS Encoder
.....
Input bytes:      64000
Output bytes:    62211
Compression ratio: 3%
.....

Y:\1F2\LAB2>lzss-c lisaw.raw llzss.raw
Compressing lisaw.raw to llzss.raw
Using LZSS Encoder
.....
Input bytes:      64000
Output bytes:    44941
Compression ratio: 30%
.....

Y:\1F2\LAB2>
    
```

2.3 Calculating the Compression ratio and the bits per pixel.

$$\text{Compression Ratio} = \frac{\text{old file size}}{\text{new file size}}$$

$$\text{Bits per pixel (bpp)} = \left( \frac{\text{new file size}}{\text{old file size}} \right) * \text{old bpp}$$

Test Image	Method	Input bytes	Output bytes	Compression Ratio	Bits per pixel(bpp)
Mouse	Huff	64000	45195	1.416	5.649
	lz	64000	31754	2.015	3.969
Cheetah	Huff	64000	56320	1.136	7.040
	lz	64000	62211	1.029	7.776
Lisaw	Huff	64000	53049	1.206	6.631
	lz	64000	44941	1.424	5.618

## 2. Lossy (DCT) Compression

### 2.1 Compressing mouse.raw image with different Q values

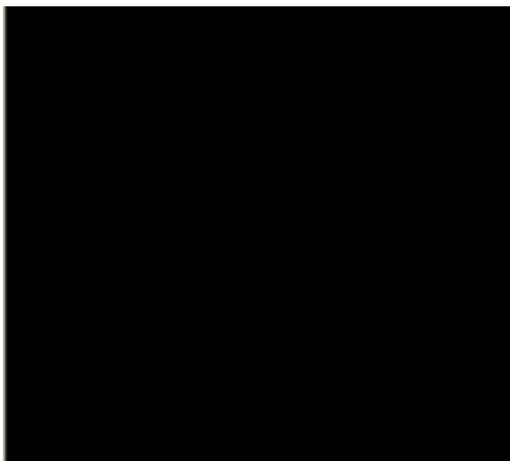
```

C:\WINDOWS\system32\command.com
Y:\1F2\LAB2>dctc mouse.raw mdct0c.raw 0
Compressing mouse.raw to mdct0c.raw
Using DCT compression
Using quality factor of 0
.....
Input bytes:      64000
Output bytes:     38019
Compression ratio: 41%

Y:\1F2\LAB2>dcte mdct0c.raw mdct0e.raw
Expanding mdct0c.raw to mdct0e.raw
Using DCT compression
Using quality factor of 0
.....
Y:\1F2\LAB2>gsdiff mouse.raw mdct0e.raw_
  
```

### 2.2 Images examples after compressing and decompressing with different Q values

Q=0

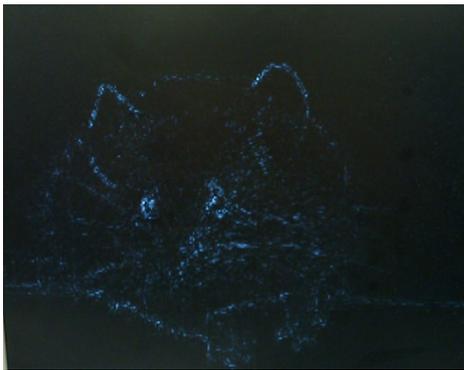


a) gsdiff mouse.raw mdct0e (no difference at all)

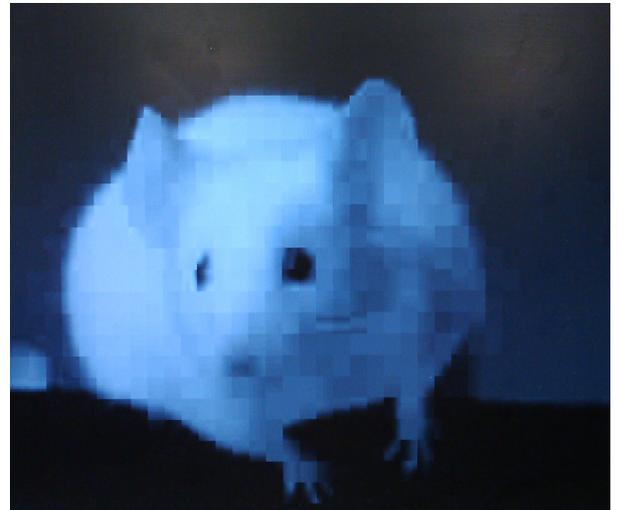
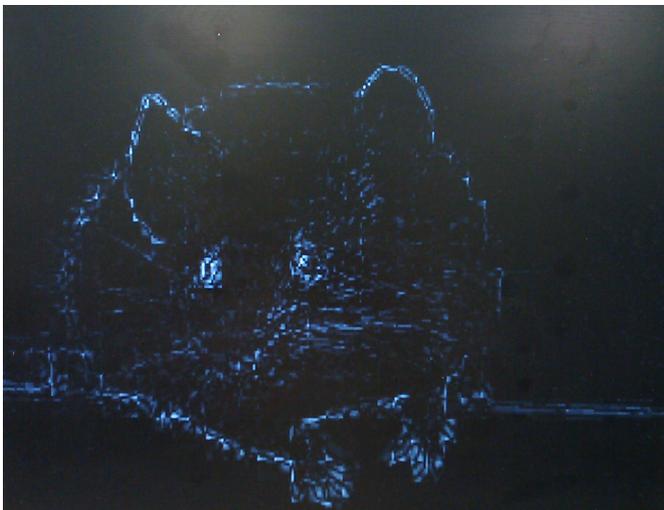


b) mdct0e.raw

Q=5



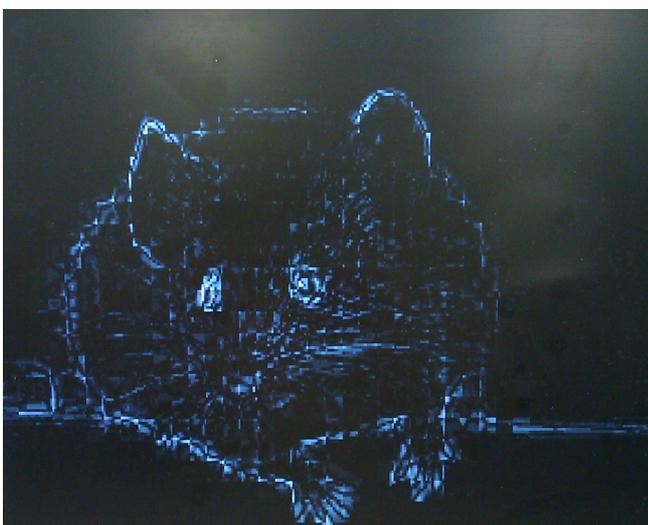
Q=15



a) Using gsdiff

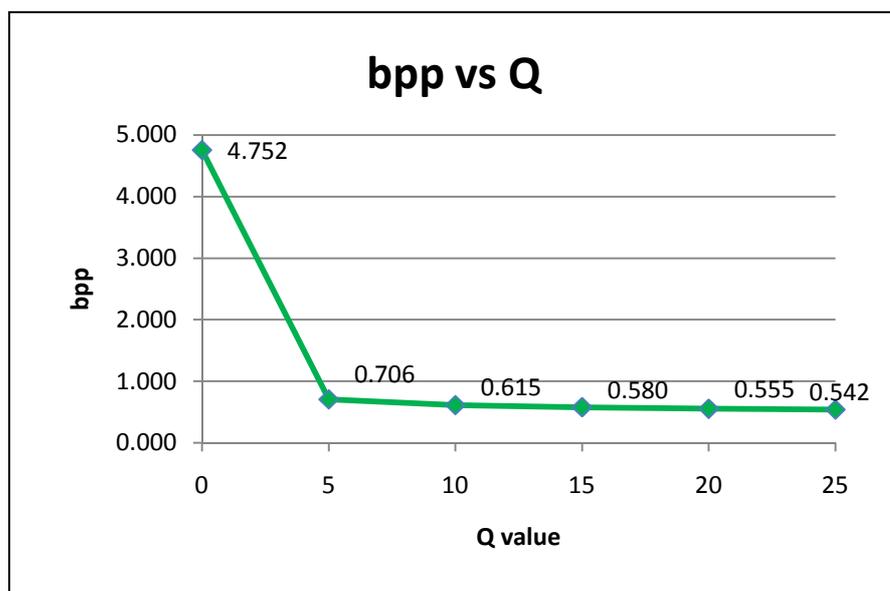
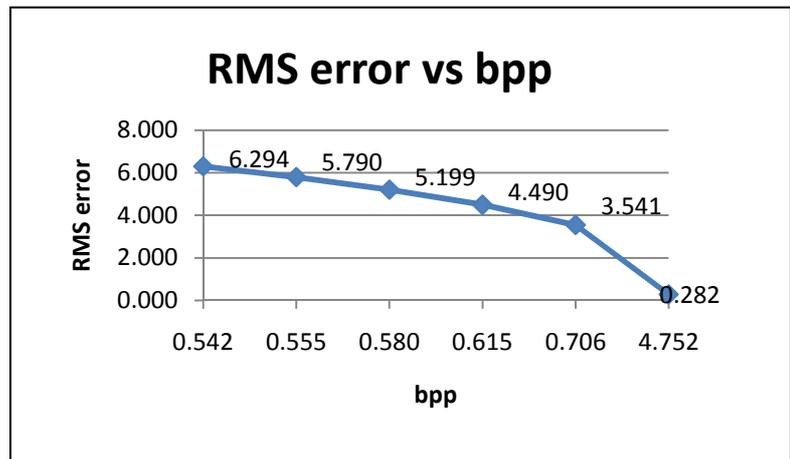
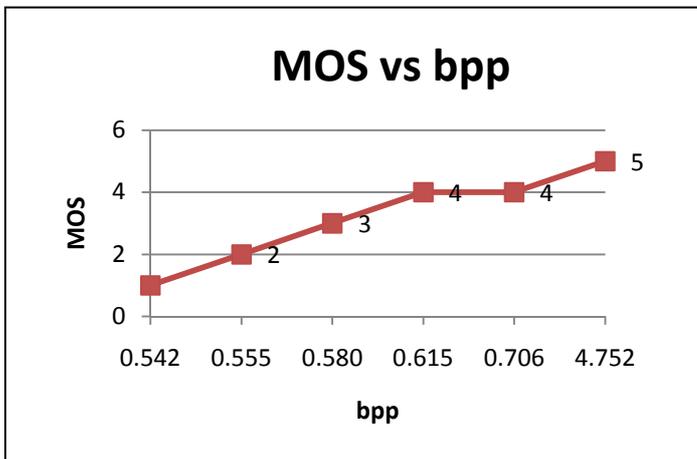
b) Image after decompressing (mdct15e.raw)

Q=25



2.3 Results

Q value	File size	Compression ratio	bpp	MOS	RMS error
0	38019	1.683	4.752	5	0.281597
5	5651	11.325	0.706	4	3.541458
10	4917	13.016	0.615	3	4.489757
15	4640	13.793	0.580	3	5.199216
20	4442	14.408	0.555	2	5.790469
25	4337	14.757	0.542	1	6.293969



### 3. Investigating the Effects of Errors on Compressed Data

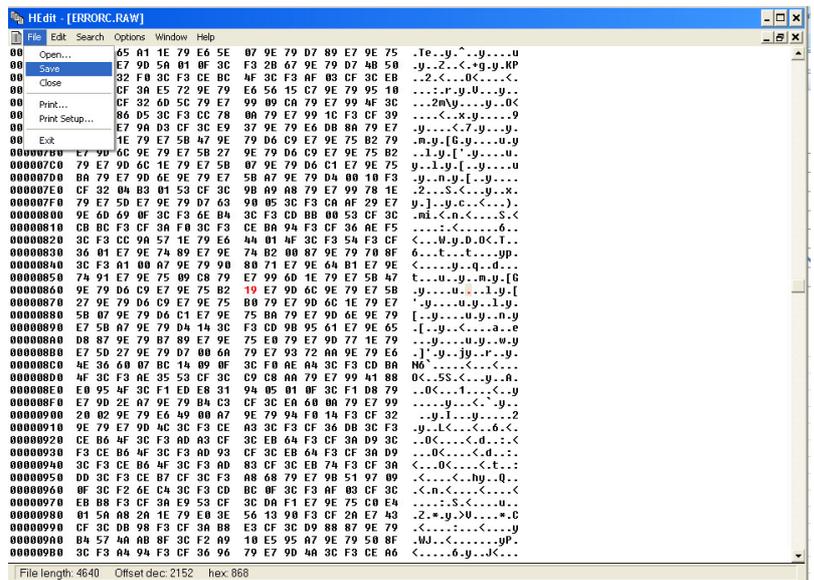
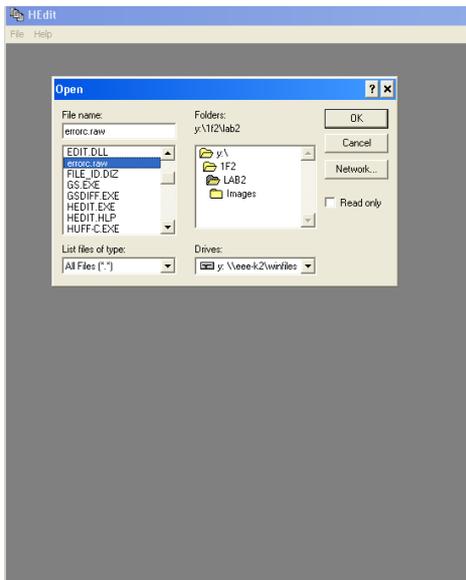
#### 3.1 Making a compressed image copy

```
C:\WINDOWS\system32\command.com

Y:\1F2\LAB2>copy mdct15c.raw errorc.raw
1 file(s) copied.

Y:\1F2\LAB2>hedit
```

#### 3.2 Editing the compressed image file (errorc.raw)



#### 3.3 Decompressing the errorc.raw image and viewing the result (errore.raw)

```
C:\WINDOWS\system32\command.com

Y:\1F2\LAB2>copy mdct15c.raw errorc.raw
1 file(s) copied.

Y:\1F2\LAB2>hedit

Y:\1F2\LAB2>dcte errorc.raw erre.rw

Expanding errorc.raw to erre.rw
Using DC1 compression
Using quality factor of 15
..Fatal error: Fatal error in InputBit!

Y:\1F2\LAB2>gs erre.rw
```

