Analysis 2 - HW #5

Note Title 2/28/2013

Note: This is not really analysis HW, but it serves as an intro to Fourier series, which certainly are an analysis topic

(1) Convert the following numbers as indicated

(a) 11101101 from base 2 to base 10
(b) 100000001 from base 2 to base 10
(c) 500 from base 10 to base 2
(d) 1025 from base 10 to base 2

(2) How can you tell if a binary number is even or odd? If it is even, how do you quickly divide it by 2?

(3) Add the following binary numbers:

a) 1001 + 100
b) 1001 + 101
c) 1011 + 101
d) 1111 + 111

(4) Remember that 8 bits make 1 byte. If you used 6 Bytes to store positive integers, what would be the largest possible number?

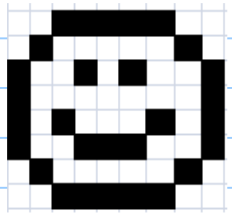
(5) Use the ASCII tables (see online) and 1 Byte = 8 bits to convert

a) the letter "a" to binary
b) the byte 01110111 to a letter
c) the letters "Dear" to (8-bit) binary
d) the 8-bit binary sequence of ASCII codes
01100010 01100001 01100100
to a word in English

⑥ Suppose an image format uses 2 bytes for # of rows n, then 2 bytes for # of columns m, followed by n×m bits, indicating 0 (for white) and 1 (for black). What picture is

0000000000000101000000000000010100010000101000001010000100

⑦ Using the same image format as above, convert the following picture to binary code:



⑧ Suppose an image format is as follows:

byte 1: # of rows n
byte 2: # of columns m
3,4,5: amount of RGB of pixel 1 (Red / Green / Blue)
6,7,8: amount of RGB of pixel 2
... etc
of pixel n·m

What is that picture?

0000001000000010111111110000000000000000
1111111100000000000000001111111100000000000000001111111100000000000000001111111100000000000000000000000011111111000000001111111100000000
1111111100000000000000001111111100000000

(4) Evaluate the following integrals:

$$\int_{-\pi}^{\pi} \cos(nx)\,dx \quad , n = 0,1,2,\dots$$

$$\int_{-\pi}^{\pi} \sin(nx)\,dx \quad , n = 0,1,2,\dots$$

$$\int_{-\pi}^{\pi} \sin(nx)\sin(mx)\,dx \quad , n,m = 0,1,2,\dots$$

$$\int_{-\pi}^{\pi} \cos(nx)\cos(mx)\,dx \quad , n,m = 0,1,2,\dots$$

$$\int_{-\pi}^{\pi} \sin(nx)\cos(mx)\,dx \quad , n,m = 0,1,2,\dots$$