CIS 350 – INFRASTRUCTURE TECHNOLOGIES
GROUP HOMEWORK #3

Topics: Data Formats and Standards, Representing Numerical Data, Computer Representation of Unsigned and Signed Numbers (2's Complement Form), and Decimal Ranges for Numbers. (Chapters 4-5)

Worth – 70 points. (Each question is worth 10 points).

Write the Group # and Names of Group Members: Group #4 Charles Degboe, Karl Dalton, Anthony Striepe, Daniel Willinger

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Logistics

1. Get in touch with your group. (See Groups folder on Blackboard.)
2. Discuss and work **all** 7 problems collectively with your group via E-mail, Discussion Forum, Blackboard Collaborate Ultra, and/or MS Teams. (Do not divide the work among the group members. If you collaborate on all problems, you may do better on the tests.)
3. Choose a recorder to prepare the final copy (**one per group**) and submit it via the Blackboard Assignments/Homeworks folder by the due date. You must provide answers on these sheets.
4. Be sure all group members' names are on the final copy. Do **not** add names of your group members who did not participate in the assignment or whose contribution was minimal.

1. How would string "Plan" be represented in the EBCDIC standard? Give the hexadecimal, decimal, and binary forms for the EBCDIC standard.

	P	l	a	n
Hexadecimal	B7	B3	A1	B5
Decimal	183	179	161	181
Binary	11010111	11010011	11000001	11010101

How many bytes does the string "Plan" occupy? (Do not count the double quotes.)

In EBCDIC: 4 In Unicode: 8 (UTF-16 standard)

2. A high-definition 25" Dell G2524H monitor has the resolution 1,920 × 1,080 pixels. You can see the monitor at the following link. Dell 25 inch Gaming Monitor (G2524H) - Computer Monitors | Dell USA

(a) What is the size in bytes and MB of the video memory to store the true color image of the size 1,920 × 1,080 pixels displayed on this monitor? (Note that in the true color image you need 3 bytes for each pixel.

1920 * 1,080 = 2,073,600
2,073,600 * 3 = 6,220,800

(b) This Dell monitor with a resolution 1,920 × 1,080 pixels generates true color images at a frame rate of 100 frames/sec. How much storage expressed in GB would a 3-minute video clip displayed on this monitor consume?

622,080,000 * 180 = 111,974,400,000 Bytes conversion to GB = 111.9744

3. Approximately how many images of the size 2MB can be stored on the following devices:

(a) a 2.7GB DVD-ROM, and

(b) the Samsung 1TB (terabyte) Solid State Drive (SSD)?

(You must show your calculations! Note that 1GB = 1024 MB, 1TB = 1024 GB.

(a) 2.7GB DVD-ROM

2.7GB * 1024 MB/GB = 2764.8 MB
Number of images = 2764.8 MB / 2 MB = 1382.4
approximately 1382 images of size 2MB can be stored on a 2.7GB DVD-ROM

(b) 1TB SSD

1TB * 1024 GB/TB * 1024 MB/GB = 1,048,576 MB
Number of images = 1,048,576 MB / 2 MB = 524,288
approximately 524,288 images of size 2MB can be stored on a Samsung 1TB SSD.

4. An analog wave representing the song titled “Shallow” by Lady Gaga and Bradley Cooper from the movie “A Star is Born” https://www.youtube.com/watch?v=3Z7ddmHlbdU is sampled with the frequency of 22,050 Hz during its conversion from the analog form to the digital form. Assume that each sample is stored in 3 bytes. (Before you work this exercise, you may click on the above link to listen to this song.) You must show your calculations!

How many MB would it take to store 4 minutes and 18 seconds of the uncompressed sound?

Total duration in seconds = (4 minutes * 60 seconds/minute) + 18 seconds = 258 seconds
Total samples = 22,050 samples/second * 258 seconds
Total samples = 5,691,900 samples
Total storage size = Total samples * Size per sample
Total storage size = 5,691,900 samples * 3 bytes/sample
Total storage size = 17,075,700 bytes
Total storage size in MB = Total storage size / (1024 * 1024)
Total storage size in MB = 17,075,700 bytes / (1024 * 1024)
Total storage size in MB ≈ 16.27 MB
approximately it will take 16.27 MB to store 4 minutes and 18 seconds of uncompressed sound.

If a compression ratio is 30:1, how many MB would that sound occupy after compression.

Compressed storage size = 16.27 MB / 30
Compressed storage size ≈ 0.5423 MB
after compression with a ratio of 30:1, the sound would have approximately 0.5423 MB.

5. Convert this 8-bit number written in 2's complementary binary form

$(10110100)_2$ = 32 + 8 + 4 = 44

2^7 - 44 = 128 - 44 = 84

to the decimal number (-84)$_{10}$

Note: Because the leftmost bit (the sign bit) is 1, the number is negative! The leftmost bit 1 is worth $-1*2^7$. It contributes to the sign and the magnitude of the number.

6. Assume that some computers used a 22-bit word to store numbers. What is the decimal range for this word size for:

(a) unsigned numbers: 0 to 2^22 = 0 to 4,194,304 values

(b) signed numbers: -2,097,152 to +2,097,152

What is the number of unique patterns 22 bits can store? 4,194,304

7. Find the 16-bit (2-byte) 2's complementary binary representation for the decimal number $(-28)_{10}$. (Note that when you convert the 1's complement to the 2's complement a carry maybe generated. You must show your calculations!

28 in 16 bits: 0000 0000 0001 1100

1's complement of 28: 1111 1111 1110 0011.

2's complement: 1111 1111 1110 0100.

16-bit 2's complement representation of (-28)10: 1111 1111 1110 0100