Assignment 1

CIS*2030: Structure and Application of Microcomputers

Assignment 1 is due **11:59pm, September 18, 2021**. The assignment is to be completed individually. If you have any questions, please see the teaching assistant or instructor during office hours.

Instructions:

(1) When answering questions, simply writing down a solution to a particular problem is not enough to obtain full marks. You must show how you arrived at the solution by showing the step-by step procedure that you performed. This procedure can be hand-written or typed – the choice is yours. However, solutions must be clear. What cannot be read cannot be marked.
(2) Make sure to neatly print/type your full name, student ID, and the name of your teaching assistant at the top of the first page, number the remaining pages consecutively at the bottom.
(3) Review your answers 1 or 2 days after completing the assignment. Taking a few minutes to do this can dramatically improve your understanding of key concepts and increase your retention. Also, it makes it much easier for you to catch any errors.

Submission:

(1) Once you are ready to submit your assignment for grading print or scan your individual assignment pages and convert them into a *single* PDF submission. (Do not upload individual pages or a zip file.) If you are working with paper and do not have a scanner, use a cellphone to take pictures of each page, then use a program like Adobe Acrobat Scan to create a single PDF. (Remember to use appropriate lighting, as dim or blurry pictures that cannot be read cannot be marked.) Upload your single PDF submission to the Dropbox labeled **Assignment 1** available in the **week 1** folder on CourseLink.
(2) After uploading your assignment to CourseLink, immediately download the assignment and verify that you have uploaded the correct document.

Best of success! 😊

Questions

This assignment provides you with the opportunity to gain experience working with the various **encodings** discussed in **week 1**. Attempt all of the questions listed below by hand, keeping in mind that calculators will not be allowed on the midterm and final exam.

1. Complete the table below by performing the necessary conversions between binary, octal, decimal and hexadecimal. [1/2 point each]

Binary	Decimal	Octal	Hexadecimal
1011011.101			
	98		
		356	
			AF.C

2. Add the following two unsigned binary numbers: 101101_2 and 110101_2. Remember to show any *carries* that are generated along the way. If the sum is stored in a 6-bit location within the computer, indicate if overflow occurs. Also, show the decimal equivalent of the problem. [2 points]

3. Assume that the following pair of numbers are unsigned and subtract 10111_2 from 1001101_2. Remember to show any *borrows* that are required along the way. Also, show the decimal equivalent of the problem. [2 points]

4. Complete the table below by representing each decimal number as 6-bit sign-magnitude and 2's-complement values. Explain any difficulties that arise. [1 point per row]

Decimal	Sign-Magnitude	2's Complement
+14		
-20		
37		

5. A particular computer uses a word size of 21 bits. What are the decimal values of the smallest and largest unsigned and 2's complement values that can be represented? [1/2 point each]

6. A and B are integer variables in a computer program, with $A = 9_{10}$ and $B = 19_{10}$. Assuming that the computer uses 6-bit 2's-complement arithmetic, show how it

would compute A+B, A-B, B-A, and –A-B. When showing your work, remember to clearly indicate if the final carry must be discarded. [1 point each]

7. Repeat the previous question, but this time try using $A = 32_{10}$ and $B = 31_{10}$. Explain any difficulties that arise. [4 points]

8. Encode the character string *Go Jays!* in ASCII. Remember to include any spaces between characters. Also, represent the encoded string by a sequence of hexadecimal numbers. [1/4 point each]

9. In a particular computer system, ASCII characters are transmitted with odd parity, where bit 8 (i.e., the left-most bit) is used as a parity bit. Show how the character '8' would be encoded prior to transmission. Once transmitted, list all of the different ASCII characters that might arrive assuming a *single-bit* error occurs. [3 points]

Remember to show all of your work when answering the previous questions. This will ensure that you are eligible for partial marks.