

## Computer Science 1510 Assignment #1

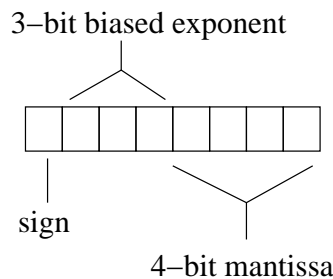
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Please note that assignments are due at the **beginning** of class on the specified due date. Assignment 1 does NOT require electronic submission.

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### Show all workings!

1. (a) i. Convert  $36_{10}$  to 8-bit sign-magnitude.  
ii. Convert  $-54_{10}$  to 8-bit sign-magnitude.  
iii. Perform the calculation  $36 + (-54)$  in 8-bit sign-magnitude arithmetic.  
Did you obtain the correct value?  
(b) Repeat (a) in 2's complement.
2. Consider a floating point system that uses 8 bits to store real values as follows:



- (a) What should the value of the bias be?
  - (b) What is the most accurate representation of 0.7 in this system? Provide both the binary and decimal equivalent of this representation.
  - (c) What is the next largest number that can be represented?
  - (d) What is the next smallest number that can be represented?
  - (e) Comment on the spacing between values. Is it always the same?
3. For the following problems, analyze the problem in terms of input and output, and develop an algorithm to solve the problem. Write your algorithm in pseudocode, and design a flowchart to illustrate the algorithm.
    - (a) Compute and display the period of an oscillating pendulum  $T$  (in seconds) as given by the equation

$$T = 2\pi\sqrt{\frac{L}{g}},$$

where  $L$  is the length of the pendulum (in metres), and  $g$  is the acceleration due to gravity (in metres per second squared).

- (b) The potential energy ( $PE$ ) of an object due to its height above the Earth's surface is given by

$$PE = mgh,$$

where  $m$  is the mass of the object,  $g$  is the acceleration due to gravity, and  $h$  is the height above the surface. The kinetic energy ( $KE$ ) of an object in motion is given by

$$KE = \frac{1}{2}mv^2,$$

where  $m$  is the mass of the object and  $v$  is the object's velocity. Compute and display the total energy of an object, given by the sum of its potential and kinetic energy.

- (c) Calculate and display the value of  $n! = n(n-1)(n-2) \cdots 3 \cdot 2 \cdot 1$ .