# CISC 260 Machine Organization and Assembly Language (Spring 2018)

### Assignment # 5
**(Due: April 19, 2018)**

Problem 1 [15 pts]. Show the IEEE 754 binary representation for the following fraction numbers in single precision. State if each number can be represented exactly.
   a. $-15.625$
   b. $1/6$

Problem 2 [15 pts]. What decimal number does the following bit pattern represent if it is a single precision floating-point number using the IEEE 754 standard?
   a. 0x0D000000
   b. 0xC4650000

Problem 3 [15 pts]. A single precision IEEE 754 number is stored in memory at address X. Write a sequence of ARM instructions to multiply the number at X by 16 and store the result back at X. You must accomplish this without using any floating-point instructions (you may ignore overflow or underflow). Note: this is a paper-pencil problem.

Problem 4 [15 pts]. At a candy shop, the $1^{st}$ candy costs 10cents. Each subsequent candy costs 10 cents more than the previous one. For one dollar, how many candies can you purchase at most? Here is a program written in C to answer that question.

```
float fundLeft = 1.0;
float cost;
int numCandies = 0;

for(cost=0.1; cost <= fundLeft; cost += 0.1) {
    numCandies++;
    fundLeft = fundLeft - cost;
}
printf("%d candies; %f left over\n", numCandies, fundLeft);
```

Run the program and report the result. If the result is not what is expected, explain why? Modify the program so that the correct answer can be obtained. Present your modified program.

Problem 5 [40 points]: Implement in ARM7 assembly language a binary tree for sorting. In the main function, open a file to read a sequence of unsorted integers. For the first input integer, create a root node (12 bytes), holding the integer in the first 4 bytes and two empty pointers, one for the left child node and the other for the right child node. For each of the following input integers, build a node containing the number and insert it to the tree such that for any interior node (holding an integer X) its left branch contains integers

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smaller than X and its right branch contains integers equal or larger than X. After all integers are inserted, the program would, by traversing the binary tree in an in-order, print out the sorted integers separated by space onto the screen,

Specification: you should write Insert as a recursive function.

| data | Null or a Pointer to the left child node | Null or a Pointer to the right child node |
|------|------------------------------------------|-------------------------------------------|

**Submission: For problem 5, a plain text file containing your assembly code should be submitted on Canvas.**

**Bonus Problem** [30 pts]. Write in ARM7 assembly language a program that takes as input a string, check if it is a palindrome or not, and print your answer as "Palindrome" or "Not palindrome" correspondingly.