<u>**Homework 9. CSCI 330**</u>

<u>**Due date: Wednesday April 3**</u>

Write short essays on each of the following topics. The essays should be broad, but also address the specific questions:

1. **Programming Language issues around pointers and references.** What are the issues to be considered when a language provides support for pointers? Explain how C++ maps variables to addresses and vice-versa? What are the two main problems with pointers? How are references similar to and different from pointers? (~600 words)
2. **Tackling the problems created by pointers.** Explain with examples the mechanisms available for dealing with the problems arising from pointers and reference variables. (~600 words)
3. **Types and type-checking issues.** What are the important concepts related to typing issues? Define each with an example. Why is mathematical type theory useful for programming language design? (~500 words)
4. **Short circuit evaluation.** Consider the following problem. We have to read a sequence of int values from a file into an array in C++, while simultaneously verifying that the numbers are in non-decreasing order. Let *infile* denote the file stream, *size* denote the size of the array *A[0...(size-1)]*. There are three possible ways the loop can exit: end of file, item out of order, and end of array. Here is the incomplete "pseudocode":

   ```
   index = 0;  // assume array size is >= 1
   if (infile >> previous_num) // read an item from file + verify success of read
      { A[index] = previous_num; index++}//store in array and increase index
   While (_____ && _____ && _____)
      { A[index] = next_num; previous_num = next_num; index++;}
   ```

   The if statement reads the first item from the file to prime the loop. The loop runs as long as none of the exit conditions occur.
   (a) What are the Boolean expressions for each of the three end conditions?
   (b) List them in order of "priority" for checking? Justify your order.
   (c) How would this code be written if C++ did not support short-circuit evaluation?
   (d) Implement both versions of the program and verify them with test cases for each of the three exit conditions.
   (e) From the point of view of the basic evaluation criteria for programming languages in Chapter 1 of Sebesta's text, how do these two options compare? (~400 words)

Chapter 7 Problem set: Questions 4, 9, 13 and 19