# CS 2150 Exam 1

# Name

You MUST write your e-mail ID on **EACH** page and bubble in your userid at the bottom of this first page. And put your name on the top of this page, too.

If you are still writing when "pens down" is called, your exam will be ripped up and not graded – even if you are still writing to fill in the bubble form. So please do that first. Sorry to have to be strict on this!

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There are 6 pages to this exam. Once the exam starts, please make sure you have all the pages. Questions are worth different amounts of points.

If you do not bubble in this first page properly, you will not receive credit for the exam!

Answers for the short-answer questions should not exceed about 20 words; if your answer is too long (say, more than 30 words), you will get a zero for that question!

This exam is CLOSED text book, closed-notes, closed-calculator, closed-cell phone, closed-computer, closed-neighbor, etc. Questions are worth different amounts, so be sure to look over all the questions and plan your time accordingly. Please sign the honor pledge below.

> You step in the stream, But the water has moved on. This page is not here.

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### Page 2: C++

1. [3 points] Assuming x is an int variable, why is if (x = 0) valid code? Note that there is a single equals in the if clause. What will the result of this statement be?

2. [3 points] We know that references are useful as parameters, but why are references not really useful as variables inside subroutines?

3. [3 points] Consider the statement foo \*p = new foo(); delete p;. What happens to the pointer p after the delete call?

4. [3 points] What is the purpose of destructors? Why are they needed?

#### Page 3: C++ and Lists

5. [3 points] What is the purpose of overloading the operator=() method? How is this different from the copy constructor? Note that this is not asking about when the two are called.

6. [3 points] Consider the following array of user defined objects: MyObject myArray[10];. If the base address of this array is 0xFF100004 and each MyObject is 8 bytes, then what will the address of myArray[6] be? Show your work!

7. [3 points] Why were references put into C++ when there were already pointers?

8. [3 points] Consider two data structures: a list implemented with a vector and a list implemented with a doubly linked list. Describe the operation(s) in which these two data structures *differ* in their big-Theta running time.

#### Page 4: Numbers

9. [4 points] Consider a two's complement integer of *n* bits. What is the largest and smallest value that this value can hold? Express each of these as a formula in terms of *n*.

10. [4 points] Consider a mini-float, which encodes just like a IEEE 754 floating point number except that it has only 5 bits for the exponent and 10 bits for the mantissa. What is the exponent offset? What is the highest value that can be stored in this type? You may leave your answer as a power of 2. And you may round slightly on the mantissa.

11. [4 points] Convert 79<sub>12</sub> to base 5. Show your work!

# Page 5: Numbers, page 2

12. [3 points] Why does nobody use the IEEE 754 quad-precision (128-bit) floating point type? It has 15 exponent bits and 112 mantissa bits.

13. [9 points] Convert -14.625 to an IEEE 754 floating point number. Show your result as a hexadecimal answer in big-Endian. Show your work!

# Page 6: Arrays and Big-Oh

14. [4 points] Prove that  $n^2 \in \Omega(n)$ .

15. [4 points] Why do we like big Theta over big Oh and big Omega? What do we think of little Theta?

16. [4 points] Consider the C++ code char a[3][4] = { {'a', 'b', 'c', 'd'}, {'e', 'f', 'g', 'h'}, {'i', 'j', 'k', 'l'} }; Draw a diagram of what memory looks like after this call.