CS 2150 final exam, fall 2014

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!

Other than bubbling in your userid at the bottom of this page, please do not write in the footer section of this page.

There are 8 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.

_____

_____

_____

_____

Three things are certain:
Death, taxes, and lost data.
Guess which has occurred.

(the bubble footer is automatically inserted into this space)

Page 2: Exam 1 stuffs

1. [6 points] Convert -35.5 to 32-bit IEEE 754 floating point notation, and put your answer in little-Endian.

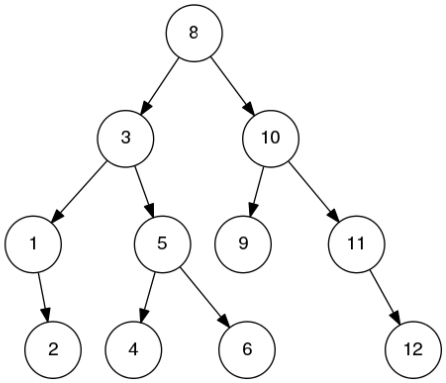
2. [3 points] Why did we insist that you program in Linux this semester?

3. [3 points] Write the minimum value, in both hex and decimal (i.e., base-10), of a signed 32-bit integer (you can leave the decimal value as a formula). Do the same for the maximum value (both in hex and decimal/formula).

Page 3: Exam 2 stuffs

4. [3 points] Why do we prefer to use big-Theta instead of big-Oh?

5. [3 points] Insert 7 into the AVL tree shown below. Show the resulting tree.



6. [3 points] For the three primary operations of a hash table (insert, delete, and find), give their big-Theta running time and *briefly* explain why.

7. [3 points] Explain the removal algorithm for a value from a binary search tree.

Page 4: C++

8. [3 points] Explain *how* dynamic dispatch is implemented in C++.

9. [3 points] List three problems that can occur with multiple inheritance – specifically, problems that do not occur with single inheritance.

10. [3 points] List three new features of C++11.

11. [3 points] Other than syntax, list the three differences between references and pointers.

Page 5: x86

12. [9 points] Write an x86 subroutine that operates the same as the following C++ subroutine:

```
int foo (int a, int b, int c) {
    int x;
    if ( a == 0 )
       x = b;
    else
       x = c;
    return x;
}
```

A few requirements: you must use one of the registers from the set { ebx, esi, edi } in your subroutine. You must also use a local variable. We realize there are ways to optimize this subroutine, but we are not interested in optimizations for this question.

13. [3 points] Write a C++ code snippet (not a full program) that will cause a segmentation fault.

Page 6: Heaps and Huffman

14. [3 points] Consider a priority queue implemented with data structures *other* than a binary heap. List three such data structures, and the associated big-Theta run time for each of the three primary priority queue operations.

15. [3 points] *Briefly* define the structure and ordering properties for a binary min-heap.

16. [3 points] Why is the expected running for insert into a min-heap constant?

17. [3 points] Write a program – in Whitespace – to efficiently solve the Traveling Salesperson problem.

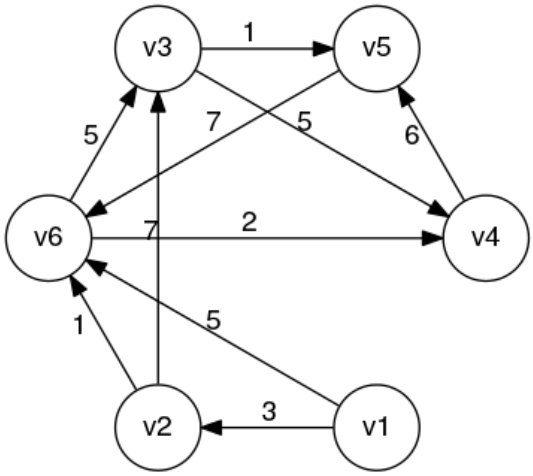
Page 7: Graphs

18. [3 points] Consider the algorithm for Dijkstra's shortest path. Let's assume that it will be running on a graph represented by an adjacency list. Write the fields in each vertex node that makes up this adjacency list.

19. [3 points] Pick either of the Minimum Spanning Tree algorithms. State it's big-Theta run time, and explain why that is so. Unless you are sure that you know the right name, be sure to *briefly* describe which algorithm you are using (but watch your word count!).

20. [6 points] Given the following graph, perform Dijkstra's shortest path in the table below. If a cell is updated, be sure to include both the original value(s) (crossed out), as well as the updated value(s). Start at node v1.

node	known?	distance	path
v1		0	
v2			
v3			
v4			
v5			
v6			



Page 8: Demographics

Name & userid: _____

We meant to ask these in an end-of-the-semester survey, but we did not get to it in time. So we'll put it here for some extra points on the exam! Sorry if this page is a bit crowded...

21. [0 points] Did you put your name and userid at the top of this page? You need to do so in order to get the points on this page!

22. [2 points] What is your major or minor? If you have not declared, then answer with your intended major or minor. Please circle one.

    - BS CS
    - BA CS
    - BS CpE
    - CS minor
    - Other (please explain): _____
    - Neither majoring nor minoring in computing

23. [1 points] Have you already declared the major/minor mentioned above? Circle: Yes or No

24. [2 points] What CS 1 class did you take? Please circle one.

    - CS 1110
    - CS 1111
    - CS 1112
    - CS 1120
    - AP credit
    - Transfer credit
    - Other (please explain): _____
    - Placed out of it via the CS 1110 placement exam

25. [1 points] If you took your CS 1 class in college (i.e. CS 1110, CS 1111, CS 1112, CS 1120, or a transfer class), in what semester did you take it? Please specify a semester by season and calendar year (i.e., "fall 2012" and not "my second year").

26. [2 points] What CS 2 class did you take? Please circle one.

    - CS 2110
    - CS 2220
    - AP credit
    - Other (please explain): _____
    - Transfer credit
    - Placement exam

27. [1 points] If you took your CS 2 class in college (i.e. CS 2110, CS 2220, or a transfer class), in what semester did you take it? Please specify a semester by season and calendar year (i.e., "fall 2012" and not "my second year").

28. [1 points] Did you attend the final exam review session? You'll get full credit for this question, as long as you answer it honestly (we know most that were there, but not all).

29. [2 points] For the 3-credit courses for next semester (not summer or J-term):

    - How many CS courses are you enrolled in (not wait-listed)?
    - How many CS courses are you wait-listed for?
    - How many CS courses would you *like* to be enrolled in?