CS 2150 Final exam, spring 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.

_____

_____

_____

_____

Serious error.
All shortcuts have disappeared.
Screen. Mind. Both are blank.

(the bubble footer is automatically inserted into this space)

Page 2: Exam 1 Material

1. [6 points] What will the following code print? Show your work!

```
union foo {
  float f;
  unsigned int i;
} bar;
```

```
int main() {
  bar.i = 0xc2ad0000;
  cout << bar.f << endl;
}
```

2. [3 points] Why would we want to create a *method* template in C++?

3. [3 points] Briefly describe *what* the `#ifndef` / `#define` / `#endif` pre-processor commands do, and briefly explain *how* they work.

Page 3: Exam 2 Material

4. [3 points] Briefly describe exactly how a `vector`'s running time for `insert()` amortizes to $\Theta(1)$, even though some operations will be linear.

5. [3 points] What is the best collision resolution strategy for hash tables? Briefly, why?

6. [6 points] Give one advantage and one disadvantage of each of the tree data types we studied in this course. You can't use the same reason twice (i.e., if *a* is better than *b*, then you can't also say that *b* is worse than *a*).

	Advantage	Disadvantage
BST		
AVL		
Red-black		
Splay		

Page 4: C++

7. [3 points] Why does C++ treat array base names as *constant* pointers?

8. [3 points] Briefly describe the difference between shared multiple inheritance and replicated multiple inheritance.

9. [3 points] Briefly describe how the C++ compiler implements dynamic dispatch in the programs it compiles.

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

Page 5: Heaps and Huffman Coding

11. [3 points] Briefly, what is the difference between a priority queue and a binary heap?

12. [3 points] While the running time of a binary heap's `insert()` method is $\Theta(\log n)$, the *expected* running time is constant. Briefly, why?

13. [3 points] Give three reasons why we store a heap as an array rather than dynamically allocated heap nodes.

14. [3 points] What is the "prefix" property of "prefix codes"? In other words, what is the particular property of prefix codes that makes them usable in Huffman coding?

Page 6: Graphs

15. [4 points] Give one advantage and one disadvantage of the two graph representation methods we discussed in lecture (adjacency list and adjacency matrix). You can't use the same reason twice (i.e., if *a* is better than *b*, then you can't also say that *b* is worse than *a*).

	Advantage	Disadvantage
Adj Matrix		
Adj List		

16. [3 points] Give a compelling example of when topological sort is necessary. However, you can not give the example discussed in class (course pre-requisites).

17. [5 points] Dijkstra's shortest path algorithm does not work for graphs with negative cost edges. Describe the algorithm steps to generate a single-source shortest path in a graph that *does* have negative cost edges (but no negative cost cycles). Efficiency does not matter.

Page 7: x86

For each of the following questions, you need to give enough detail so that somebody could implement the calling convention from your description.

18. [3 points] List the steps in the C calling convention's *caller prologue*.

19. [3 points] List the steps in the C calling convention's *callee prologue*.

20. [3 points] List the steps in the C calling convention's *callee epilogue*.

21. [3 points] List the steps in the C calling convention's *caller epilogue*.

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...

22. [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!

23. [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

24. [1 points] Have you already declared the major/minor mentioned above? Circle: Yes or No

25. [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

26. [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").

27. [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

28. [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").

29. [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).

30. [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?