

## CS 2150 Final Exam

**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!**

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.

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All shortcuts have disappeared.  
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**Page 3: Exam 2 stuffs**

4. [8 points] Give one advantage and one disadvantage of each of the four collision resolution protocols that we have studied: separate chaining, linear probing, quadratic probing, and double hashing. Note that you can not use a single fact two ways. For example, if protocol  $x$  is faster than protocol  $y$ , then you can only use that once (i.e., you can say that as an advantage of protocol  $x$ , but you can not also say that protocol  $y$  is slower than  $x$  as a disadvantage of  $y$ ).

|                   | Advantage | Disadvantage |
|-------------------|-----------|--------------|
| Separate chaining |           |              |
| Linear probing    |           |              |
| Quadratic probing |           |              |
| Double hashing    |           |              |

5. [4 points] We've talked about how red-black trees are faster than AVL trees, even though they are both  $\Theta(\log n)$  for the important operations. But why? Specifically, what properties of red-black trees allow them to be faster than AVL trees?



**Page 5: Heaps and Huffman Coding**

Consider a file that contains just the following line: 'aaaaaabbbbbccccdddeef' (21 characters: 6 a's, 5 b's, 4 c's, 3 d's, 2 e's, and 1 f). You are going to encode this file using Huffman coding. Each of the questions below builds upon the previous one. However, if you get one wrong, you can still receive full credit for successive ones, as long as your wrong answer is both reasonable and clearly indicated, and your successive answer correctly builds upon the previous (but wrong) answer.

10. [3 points] Construct the min-heap for this file.

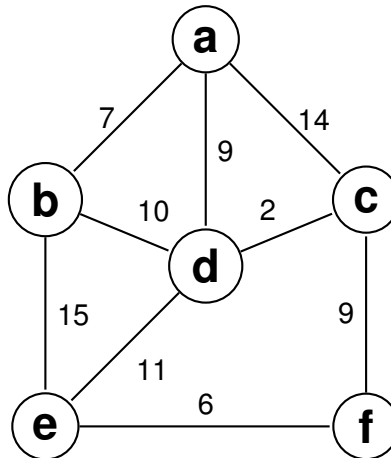
11. [3 points] Create the Huffman coding tree for this file.

12. [3 points] Generate the prefix codes for the characters in this file.

13. [3 points] Encode the word 'cafe' using the prefix codes above.

**Page 6: Graphs**

14. [12 points] Perform Dijkstra’s shortest path on the graph below, and put the answer in the table shown below. If a node’s data (the distance or the path column) is updated, cross off the old data and write the new data next to it (all in the same box), as done in class, so that we can see how you got to your answer. The start node is *a*.



| Vertex | Known? | Distance | Path |
|--------|--------|----------|------|
| a      |        |          |      |
| b      |        |          |      |
| c      |        |          |      |
| d      |        |          |      |
| e      |        |          |      |
| f      |        |          |      |

**Page 7: Memory and UNIX**

15. [3 points] Of the two ways we studied to manage the heap (buddy blocks and fixed-size blocks), which is better? Why? Your answer to the 'why' must compare the two methods.
  
  
  
  
  
16. [3 points] A memory hole is when the address of dynamically allocated memory is lost. Give two examples of how this can happen in C++ code.
  
  
  
  
  
17. [3 points] Give one advantage of C++ over Objective C, and one advantage of Objective C over C++. We are looking for an advantage of the language itself, not other factors (who uses it more, one has a better library).
  
  
  
  
  
  
  
  
  
  
18. [3 points] For Makefiles, define the following three concepts: suffix rule, target, and macro.

**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...

19. [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!

20. [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
- BS CpE
- Other (please explain): \_\_\_\_\_
- BA CS
- CS minor
- Neither majoring nor minoring in computing

21. [2 points] What CS 1 class did you take? Please circle one.

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

22. [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").

23. [2 points] What CS 2 class did you take? Please circle one.

- CS 2110
- Other (please explain): \_\_\_\_\_
- CS 2220
- Transfer credit
- AP credit

24. [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").

25. [2 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).

26. [2 points] For the 3-credit courses in the upcoming spring semester:

- 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?