

CS 2150 Exam 1, spring 2020

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 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.

*The Tao that is seen
Is not the true Tao,
until You bring fresh toner.*

(the bubble footer is automatically inserted into this space)

Page 2: C++

1. [3 points] Write a C++ code snippet that has a memory leak. The shorter the code, the better!
2. [3 points] *Briefly*, why do we have header (i.e., *.h) files?
3. [3 points] *Briefly*, why do we use references instead of pointers? *Briefly*, when do we use them instead of pointers?
4. [3 points] Assume that the line `Square * s = new Square(4);` has just been declared. *Briefly*, explain what happens when you run `delete s`? *Briefly*, what happens if you try to access `s` immediately after running the `delete` command?

Page 3: Lists

5. [3 points] Consider three list data structures: a singly linked list, a doubly linked list, and a vector. Give an operation that is constant time with a doubly linked list but that is linear with the other two. Also give an operation that is constant time with a vector but that is linear with the other two.

6. [3 points] *Briefly*, why does C++ have templates? (in other words, what are templates for?)

7. [3 points] What is the best way to implement a queue? *Briefly*, why?

8. [3 points] *Briefly*, what is the purpose of Abstract Data Types?

Page 4: Numbers

9. [3 points] Consider a new numerical type, the `subfloat`. This type is just like the 32-bit `float` that we studied, but it takes up only 24 bits: 1 sign, 6 exponent, and 17 mantissa. Assuming it encodes analogous to the 32-bit `float`, what is the maximum value it can hold? You can (and should) keep your answer as a power of 2.
10. [3 points] *Briefly* describe the quick way to convert between binary and hexadecimal.
11. [3 points] Convert 413_5 to base 8.
12. [3 points] Convert the 16-bit two's-complement value of $0x0102$, which is in *little-Endian* form, to a decimal number.

Page 5: Miscellaneous

13. [3 points] Why would you want to run `chmod` on a file?

14. [6 points] Prove that $10n \in \Theta(n)$

15. [3 points] *Briefly*, list the difference(s) in C++ between an array base name and a pointer.

Page 6: No questions here

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MISS LENHART COULDN'T BE HERE TODAY, SO SHE ASKED ME TO SUBSTITUTE.

MATH

MR. MUNROE

I'VE PUT OUT YOUR TESTS. PLEASE GET STARTED.

MR. MUNROE, MISS LENHART NEVER TAUGHT US THIS.

THAT'S BECAUSE MISS LENHART DOESN'T UNDERSTAND HOW IMPORTANT CERTAIN KINDS OF MATH ARE.

BUT THIS JUST LOOKS --

THIS MATERIAL IS MORE VITAL THAN ANYTHING YOU'VE EVER LEARNED

BUT --

NO BUTS.

THIS IS A MATTER OF LIFE AND DEATH.

Name: _____

- The velociraptor spots you 40 meters away and attacks, accelerating at 4 m/s^2 up to its top speed of 25 m/s. When it spots you, you begin to flee, quickly reaching your top speed of 6 m/s. How far can you get before you're caught and devoured?

- You are at the center of a 20m equilateral triangle with a raptor at each corner. The top raptor has a wounded leg and is limited to a top speed of 10 m/s.

(Not to scale)

The raptors will run toward you. At what angle should you run to maximize the time you stay alive?

- Raptors can open doors, but they are slowed by them. Using the floor plan on the next page, plot a route through the building, assuming raptors take 5 minutes to open the first door and halve the time for each subsequent door. Remember, raptors run at 10 m/s and they do not know fear.