CS 2150 Exam 1, spring 2022

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.

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A crash reduces
Your expensive computer
To a simple stone.

Page 2: C++

1. [3 points] Consider the `ListNode` class from lab 2 (contains an `int value` field and `ListNode*` fields `prev` and `next`). What is the value of `obj->value` after the end of the `main()` function in the program below? Assume the appropriate `#include` statements are present.

```
void mystery(ListNode *ptr) {
    ptr = new ListNode();
    ptr->value = 2150;
}
int main() {
    ListNode *obj = nullptr;
    mystery(obj);
}
```

2. [3 points] *Briefly*, what causes a segmentation fault?

3. [3 points] *Briefly*, what are templates? *Briefly*, why are they useful?

4. [3 points] *Briefly*, what are the differences between the copy constructor and `operator=()`?

Page 3: Lists

5. [3 points] Consider the code below for a ListNode class. List three errors in the code.

```
#ifndef LISTNODE_H
#include "ListNode.cpp"
using namespace std;
class ListNode {
public:
    ListNode ListNode();
private:
    int value;
    ListNode* next, previous;
}
#endif
```

6. [3 points] *Briefly*, why do most data structures define iterators? This answer should apply to linked lists as well as other data structures.

7. [3 points] *Briefly*, what are abstract data types and why do we use them?

8. [3 points] What is the worst-case running time of the various insert operations into a `vector`? *Briefly*, why?

Page 4: Numbers

9. [6 points] Convert -70.5 into IEEE 754 32-bit floating-point notation. Leave your answer in big-Endian form.

10. [3 points] *Briefly*, why are floating-point numbers not spatially uniform?

11. [3 points] Convert 53 in base 10 to base 7. Show your work! And put your final answer in the box, please.

Page 5: Miscellaneous

12. [3 points] *Briefly* describe an algorithm or function that does not belong to the $\Omega(1)$ complexity class, or explain why such an algorithm could not exist.

13. [3 points] If a program is said to be $O(n^2)$ and $\Omega(n \log n)$, give one potential big-Theta runtime for this program.

14. [3 points] *Briefly*, describe what the `-Wall` and `-g` flags to the compiler do.

15. [3 points] Have you completed the UNIX honor pledge? If not, when will you complete it by? FYI, the link to the UNIX honor pledge is on the Collab landing page. (You get full credit on this question as long as you answer honestly.)

Page 6: No questions here

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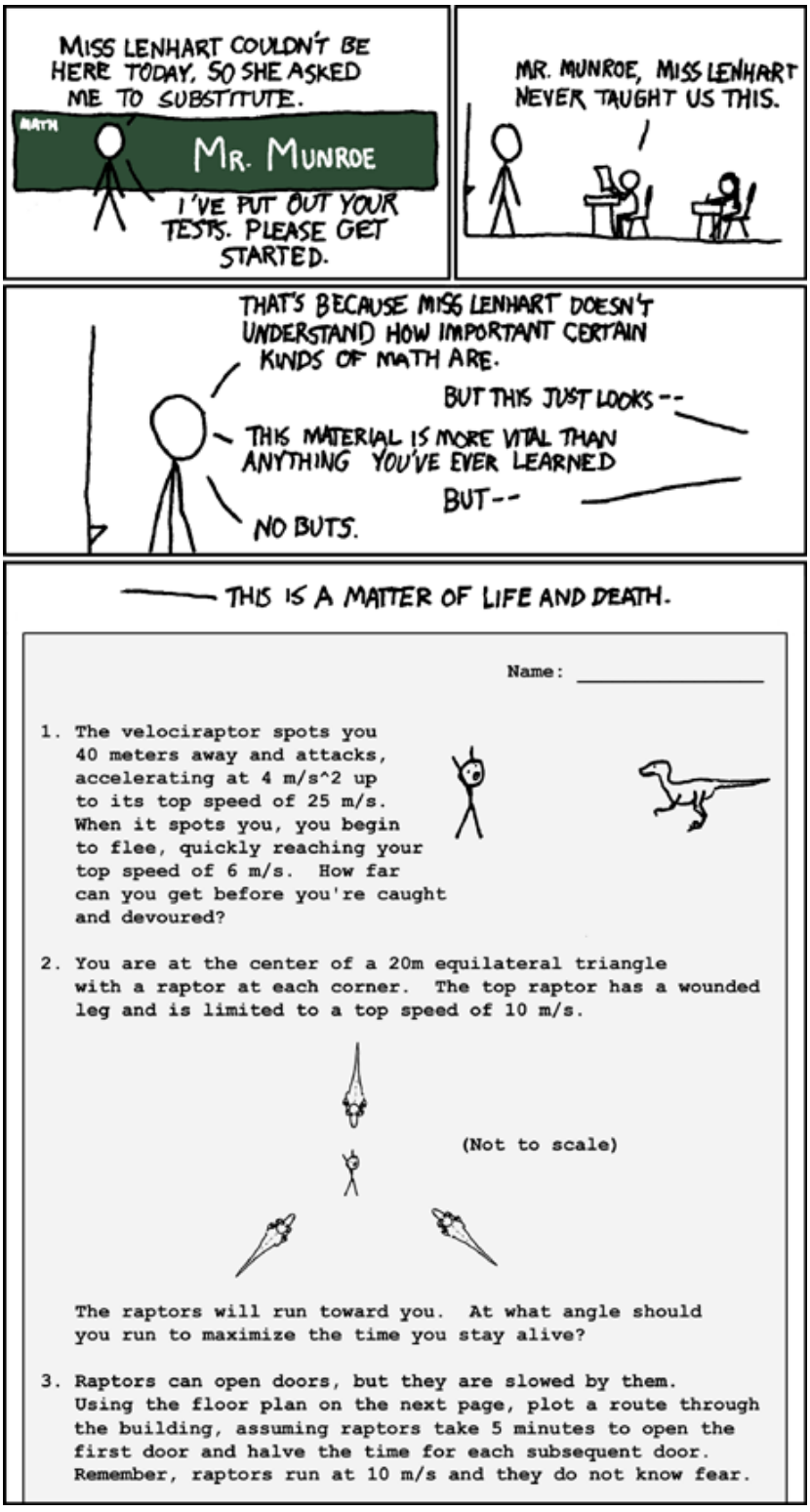

xkcd #135