

# University of Nevada, Las Vegas Computer Science 477/677 Spring 2024

## Assignment 0: What you are expected to know.

There is no due date for this assignment, since you are not supposed to submit it. I will handout the answers in class on Wednesday, August 28.

### Topics

1. High school algebra, including logarithms.
2. Programming in C++, at an introductory level. C++ is the language of programming instruction in our department. If you have programmed in another language, you should be able to quickly learn the C++ concepts you need. If you have never written a program, you should not be taking CS 477/677.
3. Elementary complexity theory, that is, “Big O” notation, to measure both time and space. I will introduce  $\Omega$  and  $\Theta$  notation in class.
4. Elementary calculus. I will sometimes use calculus to explain things, and your eyes should not glaze over.

### Questions You Should be Able to Answer

While measuring time complexity, we assume that it takes one time step to compute any arithmetic operation, such as addition, subtraction, multiplication, division, or square root.

1. True or False.
  - (a) -----  $n^2 = O(n^3)$
  - (b) -----  $n^3 = O(n^2)$
  - (c) -----  $5n^2 + 8n + 17 = O(n^2)$
  - (d) -----  $\log_2 3 * \log_3 2 = 1$
  - (e) -----  $\int_0^n x^2 dx = O(n^2)$
  - (f) -----  $\int_0^n x^2 dx = O(n^3)$
  - (g) -----  $\lim_{n \rightarrow \infty} \frac{\log n}{n} = 0$

(h) ----- The time complexity of the following code fragment is  $O(\log n)$ .

```
for(int i = 1; i < n; i = 2*i)
    cout << "Hello, world!" << endl;
```

(i) ----- The time complexity of the following code fragment is  $O(n)$ .

```
for(int i = 1; i < n; i++)
    for(int j = 1; j < i; j=2*j)
        cout << "Hello, world!" << endl;
```

(j) ----- The time complexity of the following code fragment is  $O(n)$ .

```
for(int i = 1; i < n; i++)
    for(int j = i; j < n; j=2*j)
        cout << "Hello, world!" << endl;
```

## Miscellaneous

(a) Find the value of  $\log_2 8$  (Hint: it's an integer.)

(b) Find the value of  $\log_4 8$  (Hint: it's not an integer, but is a simple fraction.)

(c) The sum of the first  $n$  integers is  $1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2}$ .

Find a formula for  $1 + 4 + 9 + \dots + n^2$ , the sum of the first  $n$  squares. (You can find the answer on the internet.)