CSCI 3104 Fall 2022
Instructors: Prof. Grochow and Chandra Kanth Nagesh

Problem Set 0

Due Date ..... August 29, 2022
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Collaborators ..... **N/A**

Contents

1 Instructions

- The solutions **should be typed**, using proper mathematical notation. We cannot accept hand-written solutions. Here's a short intro to LaTeX.
- You should submit your work through the **class Gradescope page** only (linked from Canvas). Please submit one PDF file, compiled using this LaTeX template.
- You may not need a full page for your solutions; pagebreaks are there to help Gradescope automatically find where each problem is. Even if you do not attempt every problem, please submit this document with no fewer pages than the blank template (or Gradescope has issues with it).
- You are welcome and encouraged to collaborate with your classmates, as well as consult outside resources. You must **cite your sources in this document. Copying from any source is an Honor Code violation. Furthermore, all submissions must be in your own words and reflect your understanding of the material.** If there is any confusion about this policy, it is your responsibility to clarify before the due date.

- Posting to **any** service including, but not limited to Chegg, Reddit, StackExchange, etc., for help on an assignment is a violation of the Honor Code.
- You **must** virtually sign the Honor Code (see Section 2). Failure to do so will result in your assignment not being graded.

2 Honor Code (Make Sure to Virtually Sign)

Problem 1.
- My submission is in my own words and reflects my understanding of the material.
- Any collaborations and external sources have been clearly cited in this document.
- I have not posted to external services including, but not limited to Chegg, Reddit, StackExchange, etc.
- I have neither copied nor provided others solutions they can copy.

I agree to the above, Tyler Huynh. □

3 LaTeX Intro

3.2 Problem 2

Problem 2. By default, text in LaTeX is represented as normal text. To write math, we put it between $ signs, which is called math mode. This equation is in math mode: $E = mc^2$.

Please recreate the following image using LaTeX:

My favorite function is $f(x) = 2^x$.

Answer. My favorite function is $f(x) = 2^x$. □

3.3 Problem 3

Problem 3. Commands are prefaced by a backslash, for example, in math mode, the command `\theta` creates the Greek letter theta, i.e. θ.

Curly braces are used to group symbols together. For example, to write 2^{a+b}, we write `2^{a + b}`.

Please recreate the following image using LaTeX:

Did you know that $e^{\pi i} = -1$?

Proof. Did you know that $e^{\pi i} = -1$? □

3.4 Problem 4

Problem 4. Some commands take one or more arguments, which go in curly braces immediately after the commands. For example, the command `\textbf` takes one argument and makes **text bold**.

In math mode, the command `\sqrt` takes one argument and places the square-root symbol around it. The `\frac` command takes two arguments, a numerator and a denominator, and creates a fraction.

Please recreate the following image using LaTeX:

An **excellent** number is $\frac{1+\sqrt{5}}{2}$.

Proof. An **excellent** number is $\frac{1+\sqrt{5}}{2}$. □

3.5 Problem 5

Problem 5. To write math over multiple lines, we can use the align environment. It can be used as follows:

```
\begin{align*}
  16 &= 4 \cdot 4      \\
     &= 2^2 \cdot 2^2  \\
     &= 2^4 .
\end{align*}
```

This produces:

$$\begin{aligned} \log(abc) &= 4 \cdot 4 \\ &= 2^2 \cdot 2^2 \\ &= 2^4. \end{aligned}$$

The ampersand specifies where to align each row with the row above. The double-backslash creates a break to a new line.

Please recreate the following image using LaTeX(hint: use the command `\log`):

$$\boxed{\begin{aligned} \log(abc) &= \log(ab) + \log(c) \\ &= \log(a) + \log(b) + \log(c). \end{aligned}}$$

Proof.

$$\begin{aligned} \log(abc) &= \log(ab) + \log(c) \\ &= \log(a) + \log(b) + \log(c). \end{aligned}$$

□

3.6 Problem 6

Problem 6. To write code in LaTeX, there are fancy packages, but we can also just use the `verbatim` environment, like this:

```
\begin{verbatim}
1: def myfun(n):
2:   if blah:
3:     do a thing
4:   else:
5:     do something else
6:   return 0
\ end{verbatim}
```

This (without the space between \ and "end{verbatim}"* produces:

```
1: def myfun(n):
2:   if blah:
3:     do a thing
4:   else:
5:     do something else
6:   return 0
```

All text inside a verbatim block is presented in a fixed-width font, verbatim, with white-space preserved (we recommend using spaces not tabs for indentation). There is no magic to creating line numbers in a `verbatim` environment, you just do it manually (fancy packages will do it automatically).

Please recreate code for binary search from Wikipedia, with line numbers added and proper indentation, using a `verbatim` environment below. (Note: here we are explicitly giving you permission to copy the code, because the point is to give you exercise with LaTeX. Ordinarily copying code from any source, even if you cite it, would be an honor code violation.)

Proof.
```
1: function binary_search(A, n, T) is
2:      L := 0
3:      R := n - t 1
4:      while L <= R do
5:              m := floor((L + R) / 2)
6:              if A[m] < T then
7:                   L := m + 1
8:              else if A[m] > T then
9:                   R := m - 1
10:            else:
11:                  return m
12:   return unsuccessful
```

□

*Ironically, the character sequence "\end{verbatim}" is the one character sequence you *cannot* write inside a verbatim block! See the homework .tex file for how it should look.

3.7 Problem 7

Problem 7. There may be times where you scan in an image and need to rotate it to get the orientation correct. You can rotate an image by adding an argument like `angle=90` to the `\includegraphics` command, as in

Using the task4 image that was included with this homework, display task4.png upright, rotated 90, 180, and 270 degrees, and at varying widths. You can see examples of including the actual task4 image in the LaTeX code earlier in this homework.

Proof.

$$\begin{aligned}\log(abc) &= \log(ab) + \log(c)\\ &= \log(a) + \log(b) + \log(c).\end{aligned}$$

$$\begin{aligned}\log(abc) &= \log(ab) + \log(c)\\ &= \log(a) + \log(b) + \log(c).\end{aligned}$$

$$\begin{aligned}\log(abc) &= \log(ab) + \log(c)\\ &= \log(a) + \log(b) + \log(c).\end{aligned}$$

$$\begin{aligned}\log(abc) &= \log(ab) + \log(c)\\ &= \log(a) + \log(b) + \log(c).\end{aligned}$$

□

3.8 Problem 8

Problem 8. a. We'd like to get to know you a little better. In a few sentences, tell us about something that you enjoy doing or that has recently captured your attention (could be a topic, a hobby, a game, a book, etc.). What about it makes it so engaging to you?

Proof. Something that I enjoy doing is cooking as with all the techniques and cooking methods that I have learned its not hard to fall in love with the dishes that I create, whether that be a cake or a dish from Vietnam. The different techniques remind me of a composer putting together the culmination of their life's work, but in shorter bursts. □

b. What are your larger goals in life? How do you hope this class will contribute to them and/or what do you hope to get out of this class? It's okay to say you don't know!

Proof. My larger goals in life are to become a software engineer and to just break into the tech industry to be involved in changing the way the world works. This class can contribute to that by teaching me the different methodologies of developing an algorithm would be useful for what I would need it for and for the discipline aspect of learning three-dimensionally. Where I mean to take on a problem, by thinking of all the possible outcomes and different ways of solving it. □