Honors Homework 1

Discrete Structures, CS 173, Fall 2015

Due Wednesday September 30

Honors homeworks must be formatted using the LaTeX document formatting package. (Not just the equation mode found in Piazza and Moodle.) For this homework, you will write a simple latex document.

First, see the look through the Latex start-up materials on the CS 173 honors web page. In particular, the web page has a sample latex document that you can use as the starting point for your submission. Install a copy of Latex on your machine. (EWS lab machines have it installed.) Then write and format your document.

Your homework should be submitted as hardcopy in the CS 173 honors dropbox in the basement of Siebel. Please submit a hardcopy of your LaTeX document, including **both source code and formatted output**. The dropboxes are located just east of the lounge area with the big windows. If you get to the candy/soda machines, you've gone too far east.

Your document should use 12pt font and start with the title and author (see the sample document for how to do this). Then write a brief paragraph about yourself (e.g. class year, major). Then reproduce the sections below (both titles and contents). Use intelligent formatting features (e.g. numbered lists) as much as you can, rather than faking their effects by hand.

1 Crazy about Foundations

In logic, we learned that $\neg(p \rightarrow \neg q) \equiv (p \wedge q)$.

We also saw why the following statement is true:

$\forall x \in \mathbb{N}$, if $x < 0$, then $x > 2^{10000}$

And we saw that

1. $A \cap B \subseteq A$

2. $\{\emptyset\} \neq \emptyset$.

3. $\sqrt{5}$ is not rational.

and that

- $\binom{n}{r} = \binom{n-1}{r} + \binom{n-1}{r-1}$

- $x - 1 < \lfloor x \rfloor \leq x$

- $p \mid q$ and $q \mid p$ implies $p = \pm q$.

2 Playing with the text

Here's a well-known quote:

> Two roads diverged in a yellow wood,
> And sorry I could not travel both
> And be one traveler, long I stood
> And looked down one as far as I could
> To where it bent in the undergrowth;

How about we center the text?

<div align="center">
Two roads diverged in a yellow wood,
And sorry I could not travel both
And be one traveler, long I stood
And looked down one as far as I could
To where it bent in the undergrowth;
</div>

Now, let's underline the nouns and boldface the verbs:

Two <u>roads</u> **diverged** in a yellow <u>wood</u>,
And sorry I could not **travel** both

3   Summations and lining up equations

By the inductive hypothesis, we know that $\sum_{k=0}^{j} p^k = \dfrac{p^{j+1}-1}{p-1}$. Substituting this into the previous equation, we get

$$
\begin{aligned}
\sum_{k=0}^{j+1} p^k &= p^{j+1} + \frac{p^{j+1}-1}{p-1} \\
&= \frac{p^{j+1}(p-1) + p^{j+1} - 1}{p-1} \\
&= \frac{p^{j+2} - p^{j+1} + p^{j+1} - 1}{p-1} \\
&= \frac{p^{j+2} - 1}{p-1}
\end{aligned}
$$

We also know that $\sum_{k=0}^{n} \frac{1}{2^k} = 2 - \frac{1}{2^n}$ from a table that we found in some dusty corner of the internet.

4   Let's make a table

House	**Pupils**	**Points**
Griffyndor	105	1050
Slytherin	108	900
Ravenclaw	97	850
Hufflepuff	95	600
Total:	405	3400