CSE 312 [A/B] **(DO NOT INCLUDE YOUR NAME)**
Winter 2018
HW #

LaTeX is a markup language that produces beautiful documents with mathematical formulas, and is **very** commonly used in Computer Science research. There is a learning curve, and **you are not required to use it for homework**. It is worth learning though, and this template provides an example!

The following pages illustrate most of the notation used in the class. Look at the .tex file to see how it was produced. If you can't find it there, we also have a cheatsheet linked from the course website. Also, feel free to Google it or use detexify!

LaTeX environment: Our recommendation is to use sharelatex.com, which provides an online editing environment. This is especially helpful if you switch between lab and personal computers. However, if you'd like to install LaTeX on your own computer, Adam Blank's LaTeX tutorial provides instructions.

Problem 1 (example)

Answer: $\boxed{\frac{1}{4!} = \frac{1}{24} \approx 0.04167}$

(In general, we want to see **both** a formula like $3! \cdot \binom{5}{2}$, **and** the explicit numerical value or approximation, like 60.)

Explanation: We need to get exactly DABC, and there are $4 \cdot 3 \cdot 2 \cdot 1 = 4!$ ways to arrange those 4 letters, so we have a $\frac{1}{24}$ probability of getting a random permutation in that order.

(**Remember to start each new problem on its own page.** Do **not** include the problem statement in your solution as it takes up too much space and we already know the problem statement.)

Problem 2 (multi-part example, and large numbers)

(a)

Answer: $\boxed{20! \cdot \binom{13}{5} \approx 3.131 \cdot 10^{21}}$

(Please give the raw formula you used, **and** its value, possibly in scientific notation if it is too large).

Explanation:

Explain here.

(b)

Answer: $\boxed{\textit{answer}}$

Explanation:

Explain here.

Problem 3 (proof problem example)

(Short way)

You can use the **align*** environment to align a proof or calculation. Example below:

$$\begin{aligned} \mathbb{P}(E|F) &= \frac{\mathbb{P}(E \cap F)}{\mathbb{P}(F)} && \text{(def of conditional probability)} \\ &= \frac{\mathbb{P}(F|E)\mathbb{P}(E)}{\mathbb{P}(F)} && \text{(chain rule)} \end{aligned}$$

How did I produce that? The "align*" environment produces a table structure. You use & to go to the next "column", and \\ to start a new line. The whitespaces in the .tex document were not necessary.

(Long way)

First, by the chain rule, we have

$$\mathbb{P}(E|F)\mathbb{P}(F) = \mathbb{P}(E \cap F)$$

Switching the roles of E and F gives

$$\mathbb{P}(F|E)\mathbb{P}(E) = \mathbb{P}(F \cap E)$$

Since $\mathbb{P}(E \cap F) = \mathbb{P}(F \cap E)$, we can set them equal to get

$$\mathbb{P}(E|F)\mathbb{P}(F) = \mathbb{P}(F|E)\mathbb{P}(E)$$

But dividing by $\mathbb{P}(F) > 0$ gives Bayes Theorem

$$\mathbb{P}(E|F) = \frac{\mathbb{P}(F|E)\mathbb{P}(E)}{\mathbb{P}(F)}$$

Problem 4 (Calculus notation)

(a) The syntax for integrals, summations, etc is a bit clunky but should be intuitive.

$$\int_a^b f(x)dx$$

$$\sum_{i=1}^{n} X_i$$

$$\prod_{i=1}^{n} \mathbb{P}(x_i|\theta)$$

(b) Partial derivatives:

$$\frac{\partial}{\partial\theta} L(x_1, x_2, \ldots x_n|\theta) = 2x$$