Assignment #14

Due: Thursday, January 27, 2011

There are two parts to this assignment, both of which deal with font selection. We have gone over lots of different font options today, and your job will be to explore these options.

1. Type the paragraphs of text on page 2 of this document in three of the fonts we discussed today (default font not allowed). From these three fonts choose the one you think makes the text look best. The final version you turn in should be entirely typeset in the font you choose, and it should include three things: the paragraphs of text themselves, a list of the three fonts you tried out, and a paragraph of text explaining why you chose your font over the other two. (Note: this text was taken from *The LaTeX Companion*, page 2.)

   The symbols TeX and LaTeX show up in this portion of the assignment. You get these by typing `\TeX` and `\LaTeX`, respectively. If these symbols are not followed directly with a punctuation mark, they will eat the space that comes after, so you may have to put in that extra space by hand and type (for example) `\LaTeX\ `.

2. Type the paragraph(s) of text and math on page 3 of this document in three of the fonts we discussed today (default font not allowed). (These fonts obviously need to have math support, so you'll be loading packages described on slides 24 and 25 of Wednesday's lecture #14.) From these three fonts choose the one you think makes the text and math look best. The final version you turn in should be typeset in the font you choose, and it should include three things: the paragraphs of text and math, a list of the three fonts you tried out, and a paragraph of text explaining why you chose your font over the other two.

You are near the end of a class in which we've been talking about typing beautiful documents, so the documents you turn it should be attractive! Please submit the `.tex` and `.pdf` files (four files in all) for this assignment through the Drop Box.

In the early 1990s, Donald Knuth officially announced that TEX would not undergo any further development in the interest of stability. Perhaps unsurprisingly, the 1990s saw a flowering of experimental projects that extended TEX in various directions; many of these are coming to fruition in the early 21st century, making it an exciting time to be involved in automated typography.

The development of TEX from its birth as one of Don's "personal productivity tools" (created simply to ensure the rapid completion and typographic quality of his then-current work on *The Art of Computer Programming*) was largely influenced and nourished by the American Mathematical Society on behalf of U.S. research mathematicians.

While Don was developing TEX, in the early 1980s, Leslie Lamport started work on the document preparation system now called LATEX, which used TEX's typesetting engine and macro system to implement a declarative document description language based on that of a system called Scribe by Brian Reid. The appeal of such a system is that a few high-level LATEX declarations, or commands, allow the user to easily compose a large range of documents without having to worry much about their typographical appearance. In principle at least, the details of the layout can be left for the document designer to specify elsewhere.

This is an alternating series, and we will use the Alternating Series Test to prove that it converges. Let $b_n = ne^{-n}$. We can use L'Hôpital's Rule to prove that $\lim_{n\to\infty} b_n = 0$:

$$\lim_{x\to\infty} \frac{x}{e^x} = \lim_{x\to\infty} \frac{1}{e^x} = 0.$$

If $f(x) = xe^{-x}$, then $b_n = f(n)$, so the above calculation proves that $\lim_{n\to\infty} b_n = 0$. We also need to show that $b_{n+1} < b_n$; we will do this using the derivative. Note that

$$f'(x) = e^{-x} - xe^{-x} = e^{-x}(1-x).$$

When $x > 1$, we have $e^{-x} > 0$ but $1 - x < 0$, meaning that $f'(x) < 0$. When the derivative is negative, the function is decreasing, and this proves that $b_{n+1} < b_n$. We can conclude that our series converges by the Alternating Series Test.

To answer the second question, we refer back to the Alternating Series Estimation Theorem. We write out the first few terms of the series, with some decimal approximations below:

$$\begin{aligned}\sum_{n=1}^{\infty}(-1)^{n-1}ne^{-n} &= \frac{1}{e} - \frac{2}{e^2} + \frac{3}{e^3} - \frac{4}{e^4} + \frac{5}{e^5} - \frac{6}{e^6} + \frac{7}{e^7} - \cdots \\ &= .3679 - .2707 + .1494 - .0733 + .0337 - .0149 + .0064 + \cdots .\end{aligned}$$

Since the seventh term is less than 0.01, we use the first six terms to estimate this sum with error less than 0.01:

$$s_6 = 0.19212.$$