Basic Algorithms, Assignment 2

Due, Tuesday, Sept 18

Prof. Spencer's Office Hours: Wednesday 1-2:30
Course website:
`www.cs.nyu.edu/cs/faculty/spencer/basicalg/index.html`

1. If a computer does a billion operations per second how many does it do in a year. Round this to one significant digit and write it in exponential form, e.g., something like $3 \cdot 10^{43}$ (but thats not the answer!)

2. Redo Table 2.1 on Page 34 with the processor performing a billion operations per second and with functions $n, n\log_2 n, n^3, 1.1^n$.

3. Suppose an algorithm takes $n\log_2 n$ operations, and our computer does a billion operations per second. For how large an n can our computer do the algorithm in a day. (I'm looking for a *rough* answer here, say to one significant digit.)

4. How many binary digits are there in a 100 decimal digit number? (Actually, there are a few possible answers depending on the exact number but we're just looking for a rough answer.)

5. Let $f(n) = \sqrt{2n\ln n}$ and let $g(n) = 6\sqrt{n}$. Which function is larger as for n sufficiently large? When does the eventually larger function become larger? (These functions actually came up in my work some years ago.)

6. John Wastenot decides to implement the Stable Marriage Gale-Shapley algorithm without using much space. His input consists of linked lists of size n, `MANLIST`$[i]$, $1 \le i \le n$, and `WOMANLIST`$[j]$, $1 \le j \le n$, giving the preference list for each person of the opposite gender. He adds two array `MANMATE`$[i]$, $1 \le i \le n$, and `WOMANMATE`$[j]$, $1 \le j \le n$, giving the current mate (`NIL` if there isn't one, which is the original value) of each person. He adds an array `MANLASTPROP`$[i]$ giving the last woman (`NIL` if there were none) that man i has proposed to. Write a pseudocode program for implementing Gale-Shapley with this data structure. Do a worst case analysis of how many steps the algorithm will take. (Note: The answer will *not* be $\Theta(n^2)$.)

Throughout human history, mankind has been a lot better at gathering data than at thinking about it.
From *Mirror Worlds* by David Gelernter