CSE 310 – Homework 0

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Problem: (Levitin 2.1.1) For each of the following algorithms, indicate (i) a natural size matrix for its inputs; (ii) its basic operation; (iii) whether the basic operation count can be different for inputs of the same size.

a. Computing the sum of n numbers

   Answer:

   i. n
   ii. addition of two numbers
   iii. no

b. Computing $n!$

   Answer:

   i. $\lceil \log n \rceil$
   ii. Multiplication of two integers
   iii. no

c. Finding the largest element in a list of n numbers

   Answer:

   i. n
   ii. Comparison of two numbers
   iii. no

Problem: Prove that $\frac{n(n^2)}{2} \in \Omega(n)$

Answer: We have the following theorem from Levitin, page 57:

Theorem 1. *Let $f(n)$ and $g(n)$ be two monotonically increasing functions, then*

$$\lim_{n\to\infty} \frac{f(n)}{g(n)} = \begin{cases} 0 & \Rightarrow f(n) \in \mathcal{O}(g(n)) \\ c & \Rightarrow f(n) \in \Theta(g(n)) \\ \infty & \Rightarrow f(n) \in \Omega(g(n)) \end{cases}$$

We set up our limit appropriately:

$$\lim_{n\to\infty} \frac{\frac{n(n-1)}{2}}{n} = n - 1 = \infty$$

Therefore, by Theorem 1, $\frac{n(n^2)}{2} \in \Omega(n)$

Problem: Give an algorithm to compute the sum of n integers stored in an array $\mathcal{A}$.

Answer: The following algorithm computes the sum:

SUMMATION($\mathcal{A}[0 \ldots n-1]$)
INPUT: an integer array $\mathcal{A}$
OUTPUT: the summation $\sum_{i=0}^{n-1} \mathcal{A}[i]$
  sum = 0
  for $i = 0 \ldots (n-1)$
    sum = sum + $\mathcal{A}[i]$
  return sum

Compiling Your Document

Now that our document is finished, we need to compile it. If you are on CSE or any other system that has LaTeX installed, then you compile this document from the command line as follows: `latex hw_example.tex`

LaTeX will do its thing and report any errors that you may have, otherwise it will successfully compile in to a dvi file named `hw_example.dvi`. At this point you have several options. You can convert the dvi file into a pdf file or a postscript file by using either `dvipdf` or `dvips` respectively. Another alternative is to use `pdflatex` instead of `latex`, which automatically outputs a pdf file rather than a dvi file.

If you have labels like our label, `\label{theorem:asymptotics}`, you will need to run `latex` or `pdflatex` 2 or three times to compile the proper references.

Additional Tools

You can use a program called `ispell` from the command prompt to spell check your document. Conveniently, `ispell` ignores LaTeX markup!

If you are just getting used to the linux environment, one of the best text editors for LaTeXbesides emacs and xemacs is nedit. This text editor recognizes LaTeX markup uses font and color offsets to help you out.

Additional Resources

The main source for LaTeX resources is the *TeX Users Group*: `http://www.tug.org` in particular, check out their page for beginners, *Getting Started With LaTeX* at `http://www.tug.org/begin`.

One of the best tutorials is the *Not So Short Introduction to LaTeX 2e* which can be found at
`http://www.ctan.org/tex-archive/info/lshort/english/lshort.pdf`

Good Luck on your LaTeXing

1 Supplemental - Tables

p	q	r	$p \vee q$	$p \to q$
0	1	1	1	1
1	0	0	1	0

2 Proof Example

Theorem 2. *The sum of two odd integers is even.*

Proof. Let n, m be odd integers. Every odd integer x can be written as $x = 2k+1$ for some other integer k. Therefore, let $n = 2k_1 + 1$ and $m = 2k_2 + 1$. Then consider

$$\begin{aligned} n + m &= (2k_1 + 1) + (2k_2 + 1) && \\ &= 2k_1 + 2k_2 + 1 + 1 && \text{Associativity/Commutativity} \\ &= 2k_1 + 2k_2 + 2 && \text{Algebra} \\ &= 2(k_1 + k_2 + 1) && \text{Factoring} \end{aligned}$$

By definition, $2(k_1 + k_2 + 1)$ is an even number, therefore, $n + m$ is even. $\square$