Impatiemment Attendu

Robert Sedgewick
Princeton University
A CONFERENCE ON THEORETICAL COMPUTER SCIENCE

August 15 – 17, 1977
University of Waterloo
Waterloo, Ontario
Canada

August 15 – 17, 1977
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constant if \( N \) is a power of two, with \( \Phi(2^{k}) < \Phi(2^{k+1}) \). The constant \( \Phi(2^{k}) \) is
\[
\frac{2}{\ln 2} \frac{1}{k} \Gamma\left(\frac{k}{\ln 2}\right) \zeta\left(\frac{k}{\ln 2}, \frac{1}{4}\right)
\]

Proof. From the discussion above, we need only substitute our result (29) for \( h \) into Eq. (14) for \( h_{0} \) and perform the summation. We have
\[
\sum_{k=1}^{\infty} \frac{\Gamma\left(\frac{k}{\ln 2}\right) \zeta\left(\frac{k}{\ln 2}, \frac{1}{4}\right)}{2^{k} \log 2}
\]
where the last two series are easily taken care of. Working backwards from (14), we see that they contribute \( \frac{1}{2} \) to \( h_{0} \). (The sum may be evaluated directly by an interesting application of several identities in Knuth [13]; a simple induction could also be used.)

For the other terms, we can remove the binomial coefficients with Stirling's approximation, as in the derivation of (13). We have
\[
\frac{2}{\ln 2} \frac{1}{k} \Gamma\left(\frac{k}{\ln 2}\right) \zeta\left(\frac{k}{\ln 2}, \frac{1}{4}\right)
\]
Therefore the \( O\left(\frac{1}{\log N}\right) \) term sums to \( O(\frac{1}{\log N}) \).

Theorem 3. The average number of exchanges used by Heber's odd-even merge for a random 2-ordered file of \( N \) elements is
\[
\sum_{k=1}^{\infty} \frac{\Gamma\left(\frac{k}{\ln 2}\right) \zeta\left(\frac{k}{\ln 2}, \frac{1}{4}\right)}{2^{k} \log 2}
\]
where \( \Phi(2^{k}) \) is an oscillatory function which is

<table>
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<th>( k )</th>
<th>( \frac{1}{2} )</th>
<th>( \frac{1}{4} )</th>
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<td>( \Phi(2^{k}) )</td>
<td>1.30645 988945</td>
<td>1.44246 048755</td>
<td>1.37715 661945</td>
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<td>( \gamma )</td>
<td>0.29785 59063</td>
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Table 3. Values of constants

\[
\frac{2}{\ln 2} \frac{1}{k} \Gamma\left(\frac{k}{\ln 2}\right) \zeta\left(\frac{k}{\ln 2}, \frac{1}{4}\right)
\]

where \( \gamma \) is (in 2/\( 2k \)). From this formula, we see that \( \Phi(2^{k}) \) is constant when \( N \) is a power of two, and has an oscillatory nature between powers of two. With the aid of Table 3 we can easily compute the stated values.
On the Average Number of Registers Required for Evaluating Arithmetic Expressions
by P. Flajolet, J. C. Raoult, and J. Vuillemin
We have 

\[ \psi = \frac{1}{2(2\pi)^2} \int_{0}^{2\pi} \log \left(1 + \frac{1}{e^{\tau} + 1} \right) d\tau. \]

Using the series formula (29),

\[ \psi = \sum_{n=1}^{\infty} \frac{1}{n} \int_{0}^{2\pi} \frac{1}{e^{n\tau} + 1} d\tau, \]

we can compute \( \psi \) by parts:

\[ \psi = \sum_{n=1}^{\infty} \frac{1}{n} \int_{0}^{2\pi} \frac{1}{e^{n\tau} + 1} d\tau = \sum_{n=1}^{\infty} \frac{1}{n} \cdot \frac{2\pi}{2\pi} \log(2\pi). \]

The first term vanishes as \( n \to 0 \), as for the second, the first 

\[ \psi = \frac{1}{2} \int_{0}^{2\pi} \log \left(1 + \frac{1}{e^{\tau} + 1} \right) d\tau = \frac{1}{2} \int_{0}^{2\pi} \log \left(1 + \frac{1}{e^{\tau} + 1} \right) d\tau = \frac{1}{2} \int_{0}^{2\pi} \log \left(1 + \frac{1}{e^{\tau} + 1} \right) d\tau. \]

Splitting in (19) gives:

\[ \psi = \frac{1}{2} \int_{0}^{2\pi} \frac{1}{e^{\tau} + 1} d\tau = \frac{1}{2} \int_{0}^{2\pi} \frac{1}{e^{\tau} + 1} d\tau = \frac{1}{2} \int_{0}^{2\pi} \frac{1}{e^{\tau} + 1} d\tau. \]

Each integral is computed in turn.

\[ I_1 = \int_{0}^{2\pi} \frac{1}{e^{\tau} + 1} d\tau = \int_{0}^{2\pi} \frac{1}{e^{\tau} + 1} d\tau = \int_{0}^{2\pi} \frac{1}{e^{\tau} + 1} d\tau = \int_{0}^{2\pi} \frac{1}{e^{\tau} + 1} d\tau. \]

This last integral is classical (see [34, 35]) and its value is \( -\pi \), \( \pi \neq 0.570 \) being Euler's constant.

Simple integration by parts gives \( I_2 = -\tau \) and for \( I_3 \), the function \( \log(\tau) \) ranges between \( 0 \) and \( \tau \), thus \( I_3 \) has some definite value and

\[ \frac{1}{2} \cdot I_2 = \psi(\tau). \]

There just remains \( I_2 = \frac{1}{2} \log(\tau) \) where

(19) \[ \psi = \int_{0}^{2\pi} \frac{1}{e^{\tau} + 1} d\tau = \int_{0}^{2\pi} \frac{1}{e^{\tau} + 1} d\tau = \int_{0}^{2\pi} \frac{1}{e^{\tau} + 1} d\tau. \]

Now \( I_2 \) is periodic with period \( 2\pi \) and \( I_3 \) is \( \pi \).

The choice of variables \( \tau = \log(x) \) shows that \( I_2 \) is definitely differentiable.

\[ \frac{2k\pi - \log^2 \frac{\pi}{\log 2}}{\log 2} \]
Genesis of “Analytic Combinatorics”

Late 1970s / early 1980s: optimism and opportunity

Knuth volumes 1-3

Search for generality

Algorithms for the masses

Teaching and research in AofA
When will the book be available?
An alert: “best-seller impatience attendu”

From: Google Alerts <googlealerts-noreply@gmail.com>
Subject: Google Alert - sedgewick
Date: September 26, 2008 12:26:13 AM EDT
To: Bob Sedgewick

Google Blogs Alert for: sedgewick

Best-seller impatience attendu
By Michael Lugo (Michael Lugo)
I’ve seen citations to Flajolet and Sedgewick’s book Analytic Combinatorics in things written as long ago as 1998 or so; Amazon.com says the book will be out on December 31, 2008, and the publisher, Cambridge University Press says ...

God Plays Dice - http://godplaysdice.blogspot.com/
An alert: “best-seller impatientement attendu”

... in their impatiently awaited best-seller, P. Flajolet and R. Sedgewick offer a detailed development of the symbolic method in combinatorial analysis, to which one will be able to refer.
“Impatiently awaited” on the web

Prince of Persia

plasma display

iPod

Berkeley Unix 4.4

Analytic Combinatorics

student visa

Dan Brown novel

Heroes episode

Princes of Persia

plasmas display

iPod

student visa

Dan Brown novel

Heroes episode
“Impatiently awaited” in literature

Prince Andrew listened to the account of the opening of the Council of State, which he had so 
impatiently awaited and to which he had attached such importance.
Leo Tolstoy, War and Peace

Custer and his cavalry contingent 
impatiently awaited marching orders.
Kingsley Bray, Crazy Horse: A Lakota Life

This done, he 
impatiently awaited the return of his companions.
Alexandre Dumas, The Count of Monte Cristo

A handsome young fellow like you does not obtain long leaves of absence
from his mistress, and we were 
impatiently awaited at Paris, were we not?
Alexandre Dumas, The Three Musketeers

He 
impatiently awaited her husband’s departure.
Guy de Maupassant, Bel Ami
Digression: Separated at birth??
Last Sunday I sent the message that follows, then a reminder mid-week, but haven't received an ACK. Did you get it? Was it properly addressed?

Is there a pilot in the plane?

At full speed on the highway ... but in reverse gear?

Where are we?????????

Did some e-mail message get lost? Please at least ACK having received the message below, first sent OCT 28, 2008.
Dear Phillippe,

Apologies for not acknowledging, but I have been working around the clock to get this book to press which it did this morning. All of your corrections have been incorporated and we are on schedule for a stock date of 28th November.

Best Wishes,

[ CUP staff member ]

From: david.tranah@gmail.com
Subject: Re: Is there a pilot in the plane?
Date: November 28, 2008 1:12:56 PM EST
To: Philippe.Flajolet@inria.fr
Cc: rs@CS.Princeton.EDU, dtranah@cambridge.org

Dear Philippe and Bob

Just a quick note to say that I am looking forward to meeting you both again next week at the 60th birthday colloquium, and that we are on schedule to have books on display for SODA in NYC in January and at the annual meeting of the American Mathematical Society in Washington, also in January.

best wishes

david
As a technology, the book is like a hammer. That is to say, it is perfect: a tool ideally suited to its task. Hammers can be tweaked and varied but will never go obsolete. Even when builders pound nails by the thousand with pneumatic nail guns, every household needs a hammer.

Now even modest titles have been granted a gift of unlimited longevity.

What should an old-fashioned book publisher do with this gift? Forget about cost-cutting and the mass market. Don’t aim for instant blockbuster successes. You won’t win on quick distribution, and you won’t win on price. Cyberspace has that covered.

Go back to an old-fashioned idea: that a book, printed in ink on durable paper, acid-free for longevity, is a thing of beauty. Make it as well as you can. People want to cherish it.