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Dear Professor Knuth,

As a great admirer of your work, while looking for sources to help motivate the study of computer programming to young undergraduate students enrolled in "CSE102" at my university, I ended up reading the preface to Volume 1 of TAOCP (in an electronic copy of the first edition), and stumbled on two paragraphs that I found remarkable. Quoting them to you feels a bit silly, but nevertheless let me copy the paragraphs for reference:

> To a layman, the electronic computer has come to symbolize the importance of mathematics in today's world, yet few professional mathematicians are now closely acquainted with the machines. One reason for this surprising (and unfortunate) situation is that computers seem to have made some things "too easy," in the sense that people who no longer have to do so many things with pencil and paper never discover the mathematical simplifications which would aid the work. Some mathematicians occasionally resent the intrusion of computers, not because they are afraid they will lose their jobs to automation, but because they fear there will perhaps be less necessity to give birth to invention. On the other hand, there are obvious relations between computers and mathematics in the fields of numerical analysis, number theory, and statistics.
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> I wish to show that the connection between computers and mathematics is far deeper and more intimate than these traditional relationships would imply. The construction of a computer program from a set of basic instructions is very similar to the construction of a mathematical proof from a set of axioms. Furthermore, pure mathematical problems historically have always developed from the study of practical problems arising in another field, and the advent of computers has brought a number of these with it. [...] Besides the interesting application of mathematical tools to programming problems, there are also interesting applications of computers to the exploration of mathematical conjectures, e.g., in combinatorial analysis and algebra; and in many of these cases there is considerable interplay between programming and classical mathematics. Attempts at mechanization of mathematics are also very important, since they lead to greater understanding of concepts we thought we know (until we had to explain them to a computer). I believe the connections between computers and pure mathematics which have been enumerated in this paragraph will become increasingly important.

Although finally I ended up using a different quote from the preface of TAOCP in my first lecture for CSE102 (the beautiful opening sentence on computer programming as an "aesthetic experience much like composing poetry or music"), I found these two paragraphs interesting for multiple reasons. The first paragraph, which spells out some legitimate concerns about the automation of mental tasks, feels very relevant today, with the difference perhaps that nowadays some mathematicians *are* starting to worry about eventually losing their jobs. The second paragraph I found notable for its clear statement of the program-as-proof analogy, in addition to its recognition of the importance of mechanization. I know that you were in correspondence with Nicolaas de Bruijn about the Automath project around the same time as you wrote the preface,[1] and I wonder whether you were thinking of such formal proof projects when you wrote some of the above words?

I was curious, however, why neither paragraph was cited much in the literature, and noticed that they were both eventually removed from the preface to Volume 1 – if I understand correctly, in the third edition. Maybe I'm overlooking something, but I couldn't find anything specific mentioned about that on the TAOCP page other than in Errata for Volume 1 (2nd ed.), where you wrote that "In the third edition I will revise the preface extensively, so that it will reflect the actual content of these books instead of the state they were in when Volume 1 was first published." Was there a specific reason that those two paragraphs of the preface were removed, or was it just an editorial choice to streamline the text?

Adding to the mystery for me, while trying to find references to these passages online, for fun I tried copying the text of the first paragraph into ChatGPT and asked it to identify the quote. It authoritatively answered that the quotation is from Stanisław Ulam's essay "Computers in mathematics" appearing in the book *Science, Computers, and People* (1986) edited by M. C. Reynolds and Gian-Carlo Rota.

Of course the LLM was bluffing!

But that essay is actually a reprint of an article by Ulam in the September 1964 issue of Scientific American (Vol. 211, No. 3, `https://www.jstor.org/stable/24931634`), which opens with very similar language to your paragraph in the preface:

> Although to many people the electronic computer has come to symbolize the importance of mathematics in the modern world, few professional mathematicians are closely acquainted with the machine. Some, in fact, seem even to fear that individual scientific efforts will be pushed into the background or replaced by less imaginative, purely mechanical habits of research. I believe such fears to be quite groundless. It is preferable to regard the computer

[1] I know this from William Lovas, my academic sibling, who spoke with you while you were visiting CMU in 2010. You forwarded him a copy of a letter dated 20 May 1968 that you had sent to de Bruijn about an extension of Automath with "subsorts" – a topic related to William's thesis, and which interests me as well!

> as a handy device for manipulating and displaying symbols. Even the most abstract thinkers agree that the simple act of writing down a few symbols on a piece of paper facilitates concentration. In this respect alone – and it is not a trivial one – the new electronic machines enlarge our effective memory and provide a marvelous extension of the means for experimenting with symbols in science. In this article I shall try to indicate how the computer can be useful in mathematical research.

Do you remember reading Ulam's article, and do you think that perhaps you were subconsciously influenced by it when drafting the preface to TAOCP in 1967?

Of course there is no urgency to these questions of purely historical interest, but I'm sure that you are the best person to answer them and your guidance is appreciated.

In any case, thank you for your life's work, and I just want to say that I'm eagerly looking forward to reading Volumes 5 and 6!

Best regards,

Noam Zeilberger