

Date: Sat, 25 Sep 1999 22:22:52  
From: Andrew Leman andyleman@yahoo.com  
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Hi, Ilia, thank you for the prompt response. There is nothing to apologize for, as there was no special reason for my last name to appear as 'Lehman'. The book was in Springer, Germans certainly believe that every Leman is a hidden Lehman. In this particular case they were even right - my grand-grand-...father came to Russia from Germany, he definitely used to spell his name as Lehman.

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What do I know about Boris Weisfeiler? We first met when we were 13 years old, in middle school, in 1953; Stalin just died, we all were good Soviet kids, lots of illusions, lots of belief, happy to live in the best country in the world.

The cellular adventure began for me in 1964, I was the postgraduate (aspirant) of ITEF, Institute of teor and experimental Physics, former TTL - Teplo-Technicheskaia laboratoria, one of two main sites of Soviet nuclear research in Moscow (another was LIPAN, laboratoria izmeritel'nyh priborov, aka Kurchatnik). I've graduated from MGU, meh-mat, in 1963, and somehow decided to switch to computer-related activities. I'm still not sure that this decision was right, but there was something in the air... My first teacher in programming was A.S.Kronrod - a brilliant mathematician who at some point decided that he can/should do something 'more real'. Being a chief of math (read: programming) laboratory of ITEF he created a very strong team of skilled people and tried to attack some computer-related problems considered unsolvable. BTW, the program - first world champion in computer chess was later created by this team. Among others targets, was the graph isomorphism problem. There were lot of applications, lot of interest, great demand - no wonder that everybody thought about it, including myself. Of course, it wasn't a purely scientific exersize, I've tried to do it computer-aided.

I've programmed some basic algorithms, tried them, they failed, of course. I don't know how it stays today, but in 60-ties, one could in matter of days re-discover all the facts, ideas and techniques in graph izomorphizm theory. I doubt, that the word 'theory' is applicable; everything was at such basic level. Soon enough, I rephrased for myself the graph izomorphizm problem as nodes' equivalence problem. I tried to count number of paths of length 2, 3 etc, from node to node, and distinguish (color) nodes by the numbers of incident paths of different lengths. Programmatically, I tried to multiply the (symmetric) adjacency matrix to itself, and clusterize rows by results of multiplication.

At this time Boris who graduated from meh-mat MGU same 1963 year, was designated to Moscow Elektrolampovyi zavod (MELZ), as a programmer. Unlike me, he wasn't interested in programming, wasn't excited by computers, in his spare time he was doing some algebraic stuff (sorry, I forgot what was it, 35 years is a lot). After serving his term on MELZ, he joined our team in ITEF; Kronrod was eager to hire good brains, not necessarily computer enthusiastic.

We were old friends, met every day, talking politic, computers and life, all together, no wonder that Boris knew everything I was doing from day one, we discussed every little success or problem, trying to figure out what does it all mean in math terms. This is how the notion of cell ('kletka') was born - it was our working name for a graph (matrix) which doesn't clusterize after multiplication process stabilizes. We had a proof (an obvious one) that stabilization happens and had some estimate for the number of steps for it to happen, but couldn't get any furhter.

Then I built a counterexample - a cell with not all nodes equivalent. It was done by means of a very smart computer program. I'm still proud of how I did it; computers weren't powerfull enough to handle all necessary computations, if you do it by force. At this point I basically lost my interest in the theoretical part of the problem. Actually, multi-cellular graphs, aka cellular algebras never excited me. It was all so obvious, so trivial that time, it was much more interesting to try another approaches. Since then I was doing operating systems, data bases, some theoretical physics (computer aided).

Boris didn't give up, though. He spent a lot of time and developed lot of understanding on the subject. Once, he thought that he knows an algorithm, which takes  $n^* \log(n)$  time to establish graph izomorphizm. Later we found a mistake. Then, in 1971 (?) a monography was written on dif-

ferent graph theory, computer related problems, including our stabilization process. (among others was the now famous 'algorithm of four Russians' - all four also being members of our team). The monography was committed to be published, Boris invested a lot in it, it was his baby. Then we were told, that it can't happen, because too many authors have non-Russian last names. Then Boris decided to emigrate. He never ever considered this possibility before, we were close friends, and in so many years were quite sincere with each other. So, I may declare, that his emigration was directly caused by this stupid antisemitic move.

He moved to USA, became a professor in Pensilvania State University. I don't know much about his life in US. Rarely, he called, occasionally sent letters. His life in US wasn't easy, as wasn't life of any immigrant. He traveled a lot. He was a big fan of tourizm back in Soviet Union, having a habit of travelling alone. Podkamennaia Tunguska was his last journey in SSSR. A full month in taiga, alone (well, with bears). I don't remember now what year, but one summer he decided to go to Chili mountains. Alone as usual. And vanished. No one knows what happened. His backpack was found on a river's bank, no signs of violence, force, anything of that sort. Just dissapeared.

Ilia, I hope, I've answered your questions. For me, it was pleasure to learn, that "Weisfeiler-Leman" is known and still causes interest. One of my friends told me, that VAK was right not approving my thesis. The definition of candidate's is "known problem solved"; this is for doctor's to "open new direction". Sad joke, isn't it?

regards, Andrew Le[h]man.