

Biljana Stamatović

$$\varphi_A(c_i(t)) = \begin{cases} \max \{ \omega_i \mid \omega_i \leq c(t) \}, \\ c_i(t) + \omega_0 \\ c_i(t), \text{ otherwise} \end{cases}$$

Biljana Stamatović was born in Niksic, Montenegro. She graduated in mathematics at the State University of Montenegro in 1990, earned her Master of Science in Mathematics from the University of Belgrade, Serbia in 1995 and after spending two years in Moscow she completed her PhD in 2000 at the University of Belgrade. Biljana is currently a full professor at the University of Donja Gorica, Montenegro, where she is head of the Department of Mathematics.

Research topics:

- Automata theory
- Computer science
- Data science



How and when did you choose to do mathematics?

I believe that mathematics chose me. At elementary school in Nikšić, a small town in Montenegro where I grew up, I was top of the class. I was 12 when we moved to Podgorica because my father, who was working for the Yugoslavian army, was transferred there. At the Gymnasium in Podgorica I was an excellent pupil and an all-rounder. Yet maths was the subject I found easiest and which gave me most pleasure. I never hesitated about whether or not to do maths, even though most of my school mates chose to study electrical engineering, mechanics or economics. During the last two years of secondary school I was part



of a cohort taking courses in advanced maths, including probability, algebra, analysis and Euclidean geometry. From this cohort of thirty odd students, only a girlfriend of mine and I entered the maths department of the Faculty of Natural Sciences and Mathematics, which had been founded in 1979. Mathematics is very present in my life. I married a mathematician who works in statistical mathematics, and we have a thirteen year old daughter who is also talented in mathematics; she is the best in our country for her age group.

Were you then encouraged by your family, friends or other people around you?

I don't remember anyone encouraging me. My mother was brought up in the countryside where she was unable to finish secondary school. From the Second World War to the middle of the 70's boys would be sent to school but girls did not attend systematically. My father entered the military secondary school at the age of 12, which he completed. I have a younger brother and an older sister who both finished secondary school, but they did not go to university. Both my brother and sister have three children. He is a policeman, and she works as a taxi driver. I managed well on my own, since I liked working and think-

ing, and found a good routine for studying. I was able to fund my studies thanks to what was called a Tito Fellowship, and by working in vineyards during the summer. After secondary school I also started giving private lessons. I went through a difficult time after my father's death in 1993. I was then 25. My mother, who had never worked, benefited from my father's pension. Now I have a lot of moral support from both my husband and my daughter, born in 2006.

Did you come across obstacles in pursuing your career as a mathematician?

Although it was a struggle to fund my studies, financial issues were not important to me, I never needed much money. When I finished my undergraduate studies with two awards, I was top of the class, and I wanted to enter a Master's programme. There were none in Montenegro so I applied for a grant to go abroad. This was not straightforward since I didn't have the connections which tend to make things easier in our system. It so happened that as I was submitting my application at the Ministry of Education, I met by chance the Dean of our faculty, who was very helpful and handed my application directly to the person in charge.



I must say that I never felt that I encountered particular any obstacle as a woman. I had my child late, when I was 38, and benefitted from a year's maternity leave with full salary. Raising a child was not a problem as my husband and I, who had flexible working hours, shared the work at home.

In retrospect, are you happy to have chosen mathematics or do you have some regrets? What are for you the joys of mathematics? What are for you the hardships of mathematics?

What I like about mathematics is that it is an abstract world, where you are on your own without any limits in space or time. This is a nice feeling, especially when you solve a problem. For me the biggest joy of doing maths is solving problems. It is sometimes hard when your attempts fail and you have to give it another try. Mathematicians are sensitive to nature with all its perfection. Just as artists see and experience details that others might not see, mathematicians feel emotions from details invisible to others. Mathematicians, and particularly female mathematicians, see and feel in a more intense way than other people, which can be both nice and unpleasant. For example, the colour of a child's eyes, the lines on her hands, or her

cowlick, might trigger intense positive emotions and feeling of full consciousness. Mathematicians can focus their attention so much that they forget the real world, and they probably deserve their reputation of being forgetful and not down-to-earth. They can spend a long time on a problem without solving it and have the problem on their mind all day and maybe all night. This can be a way to escape from problems of ordinary life, from poverty, sadness, illness.

Let me now tell you about the tough experience I went through as a PhD student. In 1992 I started a Master's thesis on Database at the department of mathematics and computer science in Belgrade, which meant traveling from Podgorica to Belgrade every other month. After I completed it in 1995, I spent two years from 1996 to 1998 at Lomonosov Moscow State University to do a PhD in the mathematical theory of intelligent systems under the supervision of Valerii Borisovich Kudryavtsev. I learned Russian there as part of the agreement for the grant I had obtained from our ministry of science and education. Living in Moscow was tough. Because of the cold, I couldn't spend time outside as I like to do. Also, interactions between people were very different from what I knew, they were rather distant,

and I wasn't used to that. At university, things were not easy either. The way seminars were run was tough, in a different tradition to what I was used to. The speaker would receive very tough criticism and ironic comments. I never got used to these rough manners and in hindsight I see that I was the only female student at those seminars. Near the end of my stay in Moscow, I thought I had solved the problem I had been given by my adviser. But I woke up one morning of May 1998, suddenly realizing there was a mistake in one of my proofs. It took me another six months to work out, and then prove, that the conjecture was in fact false. In June that same year, I returned from Moscow to the University of Montenegro and completed my PhD in 2000 at Belgrade University.

What would you recommend a young woman in your country wanting to start a career in mathematics?

As head of the school, students often come to me for advice. There are seven women and one man in our fourth year. Usually, they go for teaching jobs at elementary and secondary schools. Yet the monthly salary is low, around 500 Euros, there is no privilege, no accommodation that comes with the job as is the case for university professors, nothing.



I tell them that they have other possibilities, that they can work in banks or find many other jobs involving maths. I try to build their ambition, making them feel special by telling them that only 2% of the world population can obtain a job involving maths. In my country Montenegro, I am not sure whether it is a good thing to work in pure mathematics. If they do opt for that path, I suggest that they go abroad and apply for a grant.

Could you describe your favourite personal achievement(s) in

your career as a mathematician?

I am satisfied because I am healthy. Nowadays, mathematicians are subject to a lot of pressure, they have limited time, whereas time is essential for mathematics. So mathematicians are under constant stress, and in spite of that I manage to remain healthy, which I am proud of. I live in a small country where we don't have the propitious environment for work that other universities around the world can offer. This is another source of

pressure. We are inevitably very isolated as scientists, a difficulty that we face on a daily basis. It has at times been difficult for me to find problems to work on. Interactions with scientists abroad help. These can result from setting up projects, which requires a lot of work. I am very proud of having developed international projects. Also, as well as being satisfied with the result I proved during my PhD, after much effort and stress as I already mentioned, I am very happy with the choice I made some eleven years ago



to work at private university. I received my first position at the University of Montenegro as an assistant professor in 2000, and later became associate professor in 2005 at that same university. I didn't want to

become a full professor due to the unpleasant atmosphere in the mathematics department at the time, so in 2008 I decided to accept a position as a full professor at a private university in Podgorica, of the University

of Donja Gorica, which had just been established. This was a risky step since I was giving up the secure salary I had been receiving from the state university. Yet I think it was a good decision as we then created a Faculty of Applied Science, which has become the Department of Mathematics. I am head of this department which is now four years old and comprises myself as the only full professor and six professors, two men and four women. We have an accreditation for 4 years and plan to start a Master's programme (so 4+1) next year. I feel freer here than I did at the University of Montenegro, since I have the freedom to suggest pure maths subjects as well as other subjects connected to maths, such as mathematical modelling, financial mathematics, innovative modelling, programming, bioinformatics and physics. In the current fourth year, we have some 60 students including the twenty odd students who started this year. I also have some freedom in the management of the department and run various national and international projects. In the past seven years I have been able to set up four bilateral projects (with Slovenia and Serbia and two with China), one innovative project, one national project (MC in tree COST actions) and I have also been a member of a pilot Horizon 2020 project.

Could you describe your field of research to a non-expert?

In the past ten years my field of interest in science is connected with automata, which can be seen as another approach to making simulations of agent-based dynamical systems stemming from nature or science – extraordinary systems that you can find in nature such as ant or bee populations. They do not have a central unit of

management yet their species has existed for a long time and they achieve a lot. In complex system theory we call this self-organization emergent behavior. There is no generic methodology for creating such complex systems. With cellular automata, we can simulate these types of large scale systems with no central control unit, using only local knowledge. This approach doesn't use traditional techniques, but

rather involves new ways of thinking. In general, in order to describe and solve a problem, I usually implement graph theory or combinatorial techniques. Instead, to handle such complex systems in many cases "ad hoc" ideas are needed.

