



গণপ্রজাতন্ত্রী বাংলাদেশ

I graduated in 2019 from Munkkiniemi high school. Mathematics was a subject I had naturally thrived in – so, after some bumps and turns, I found myself in the University of Helsinki studying mathematics. And yeah, indeed, I love mathematics – I love the apparent universality of it. This subject is without a doubt debatable, but, at least in some sense, I like to think that mathematical truths are universal in the truest sense of the word; they are eternal, they are the same everywhere, regardless of the physical universe we live in. Alien in another galaxy will end up in the same mathematical truths we do. Alien in another universe will end up in the same mathematical truths we do. Mathematics has the power to explain what we see in our everyday life. Mathematics is not only natural science but a form of art and poetry. Mathematics is music – music is mathematics.

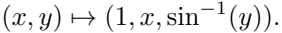
While studying mathematics, physics and computer science, I took some courses on economics. That inspired me to write my Bachelors thesis on optimal control theory. I worked on the problem of how increasing public investments affect the GDP. I did not find any breakthrough, but it was an intriguing subject.

I proceeded with my graduate studies studying applied mathematics. I studied subjects like partial differential equations, functional analysis and dynamical systems. I also studied – the University of Helsinki's proudness – complex analysis. (My thesis advisor said that, in a moral sense, you cannot graduate from the University of Helsinki without taking some courses on Complex analysis, because a lot of the discipline has been developed in the university.) Inverse problems was one of the more practical oriented subjects I took courses in. During my graduate studies, I spent half a year in Utrecht, Netherlands, studying more applied analysis of varying subjects (searching periodic orbits in the Lorentz equations as an example of a course – that I failed). At Utrecht University, I got the inspiration for a subject for my future master's thesis; the Finite Element Method. After I got back to Helsinki from the exchange, I had a chance to study more about the finite element method in Aalto University's courses. (Aalto University is a consortium of the Helsinki University of Technology, the Helsinki School of Economics and the University of Art and Design Helsinki.) While writing my thesis I also taught basic mathematics courses at the University of Helsinki and gained valuable experience in the pedagogical area.

In the binge of graduation, I started to look for future opportunities. I looked for coding jobs in Helsinki and Tallinn, jobs for mathematicians in the mapping industry, continuing at some university to pursue a PhD etc. I ended up in the last one as doors opened for me into Aalto University's Department of Signal Processing and Acoustics to research low earth orbit satellite communications. My professional ambitions are in improving the lives of people globally. Communications play an essential in the picture. (But contain some challenging problems also, as we have seen with the social media.) Through effective communication, we can share knowledge, control resources, discuss issues etc. – however, globally, the communication infrastructure is still not nearly complete. My interests contain, but are not limited to, communications, particularly wireless networks and signal processing. My dream is to share my knowledge in the process towards a free and honest world. (Pardon me for the cliches.)













$$1 = e^{-\frac{\pi^2}{2\sqrt{P}}}$$





$$] = 1 - \left( 1 - e^{-\frac{\pi^2}{2\sqrt{P/N}}} \right)^N,$$



1000



1992



$$2 \sqrt{r_1 r_2} \frac{1}{\sqrt{2\pi}} e^{-y^2/2} dy.$$



$$= \mathbb{E} \exp \left[ - \sum_i f(|Y_i|) \right] = \mathbb{E} \prod_i \exp \left[ - f(|Y_i|) \right]$$

$$= \mathbb{E}_n \left[ (2\pi)^{-n/2} \int_0^\infty \cdots \int_0^\infty \prod_{i=0}^n \exp[-f(y_i)] \frac{2}{\sqrt{2\pi}} e^{-y_i^2} dy_1 \cdots dy_n \right]$$

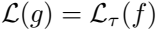
$$= \mathbb{E}_n \left[ (2\pi)^{-n/2} \left( \int_0^\infty 2 \exp[-f(y) - y^2] dy \right)^n \right]$$

$$= \mathbb{E}_n \exp \left[ \sum_{i=0}^n \log \left( \int_0^\infty \exp[-f(y)] \frac{2e^{-y^2}}{\sqrt{2\pi}} dy \right) \right]$$



$$g = -\log\left(\int_0^\infty \exp[-f(v)] \frac{e^{-v^2}}{\sqrt{2\pi}} dv\right)$$





$$= \exp \left[ - \int_{\mathbb{R}^2} 1 - e^{\log \left( \int_0^\infty \exp[-f(y)] \frac{2e^{-y^2}}{\sqrt{2\pi}} dy \right)} \Lambda(dx) \right]$$

$$= \exp \left[ - \int_{\mathbb{R}^2} \left( 1 - \int_0^\infty \exp[-f(y)] \frac{2e^{-y^2}}{\sqrt{2\pi}} dy \right) \Lambda(dx) \right]$$

$$= \exp \left[ - \int_{\mathbb{R}^2} \int_0^\infty (1 - \exp[-f(y)]) \frac{2e^{-y^2}}{\sqrt{2\pi}} dy \Lambda(dx) \right]$$

$$= \exp \left[ - \int_0^{\infty} (1 - \exp[-f(y)]) \sqrt{\frac{2}{\pi}} e^{-y^2} N dy \right], \quad (1)$$

$$\sqrt{\frac{2}{\pi}} e^{-x^2} \mathcal{N}.$$







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$$t \rightarrow \text{order} \rightarrow \frac{\sin(2\pi B t)}{\pi t},$$





$$\mathbb{Z} \ni i \mapsto \frac{\sin\left(2\pi \frac{B_L}{f_c} i\right)}{\pi i},$$



$$i \mapsto \delta[i] - \frac{\sin(2\pi \frac{B_H}{f_c} i)}{\pi i},$$





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