# Júlia Kossmann, Professional Problem Solver

Legal name: Júlia Guazzelli Monteiro. Kossmann is my marital surname.

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| Nationality | Brazilian & Italian |
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## PROFESSIONAL EXPERIENCE

**Reverse Engineering & Security Project (Freelance Job)**
**Brazil/Remote**
*December 2021–Feb.2022*

- Integrated a team of 3 in a complex project, proposed by a British businessman, dedicated to extract and modify the source code of a closed software.
- Managed to advance the project by decrypting and extracting resources from the binary code.
- Developed an application that was able to automate the process of modifying the files and resources with efficiency.

**One-time pad (OTP) Encryption project**

- Used Claude Shannon's definition of Secrecy to measure the security of a cipher to disable hackers from, hence, decipher the plaintext.
- Applied $[\forall p, c : P[E(k,p) = c] = \frac{\#of\ keys\ in\ \mathcal{K}\ s.t.\ E(k,p)=c}{|\mathcal{K}|}]$ to match the probability of two plaintext being encrypted, implying that there can be *no* discernible patterns in the encryption process, making difficult hacker's process of decrypting.

**Image Compression using Fast Fourier Transform (FFT) project**

- Used the FFT2 built into NumPy (Python lib) averaging the colours channels to work on a grayscale array to reach better performance+simplicity.
- Applied the FFT algorithm, managing to reduce the complexity of computing the DiscreteFT (def. $X_k = \sum_{n=0}^{N-1} x_n e^{-i2\pi kn/N}\ k = 0, \dots, N-1$) from $O(N^2)$ to $O(NlogN)$, $N$ being the data size.
- Such that, achieved a high efficiency by keeping the largest 10% of Fourier coeff. turning into a vector and sorting all values, thresholding the image and obtaining a perfect compressed one.

**Malware Analysis Project**

- Runned REMnux as a docker image, executed $1 \leq n \leq 10, s.t.\ n \in \mathbb{N} \setminus \{0\}$, static analysis in a traditional pdf-based file corrupted by a malware, aiming at vulnerabilities.
- Found the document was opening the powershell and passing encoded texts.
- Analysed encoded text by decrypting it and checking for suspicious infos, hence, came up with a mitigation against the malicious software.

### SOFT SKILLS

- Autodidact
- Ambitious
- Fast Learner
- Stress Resistant
- Good Teamwork
- Leadership Skills

### COMPUTING EXPERIENCE

**Programming**: C/C++, Python, Julia, SQL.
**Tools**: SAGE, OpenCV, Jupyter Notebook, LINUX, Gnuplot, Pandas, Numpy, Scikit-learn, LaTeX, various mathematical packages. Usage of interval arithmetic and validated numerics.
**Additional basic knowledge**: HTML, CSS, JavaScript, R, MATLAB.

**Main Operating System**: BlackArch Security.

## EDUCATION

**Independent University of Moscow, IUM**
2022 — Master of Science in Mathematics
Invited to join a special program after achieving medals in Mathematical Olympiads.
*Key courses for cybersec/cryptography*: Number theory, Algebra and Combinatorics.

**Federal University of Minas Gerais, UFMG**
2022 — Bachelor of Science in Computational Mathematics
*Emphasis in Computer Science and in Mathematics*

**Federal University of Santa Catarina, UFSC**
2021 —2022 Bachelor of Science in Computer Engineering
*Interrupted.*

### RESEARCH SUBJECTS

Analytic number theory, asymptotic group theory, position-based quantum cryptography/applied number theory, formal logic and semantics of programming languages, homotopy type theory, Kolmogorov complexity, relative computability and the turing degrees, probabilistic number theory.

**CONTACT ME:**

## HOBBIES

**Hobbyist Competitive Programmer**

- Won a university's competition in which a deadline of 30 days was given, achieving the success of solving all the programming problems in a few hours.
- Self-studied competitive programming and a lot of algorithms in C++ programming language, getting solo into the semi-finals of the ICPC female league (a big programming competition in teams).
- Improved constantly the abilities in solving complex programming problems for companies' better efficiency.

## LANGUAGES

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| Portuguese C2 | Turun murre A2 |
| English C1 | Ukrainian A2 |
| Russian C1 | Chinese A2 |
| French B1 | German A2 |
| Finnish B1 | Italian A1 |
| Spanish B1 | |

## ALL COURSES

- Cryptography I, **Stanford** University
- Master's Course in Fundamentals and Trends in Vision and Image Processing: The Two Sides of Neural Networks, National Institute for Pure and Applied Mathematics, **IMPA**
- Introduction to Quantum Computing, National Institute for Pure and Applied Mathematics, **IMPA**
- Master's Course in Complex Analysis, National Institute for Pure and Applied Mathematics, **IMPA**
- Mathematical and Computational Modelling, National Laboratory of Scientific Computing, **LNCC**
- High Performance Computing and Fundamentals of Quantum Computing, National Laboratory of Scientific Computing, **LNCC**
- Mathematical Modelling of Tumor Growth, National Laboratory of Scientific Computing, **LNCC**
- Combinatorics and Algorithms Design, **Tsinghua** University

## PRIZES AND RECOGNITION

2022 Semi-Finalist, International Collegiate Programming Contest (ICPC) Fem. League
2020 Honorable Mention at the International Astronomy and Astrophysics Competition, IAAC
2020 Honorable Mention at the International Youth Math Challenge, IYMC
2020 Bronze Medal at the International Mathematics Olympiad Without Borders, OIMSF
2020 13º International STEM Olympiad
2020 Honorable Mention (First Place in the country) International "Purple Comet!" Mathematical Olympiad
2020 Gold Medal at the Brazilian Mathematical Olympiad, OBM
2020 Gold Medal at the Brazilian Astronomy and Astronautics Olympiad, OBA
2020 Silver Medal at the Itabiranian Mathematical Olympiad, OIM
2020 Silver Medal at the Brazilian Applied Mathematics Olympiad, OBMACS
2019 Bronze Medal at the National Mathematical Olympiad, OLIMPIMAT
2020 Honorable Mention at the Brazilian Financial Mathematics Olympiad, OBMF
2020 Honorable Mention at the Brazilian Neuroscience Olympiad, OBN

## BOOKS

### First Book
- "O Destino de Koda" & "O Destino de Koda II" (The Fate of Koda) - A book collection with Astronomic science fiction as the subject. Júlia's passion for physics, literature, and reading had awakened an interest in writing, which took place quite early, at the age of 8. At the time, while attending the local library to study physics concepts in the spare time, gradually ended up completing the first book with more than 700 pages, using much of what had learned as inspiration and analogous reference.

### Second Book
- "Morte ao Olhar" (Death Gaze) - A psychological thriller that incorporates biblical and dystopian elements. With a sophisticated writing style, the book had several biblical references embraced in a gloomy yet peaceful setting. "Morte ao Olhar" was written at the age of 9.

## VOLUNTEER EXPERIENCE

### MATHEMAGIC4U (2021/22)
- The MATHEMAGIC4U project consists of free tutoring for everyone interested who want to learn mathematics in depth and with guidance, but who cannot afford a private tutor.

### ARAÇA Project (2020)
- During the period of a year, worked as an assistant in a project dedicated to helping children in poor regions of Brazil to have contact with art, cinema, culture and music. The share of experiences and knowledge was touching and inspiring. Of those children, many did not have activities to do after school and some of them didn't even have food security at home. The project, with the help from the government of the state of Espírito Santo, provided food and also the cultural and inspiring side of arts, music and dance to all children.

### VIPA (2018)
- During the year of 2018, took part in volunteer activities whit an NGO (VIPA) responsible for rescuing stray animals. In VIPA took care mostly of cats, feeding them, cleaning their habitat and helping in the adoption process.