**MathILy**

1. **Math courses taken recently.**

Algebra: polynomials, sequence and series, exponents and logarithms, permutations and combinations, complex numbers, equations and inequalities, and etc.

Geometry: plane, solid and analytic geometry

Number Theory

Circular Functions and Trigonometry

Vectors

Conic Sections

Statistics and Probability

1. **List (perhaps of length 0) of previous mathematics or science summer programs you’ve attended.**

I’ve never attended any mathematics or science summer program before.

1. **Academic achievements you feel like sharing:**

* Have just finished the AMC 12 in February 2019, the score to be released;
* 2018, First Prize (China), Math League, qualified for US Final (at Stanford) and its Math Camp (co-held by the Departments of Mathematics of Princeton University, Columbia University and Williams College);
* 2017, Second Price, Jiangsu Junior High School Mathematics Competition;
* 2017, Second Place (Global Final), The Berkeley Mini Math Tournament (BmMT);
* 2017, First Price, Suzhou Middle School Applied Physics Knowledge Contest;
* 2017, First Prize(Jiangsu), 15th “China Daily” National Middle School English Speech Contest;
* 2017, Final, “FLTRP Cup” National Middle School English Debate Competition

\* FLTRP: Foreign Language Teaching and Research Press Cup

1. **Extracurricular activities you like (both mathematical and non-mathematical; and, okay, you can include activities you don’t like if you think that would be interesting).**

Mathematical activities.

Spider Solitaire was my favorite childhood game, and Sudoku books occupied my book shelves, they were my major source of entertainment. I also had tremendous fun learning abacus from my mother, a math teacher, and beating her in 24 Game. Klotski number game, a Chinese classic, is my all-time favorite. It has a n^n matrix with one space left blank. The position of numbers is disorganized and the player needs to recover it.

After three days of my initial contact with this game, my record improved from over one minute to 26 seconds. Constantly endeavoring for a higher record, I came across one puzzle particularly hard, where only two numbers were displaced and I only needed to switch the positions of 14 and 15. An arduous half-hour attempt resulted in zero progress, which pushed me to take a step back and think hard about the problem.

I came up with a new idea: first complete the outmost orders to make it become a 3\*3 matrix, then continue to make it become 2\*2. I tried this method on that unsolved puzzle, but still, the outcome was frustrating. I got a 3\*3 matrix where there is no solution, and it was proved by showing the number of inversions in the sequence was odd, and the Klotski was thus unsolvable. *What if mine has no solution neither? But how can I prove that with n=4?*

By investigating in the concept of inversion, I found that it the case of n=4, there are two possibilities: if the empty space is in an even line, then it’s solvable if the number of inversions is even, and if the empty space is in an odd line, then it is solvable if the number of inversions is odd. The concept of Inversion in a sequence: the parity of the number of inversions determines whether a Klotski puzzle is solvable.

My addiction to Klotski may contribute to the easy-to-follow rule of the game, but the most important reason is that I enjoyed the process of pushing my limits, and that by employing mathematical methods, I could surpass myself.

Activity important to me.

1. U-CODE Movement (girls’ coding), Principal Member

* Self-study and peer-tutor Python; develop small CS projects with mastery of basic coding skills;
* Promote the education of girls’ coding with bilingual teaching, and empower girls from local secondary schools with coding skills to explore boundless potential in STEM;
* Develop women confidence, and break the stereotype and limitation of gender.

One year ago, I attended a NASA program to get a taste of the most advanced aeronautics technology in the world and to challenge myself with the hands-on programs. However, in my section, only six out of thirty participants were females while the male students constantly emphasized that they were “ready to help.” Even my teacher discouraged me from majoring in the CS program saying that “it’d be hard for the girls.” Moreover, male students outnumber their counterparts in every single STEM class I’ve taken. It’s hard to find support around me. Occasionally, I just can’t help but feel out of place.

However, none of this has stopped my desire to excel. Since my high school curriculum didn’t offer Computer Science, I signed up for an outside after-school class and self-studied Python.

Thinking of how many female students might share my experience, I decided to take another step further - assembling a team called U-CODE within school, ready to break down some stereotypes. “Everyone should learn to program a computer, because it teaches you how to think.” Steve Jobs’ words resonated with me. We then approached different organizations for sponsorship. After a month’s effort, a Shanghai-based company responded and generously sent us a teacher, with whom we studied two hours per week for free. After a semester of preparation, we started to provide coding courses to girls in local primary and middle schools with a bilingual instruction, aiming to stimulate young female students’ interest in STEM and enabling them to access educational resources outside of the Great Firewall.

Our first class project that I led was indeed about “penetrating the wall” - a collective effort.

Day 1: Requirement identification and framework set up.

Day 4: Visual Studio installed.

Day 18: Database migration completed.

Day 60: Data security with encapsulated security payload(ESP) done!

…

Upon the project’s completion, we spent three days debating. Finally, we got its name: Papercraft. It would carry our hope like an aircraft, free and ambitious, into the distant sky.

Our influence has grown steadily ever since then, now 20 volunteers on board and over 100 students.

Other activities.

1. Zhi Xing (UWC-CSC Signature Project): Volunteer Teaching in Henan (China), 2018; Team Leader

* Instructed a group of leftover children (6-to-8 graders) in Ruyan Hope School the subject of geography by inspiring them to map the outside world with imagination;
* Observed and logged the psychological development of pupils whose growth lacks parental companionship for their laboring in remote cities all year around.

1. National Final, China Thinks Big, 2019; Captain

* Assembled a team of members from different cities across China, and coordinated on-and-offline meetings to prepare for a research project;
* Studied the development of juvenile psychology in their growth, and proposed solution to improve the introverted mentality by applying Moritatherapy.

1. Third Prize (Chendu Division), Columbia University Social Science Research Training Workshop, 2019, Team Leader

* Interviewed 50 groups of students, conducted literature review of behavioral psychology, analyzed data for social media and advertising, produced an English paper: *How does targeted advertising on social media impact the behaviors of adolescent?*
* Honed research skills by attending intensive-reading lectures; studied topics of social justice, gender equality, and juvenile development; mastered new tools to analyze our contemporary social problems.

1. Kayaking, UWC-CSC Gym Session, three hours once a week.
2. **Write a couple of paragraphs that tell us why you want to participate in MathILy and how you expect to benefit. What is exciting about spending weeks doing lots and lots of mathematics? What resources do you lack, particularly in the educational or social realms, that we can provide?**

“All is number,” says Pythagoras.

Yes, life is like a mathematical function, simple at first glance but full of possibilities in hindsight. Since childhood, I have loved solving math problems, a hobby I obtained from playing math-related games. Over time, mathematical thinking has become an indispensable part of who I am.

Simply consider the function: y = a^x.

Assume “a” is greater than 1.

The graph will always pass the point (0,1).

This precision, a sense that outcomes are predetermined, may have a drag on people, making them content; they give up on looking for new a different possibility because they think they know the outcome.

This succinct, elegant mathematical function has inspired me to understand myself and the world.

1. “a” is who I was.

“a” is a constant. It’s the unwavering part of my identity.

I was brought up in a relatively less-developed town in the outskirt of Suzhou. Growing up here, I once assumed the rest of the world goes with the same slow pace. I’d left for a few months. As I returned home after seeing a bigger world, I viewed everything with a fresh perspective, recognizing patterns and nuance like I’d never before.

2. “x” is what I see, do, and feel …

In my world, “x” is a variable, always larger than 1.

I traveled a lot. For ten years my parents cut our daily expenses to give me tours around the world. Speaking little English, riding a motorcycle, sleeping in tents, I traveled through New Zealand, Iceland, Sri Lanka, Kenya and numerous wonderlands.

United World College has captivated me as much as the novelties on my journeys. In UWC, I met people from all over the world, some I’ve been to, some I’ve never heard of.

I learned from my Afghan roommate how their country is suffering from upheavals; how she’d watched her friends dying, and how fortunate she feels about being able to study here. I also learned about different religions. I greeted all the vegetarians around me. I joined forces with the LGBTQ movement.

As a proud UWCer, I’m pursuing my values, never afraid of the unknown.

3. “y” is who I will become.

Now I’ve seen parts of the world and known better whom I am as a person.

Mathematics is such a beautiful language that helps me to interpret myself and the surrounding world: Feeling hot can be expressed by regression (in sports), Bayes’ formula can be used for testing cancer treatment’s effectiveness (in medicine), wise decisions can be made based on the expectation (in lottery), and numbers can show the faults of an electoral system (in politics). If I want to figure out what Quantum mechanics is, the easiest way for me is to draw inspirations from uncertainty, wave function collapse, Schrodinger equation, and Quantum Bayesian model.

In this spirit, I conducted a project with statistics and probabilities to investigate the efficiency of different studying approaches. Subsequently, I applied my research results to help students in a local elementary school to improve their processes. In the future, I aspire to use mathematics to study different democratic systems, to enhance the fair distribution of educational resources, and to eliminate gender discrimination. In this respect, MathILyis such a good opportunity that will guide me to explore more beauties of mathematics - both theoretical mathematics and its applied tracks.

Besides, through attending math lectures and intensive training sessions, I will actively challenge myself with advanced topics and enhance my problem-solving skills. Given the opportunities to choose my own courses and attend workshops, I will be able to more profoundly explore the fields of my interest. By conversing with math lovers from all over the world, I can benefit from an atmosphere of creativity and exploration.

“Life is mathematics,” I’ll say at MathILy.

1. **Anything else you want us to know?**

I watched a herd of yaks returning home at sunset in Yellow Stone National Park; I hiked 15 hours to top Mount Huangshan in Anhui; I climbed an Iceland glacier laying my bare hands on the permafrost of a thousand-year history; I joined the monkeys for hot spring in a village deep into the mountains of Shirakawago; I kept vigil on a nameless lake in Norway for the splendid aurora; I suffered from seasickness in a fisher boat in Sri Lanka to study whales; Tents, woods, ice caves. Wind, snow and rain. But I wanted to test how far courage can take me.

Intimacy with the nature happens in many ways. When I don’t travel, I farm, the cropland full of yellow rape flowers in spring, the green watermelon resting under its vine in summer, the golden wheat bundled near the field in fall, and the grandma’s garden filled with white radish in winter.

After spreading the seeds into the soil, I took good care of them and waited to see the colors covering the field - from the refreshing green cabbage with fiber good for digestion to the energetic red peppers full of capsaicin to promote metabolism. Harvesting those colors from the field, I started to imagine how they could be cooked, bring people happiness and health.

Putting on the gloves and stepping into the field, I’m brought back to the very moment that I first touched the soft, moist soil. Laboring on land connects us to the Great Nature. For nature is where we came from, I find it home to rest our bodies and minds. Taking time from our intense lives to observe a plant gradually growing tall from sprouts, I savor that inner peace and joy. Like our ancestors, on land, we grow, share and bond.