

Glassblowing

by Mark Lukin



Glass makes a perfect container for most chemical substances, so chemists use a lot of glassware, sometimes of very exotic shape. This is why most experienced chemists are also glassmakers. During this workshop we will learn some basic glassblowing techniques.

Friendship Bracelets

by Iana Podobedov



Come to this workshop to make friendship bracelets with and for your friends!

Bang! Nail guns.

by Alexander Brook



After discussing pneumatic tools in general, and familiarizing ourselves with a brad nailer, we will use it to shoot as many nails as we can.

Fun with Morse Code

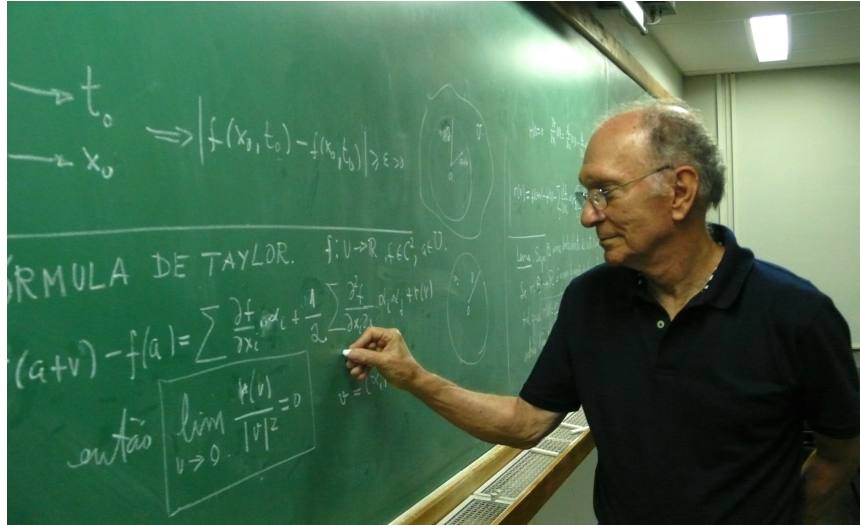
by Oded Regev



Would you be able to call for help on a sinking ship? Morse code might be slower than 4G, but it is sometimes the only option for truly long distance communication (e.g., when bouncing radio signals off the moon). We will practice sending and receiving Morse code, and tune in to some amateur radio communication.

A glimpse into the truth

by Arthur Rabello Oliveira



Why $3+5=8$? What is the set \mathbb{N} ? Why there are infinite prime numbers? These are some questions we solely believe to have a and indiscutable answer, but can we be sure of this? Can we prove it? In this workshop I will introduce the very foundations of mathematics through some techniques to prove sentences (or to prove they are wrong)

Harnessing the Cosmos

by Nano Gennari



We will explore the captivating world of megastructures, fantastical feats of engineering that stretch our imagination and challenge the boundaries of contemporary science and technology. Delving deep into the realms of Type II and Type III civilizations on the Kardashev Scale, we will discuss how these advanced societies might harness and dominate the cosmos using technologies such as Dyson Spheres, Dyson Swarms, Matrioshka Brains, Ring Worlds, Stellar Engines, and even galaxy-spanning megastructures. This session aims to blend science fiction with science fact, providing a comprehensive overview of how these megastructures could revolutionize the future in space exploration and energy management.

Juggling

by Adam Smith



Have you ever wanted to juggle watermelons in the supermarket, but felt awkward about spattering people with juice as you practice? This workshop is for you. We'll cover two basic skills: passing hand to hand, and three-ball juggling. If we get good enough, we'll try passing between jugglers. We'll have other objects to try juggling, like pins and scarves and flaming torches.* No tasty fruit will be harmed.**

Note: This workshop is aimed at beginners. Experienced jugglers are welcome but may be pressed into service as teaching assistants.

* We won't actually have flaming torches.

** Unless you count lemons as tasty.

Hilbert's Infinite Hotel

by João Rafael



You are a manager in an infinite hotel. Somehow, your hotel is completely full, and you're on the edge of losing your job if you don't manage to allocate the new guests that are arriving soon. Let's dive into the concept of cardinality and explore one of the most fascinating and mind-bending fields of mathematics.

Genome Gems

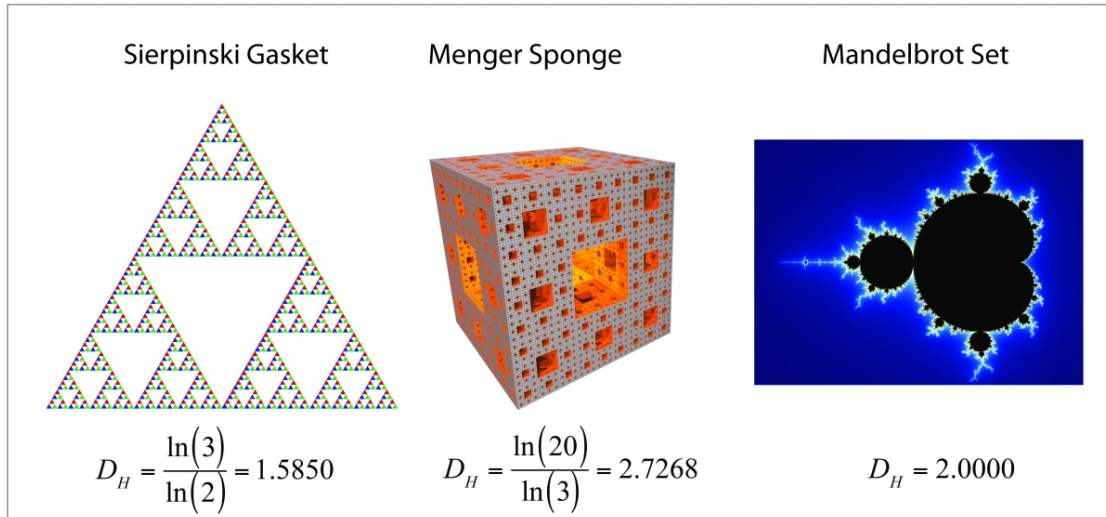
by Rebecca Balaban



Interested in combining your love of science and fashion style and don't know where to start? Come make DNA bracelets designed from your favorite sequences! Learn about the interactions between nucleotides while designing a bracelet that reminds you of your favorite gene.

Fractal Dimensions

by Matvey Borodin



”Of magnitude, that which is extended in one dimension is a line, that which is extended in two is a surface and that which is extended in three dimensions is a body. There is no other magnitude beyond these.” - Aristotle

Or rather there was no other magnitude beyond these until some analysts in the 19th century tried to classify the dimensionality of fractals. Fractals are geometric figures in which similar patterns appear at smaller and smaller scales, yielding objects with some bizarre mathematical properties. Imagine an object that lives in 2-D, has an infinitely long perimeter and has no area, or a line that fits in a circle of radius 1 but has infinite length...are these one dimensional or two dimensional? Or something in-between? The first good answer to this question came in the form of Hausdorff dimension, invented by (surprisingly enough) a mathematician named Felix Hausdorff. In this workshop we are going to draw and explore the essential properties of some famous fractals. We are then going to learn about Hausdorff dimension and calculate the dimensions of the fractals we drew; soon, you too could draw something that has dimension 0.63092975357...

Start in Blues Harmonica

by Alexander Galkin



How to play simple diatonic harmonica. How to make notes. First and second position. Bends and licks. Only 6 people.

Insects of SigmaCamp

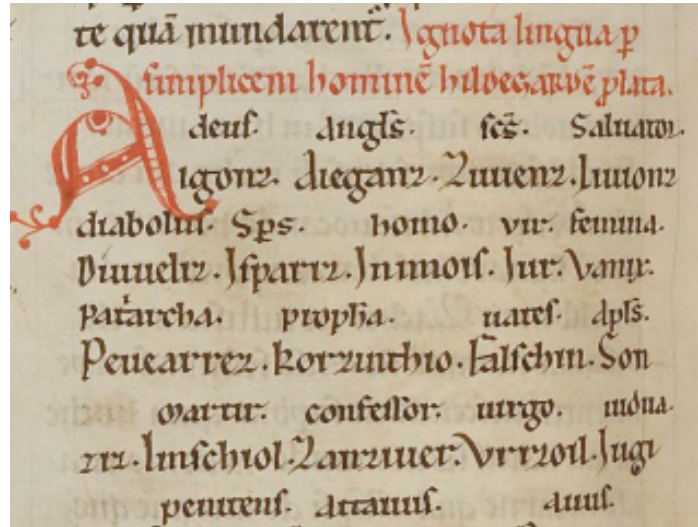
by Alexander Galkin



Did you know there are more insects in one square mile of rural earth than there are human beings on the whole planet? What insects can you find in SigmaCamp? Where are they hiding? Can we catch them? What are their names?

Creating Languages

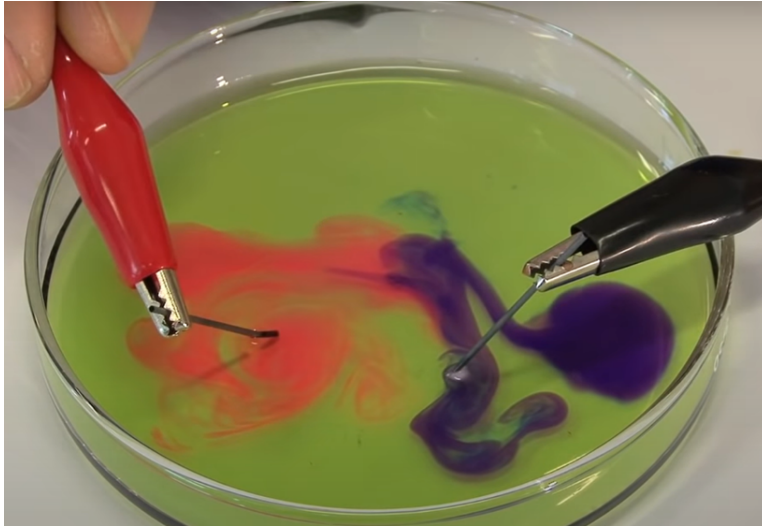
by Ashley Malkin



Book series such as Lord of the Rings are famous for their constructed languages (or conlangs) that build immersion into a new world. However, conlangs can also be a fun way to explore the principles of linguistics: the science of language. In this workshop, we will design the basics of our own language while learning about linguistic ideas like the International Phonetic Alphabet, language evolution, and how language sounds are produced.

Having fun with electrons

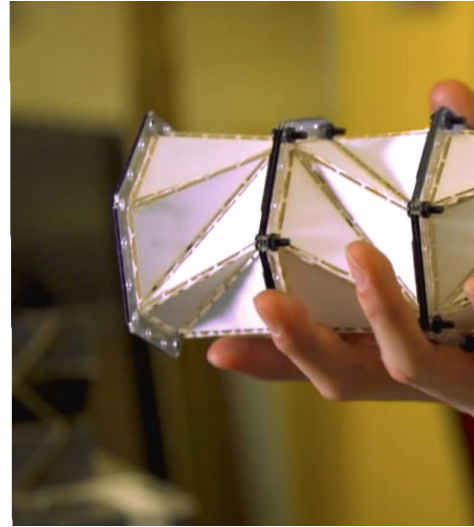
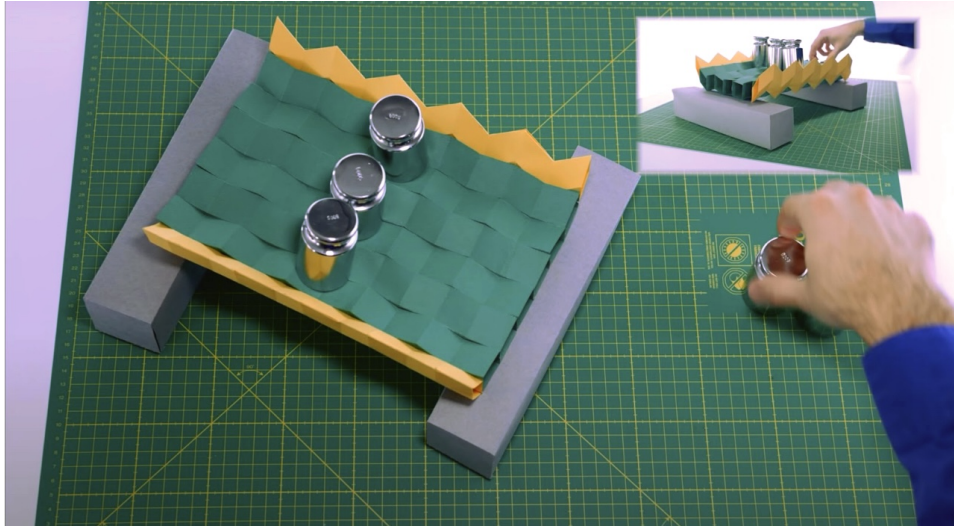
by Victor Paiva



Learn how we can use chemistry to power our electronic devices.

Origami Metamaterials

by Belén Franco de la Matta



To some, Japanese origami may seem like a beautiful art form or an amusing hobby, as paper is folded into intricate shapes and figures, like birds, flowers and dragons. But to scientists and engineers, the principles of origami have been applied to design problems, such as getting solar panels into space, making a foldable robot that can walk and even creating working optical microscopes. One of the most revolutionary properties of origami engineering is the ability to transform thin sheets of material into strong units, simply by folding it in a systematic way. This has exciting applications in the creation of metamaterials - artificially designed structures that exhibit properties and functionalities not found in nature. In this workshop, students will design their own origami metamaterials based on the Miura origami fold, which due to its unique pattern are capable of bearing significantly heavier loads than single sheets! Students will learn how the potential of this engineering technique expands significantly when applying these concepts beyond paper, such as plastic, steel, and other engineering materials to create stiff, yet reconfigurable devices.

Darkness

by Deniz Erdag



How do you find something that you can't touch? We will have an interactive session to answer questions about dark matter research and how we look for different particles. Join us also for a competition on who will create the best particle.

Tic-tac-toe: you vs. AI

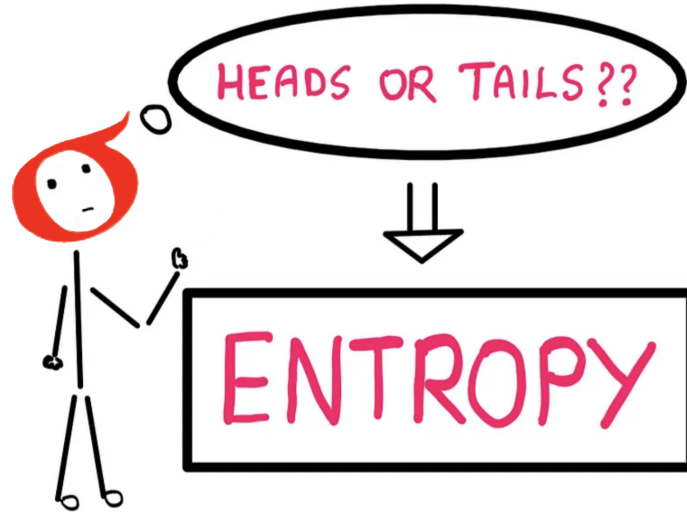
by Paulo Alves



A reinforcement learning algorithm can learn to play tic-tac-toe through trial and error in each game, adjusting its strategies based on the rewards received for successful moves. Can you beat an artificial intelligence at tic-tac-toe?

Derivation of Entropy

by Boris Barron

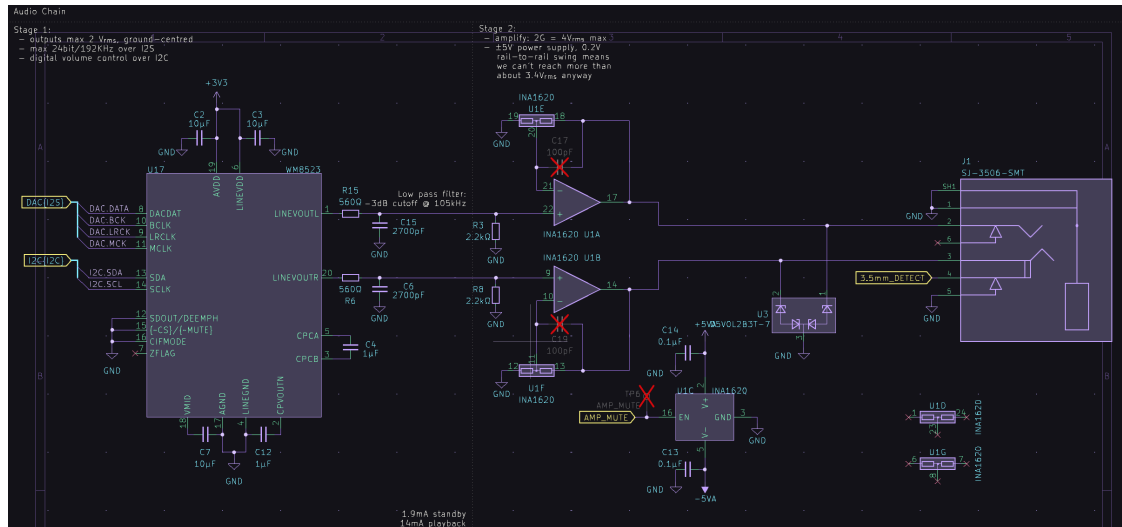


We often hear entropy described as randomness, disorder, and chaos; does anyone else find that confusing? At the level of advanced high-school level math, we will derive entropy from first principles following the path of Claude Shannon, the father of information theory.

Come and explore the concept that has been at the heart of my PhD and underpins approaches in machine learning, data compression, physics, and model construction in general.

Audio Electronics

by Alexey Tatarinov



What is sound and how can we put it inside of wires and computers? What's the difference between analog and digital audio, and is one better? How do we make sounds louder, or apply other effects to them? This workshop is about that.

Make Astronaut Ice Cream

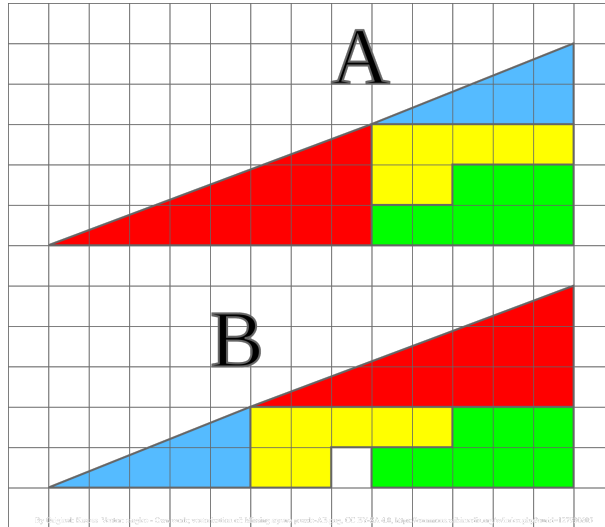
by Stasya Selizhuk



Ever wondered how and what astronauts eat in space? Come to this workshop to learn about food on the ISS and even make your own astronaut ice cream!

How to Lie with Proofs

by Sofya Raskhodnikova and Maya Smith



a.k.a

textitSophisms with Sofya (and Maya)

Did you know that pi is 4? Or that one and one make one? Don't believe us? We have proofs. Come try to find the errors in our arguments!

Virtual Reality 101

by Luigia and Pina Than



Join us to talk about what Virtual Reality (aka VR is), and what makes it cool and/or useful and/or fun! We will be discussing VR and also collaboratively building an immersive experience in VR that we will all try at the end of the workshop. No experience in VR or coding necessary!

Holographic chocolate

by Polina Zavyalova



Tbadded

Solar sunflowers

by Anna Rosner



Come solder together your own solar panel charger in the shape of a sunflower! We'll go over how to solder and how solar panels work!

Dividing Cake Fairly

by Andrey Boris Khesin



What does cake have to do with the number of 1's in the binary digits of a number? What can divorcees learn from pirate treasure? How can we divide something fairly? In this workshop, we will cover how to divide things fairly when not everyone values them the same way. We will talk about what it means for a division scheme to be fair and envy-free. We will try to come up with our own division schemes and explain how the Thue-Morse sequence ties into it all.

Learning about Learning

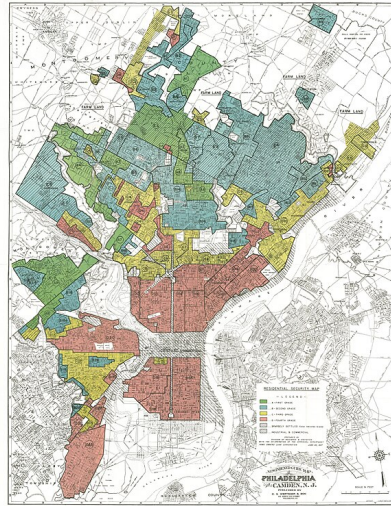
by Daniel Salkinder



You are here at Sigma to learn... but how does one do that? And what is this “learning” anyways? In this workshop, I will share what psychology has to say about learning and memory, test your memory in some experiments to back this up, and use this to give some practical tips on how to learn more effectively. So hopefully you will learn something!

Urban planning & policy

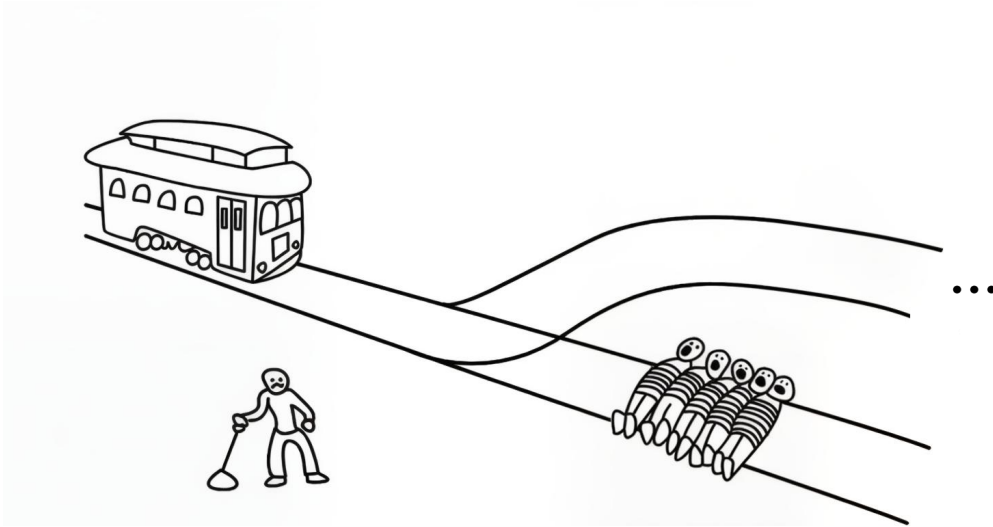
by Anna Rosner



What makes a good city? Walkability? Housing? Infrastructure? Come be the fictional mayors of a city, explore the issues that urban planners face, and learn why a map from the 1930s predicts life in cities today.

Beyond Trolley Problems

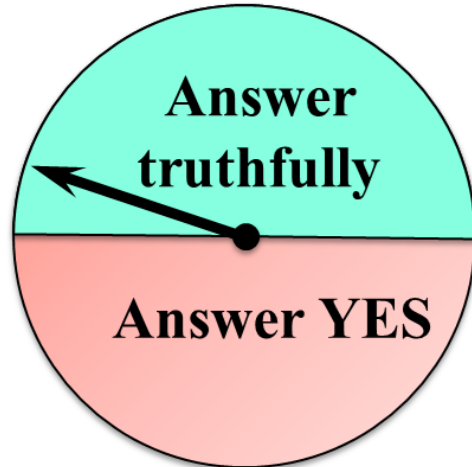
by Daniel Salkinder



Clearly, we would all save 5 lives over 1. Unfortunately, life is not often that clear cut. Come play through various ethical scenarios and discuss the thin line separating right from wrong.

Secret Surveys with Dice

by Sofya Raskhodnikova



Have you ever wondered what your fellow campers think about some sensitive topic? If you were to run a poll, they might lie or refuse to answer... Unless you can guarantee them privacy. At this workshop we will learn how to conduct secret surveys using randomness and even explain the math behind the method. If you wish, you can bring ideas of sensitive topics for our secret poll.

Build a music instrument!

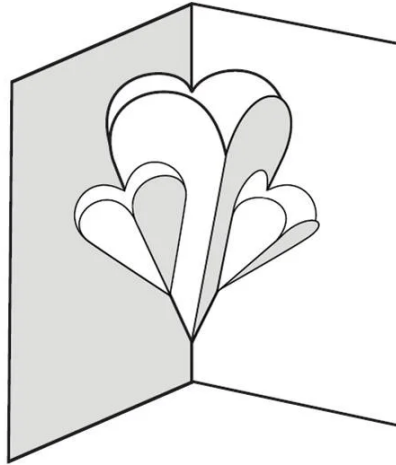
by Ethan Abelev



Music is magical, beautiful, and often inexplicable. We will combine theory and practice to create our very own panflutes out of household materials, and mathematically tune them to create clear, accurate, and “professional-sounding” instruments. In the process, we will explore the physics behind sound, how math makes harmonies in music, and the design principles behind various musical instruments. Finally, we’ll take some time to practice our homemade instruments and make some music!

Pop-up Cards

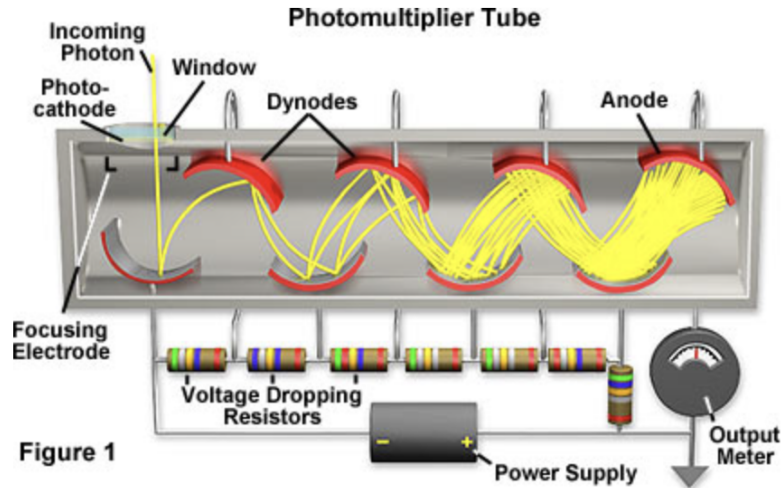
by Maya Smith and Anatoly Zavyalov



On a budget but want to make a personalized gift for your friends, family, or Sigma counselor? Fear not ... pop-up cards are here to save you. Combine your art, engineering, and scissor skills to make cards using a variety of techniques.

Counting single photons

by Daniil and Melissa



Einstein was the first to hypothesize that light consists not of continuous energy, but of indivisible packets of energy, i.e. quanta of energy, which later came to be known as photons. The experimental phenomena that led him to develop this theory is the photoelectric effect - the emission of electrons from a material when light impinges on it. The photoelectric effect can be used to directly observe single photons, which is what we will do in this workshop, using a ultra-sensitive detector called a photomultiplier tube.

Making Silver Mirrors

by Phoebe Hartch



Tollen's Test is used to distinguish aldehydes from ketones. If an aldehyde is present, a thin coating of silver forms on the inside of the test tube. Here, we will use this reaction to create a beautiful silver mirror inside glass bottles.

Taylor Swift & Bracelets

by Anat Dubinsky and Stasya Selizhuk



Come listen to Taylor Swift and make friendship bracelets!

Paper Lanterns

by Alina Aminova



The Schwarz lantern is named after German mathematician Hermann Schwarz. It can be folded from a flat piece of paper using the Yoshimura crease pattern - tessellation of the plane by triangles of the same shape. In this workshop, you will learn how to fold these paper lanterns with a nice geometrical surface design and flameless LED candles. You will also discover how they are connected with Renaissance paintings of the 15th-16th centuries, including the Mona Lisa.

Intro to Legal Reasoning

by Stephen Nye



How do you prove that something is illegal? How do you convince a judge, or a jury, that the law is one way and not another? What is the best way to defend a claim, and what kinds of evidence do courts care about? The law is a complex and fascinating world of logical reasoning, oratory, and problem-solving. In this workshop, we will learn about what lawyers, at the most basic level, do - make a legal claim and support it persuasively. Come to learn how to write a persuasive brief, how to structure a winning argument, and how to conduct research - see the sinews of the world economy from the ground floor.

Mind Over Machine

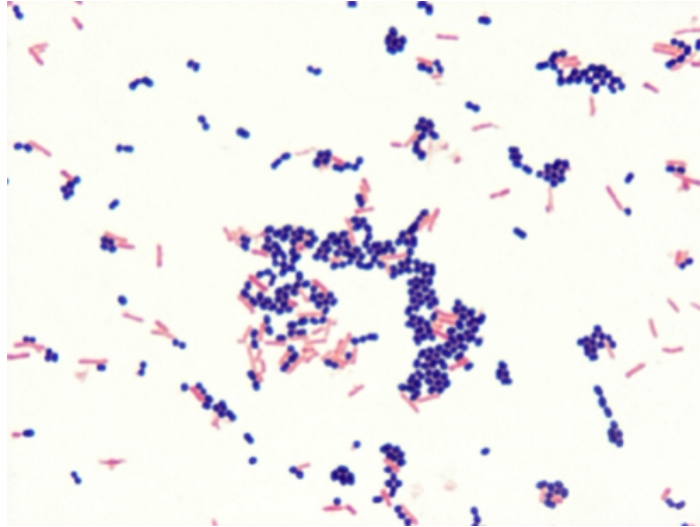
by Katya Donetski



Explore the world of DIY neuroscience! We'll record and manipulate live neurons, and discover how to control machines with only a couple tools: a brain and a microcontroller.

Intro to Gram Staining

by Natasha B



This workshop will guide you through the fascinating process of staining and identifying different types of bacteria under a microscope. You'll learn how scientists distinguish between Gram-positive and Gram-negative bacteria, gain insight into the importance of this technique in medical and environmental research, and get a chance to practice your laboratory skills and run your own investigation. Discover the invisible world around us and unlock the secrets of the microbes!

Engrave Your Own Print

by Iris Brook



Dive into the exciting world of linoleum printmaking in this hands-on workshop! Learn about the fascinating history of printmaking, from ancient methods to modern masterpieces, and discover how artists create stunning prints. Then, roll up your sleeves and get creative as you are guided through designing, carving, and printing your own unique artwork. Come create your own amazing print!

Chess Variants

by Anatoly Zavyalov



Bored of chess? Impossible. Even though there have been no updates for chess in hundreds of years, there are tons of variants of chess to spice up the 1,500-year-old game. Imagine chess where captured pieces cause explosions, or where you team up with your friend and use their captured pieces, or even teleport your pieces through interdimensional portals! Come and play a ton of chess variants!

Political science

by Luiz Viegas



Development of modern sciences, use of big environmental-impact policies, construction of machines for nuclear energy. So as science thrives, it needs responsibility for its debating. Let's gather in a simulation of the International Atomic Energy Agency and discuss how science can be fostered in a field living on a threshold between peace and war. Let's simulate being the world leaders in modern science!

We dissect animals.Join!

by Evgenii Boriushkin



In this workshop, we will dissect frogs, rats, pigs, and sharks. Each camper will gain hands-on experience exploring the anatomy and physiology of these vertebrates. We will discuss the similarities and differences between the animals and how their anatomical features make them well-suited for their specific habitats and ecological roles.

The Magic of Planarians

by Lena Yakubovskaya



Regeneration is one of biology's greatest mysteries. Planarians, remarkable flatworms, can regrow entire body parts, a feat that has fascinated scientists for centuries. How do they do it, and why can't humans? In this workshop, we will delve into planarian anatomy and explore the mechanisms that enable these fascinating creatures to replace missing organs and body regions. We will observe planarians under the microscope, experiment with their regenerative abilities, and to take home a new pet or two.

Cryptic Crossword Clues

by Ilana Walder-Biesanz



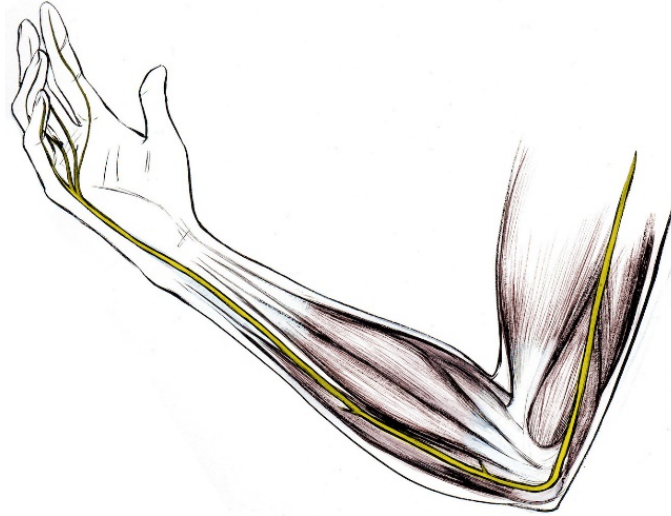
Undiluted part of chlorine atoms (4)

Confused? You've probably never seen a cryptic crossword! In these fiendish puzzles, every clue is a mini-puzzle of its own, incorporating not just a definition but clever wordplay. These cryptics (as they're known for short) can seem impenetrable at first, but they're addictingly fun once you understand how they work. (They also show up a lot in puzzle hunts, so this is useful knowledge!) We'll start the session with a brief lesson on the anatomy of a cryptic clue, then spend most of the time solving crosswords together.

Note: This session is intended for beginners. If you are already familiar with the cryptic crossword format, you may find it boring.

Human-to-human interface

by Anar Amgalan



We will see if you really control your muscles. Muscles, being millions of years old electrically-actuated biological devices, might be susceptible to outside tampering and even control if a concentrated electrical impulse is applied in just the right way. We will take turns trying to take over each others' muscles and measuring how many volts is necessary for such a control.

Balancing Act

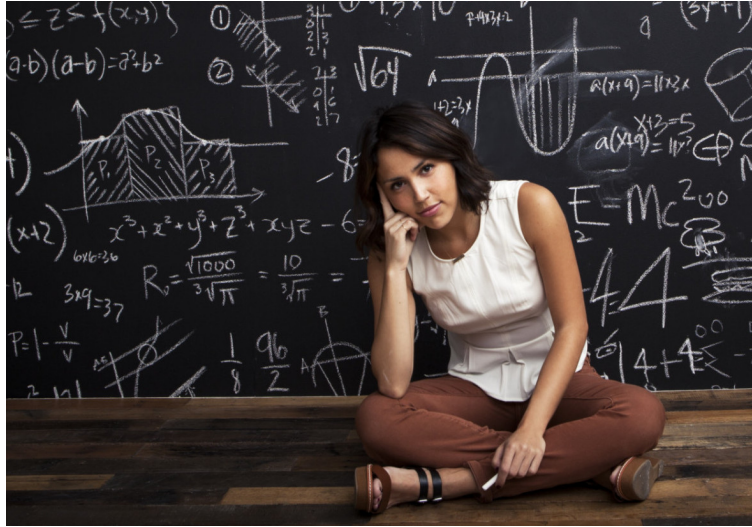
by Sofiya Filippova



Have you ever wondered how balancing eagles and other similar toys work? In this workshop, we will talk about the simple and genius design of balancing toys and create some of our own!

Want to be a professor?

by Olga Troyanskaya



We will have an informal, and hopefully informative, discussion of life as a STEM faculty member. What is it like to be a professor? What does it take to be successful? Why is it fun and why is it hard? Work/life balance and does it exist? And any other questions you might have! I'll draw on my experience as a Computer Science and Genomics professor at Princeton since 2003 and do my best to answer any questions and tell you the good, the bad, and the awesome about life in academia.

What I do at a Trading Firm

by Sophia Abanov



Since getting a math degree, I've been working at an Options Market-Making firm as a Trader. If you don't know what any of those words mean or if you do and want to learn more, come to my workshop! I'll teach you what options are, what it means to make a market, and how you do it. We'll play a game to put our knowledge into practice by making markets on random, fun things like the number of chickens in the US or the most expensive house sold in Miami in the last month.

Wizard Hats and Fireworks

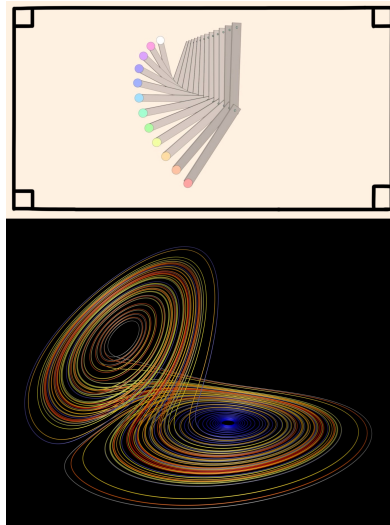
by Andrey Boris Khesin



Suppose some wizards are in a line wearing white or black hats. They can only see the hats in front of them and they must guess the colour of the hat on their head in any order. Only one wizard is allowed to guess their own hat incorrectly. At this workshop we will discuss and try many forms of the classic "wizards and hats" problems and their (literally) endless variations. We will talk about how this relates to the wonderful game of Hanabi, a cooperative game where you hold your cards towards your teammates and give them clues about what they hold. Time permitting, we'll cover why the wizards will need to invoke the axiom of choice to solve the harder hat-guessing problems.

Making a Chaotic Pendulum

by Santiago Franco de la Matta



Do you like to wreak havoc in your everyday life? Do you want to know how to make more chaos? It turns out that in everyday life, chaos is quite frequent. A common example of chaos is the weather! Don't you wonder why it is so hard to predict what the weather will be like in a month? That is because weather is chaotic! This means that weather is a system that depends very highly on its initial conditions. This means that if the weather was 1 degree hotter on one day, then in a year, the weather might be completely different than what it was supposed to be. In our workshop, we will learn more about chaos via constructing double pendulums! After we finish making them, we will test them out to see how they work!

Foam Flyer Fun

by Sasha



Airplanes are fascinating machines that work on intriguing principles and are generally very elegant. The best way to learn about them is through hands-on experience. If you enjoy hands-on learning, have an interest in airplanes, or both, this workshop is perfect for you. In this workshop, you will learn about airplanes and then build and fly your own model airplane

Rockets

by Nano Gennari



Discover the fascinating journey of rocket technology, from its origins in medieval China to the moon landing. Learn how ancient Chinese innovations laid the groundwork for centuries of advancement. Explore the contributions of the fathers of modern rocketry: Konstantin Tsiolkovsky, who theorized space travel; Hermann Oberth, who inspired modern astronautics; Robert Goddard, who built the first liquid-fueled rockets; Sergei Korolev, the chief architect of the Soviet space program; and Wernher von Braun, who developed the rockets that took us to the moon. Celebrate the technological breakthroughs and visionary pioneers that transformed rocketry into a vehicle capable of reaching the stars. Join us in exploring the remarkable milestones of rocket development and space exploration.

Planning a Planner

by *Luigia and Pina Than*



Bullet Journals are fun, useful, and aesthetically-pleasing ways to get organized! After its public debut in 2013, the bullet journal has exploded in popularity, meaning there's lots of different ways to style and format your bujo. We'll help you select a format and get you started on ways to keep track of school, work, and other goals while leaving ample time to decorate! Everyone will receive a journal, pen, and miniature ruler.

Bio Leather Wallet

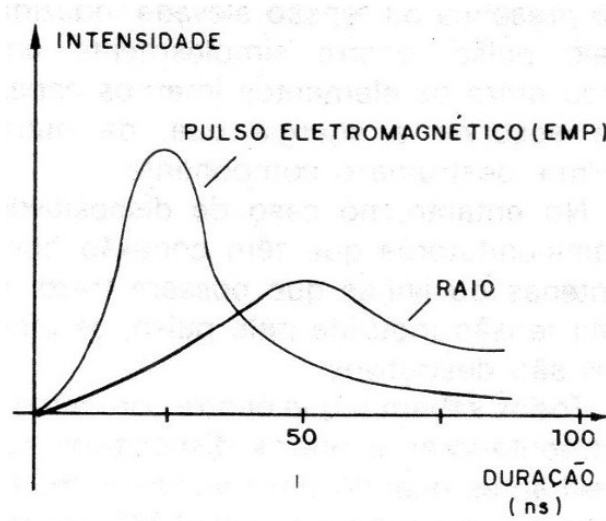
by Alex Suponya



Legend has it that if you make yourself a new wallet, you will soon make lots of money. Try your hands at an (admittedly non-vegan) leather substitute made from oranges and sEcREt ingredients. Get yourself some sustainable reduce-reuse-recycle drip and share a sip of homemade orange juice over some banter about biomaterials – which can be used for prosthetics, drug delivery, artificial implants and, apparently, fun.

How to Make an EMP

by Henrique Passoni



In this workshop, you will see a small EMP (Electromagnetic Pulse). Electromagnetic pulses (EMPs) are very fast discharges of high-spectrum energy that can disrupt the operation of electronic equipment (and in larger cases, can even damage electronic devices). Using simple materials like an electric mosquito swatter and a simple coil, we will be able to test and play a little with electromagnetic pulses, thus disabling some scientific badges.

Napalm Nail polish

by David Bershadsky



Do you like napalm? Do you like nail polish? Well they are both very easy to make and have basically the same recipe so lets make some.

Best ever cookies

by Eugene Pinkhassik



In this day and age, everyone should know how to bake something. In this workshop, we will learn the basics of a simple recipe that consistently produces delicious cookies. No prior baking experience is needed. This recipe can be used as a foundation for making classical favorites, such as chocolate chip or peanut butter cookies, or for designing a unique creation of your own.

Tatar holiday dessert

by Eugene Pinkhassik



Expand your cultural experience by learning how to make a traditional Tatar dessert. Having originated in a progressive bakery in Kazan, Russia, during the city's growth as a transportation hub, it became immensely popular in early 20th century as a homemade sweet. It is usually made for birthday parties and weddings, but we can recreate these festive occasions right here at SigmaCamp.

Suncatchers

by Iana and Katya



Come make suncatchers with us!

The Science of Steak

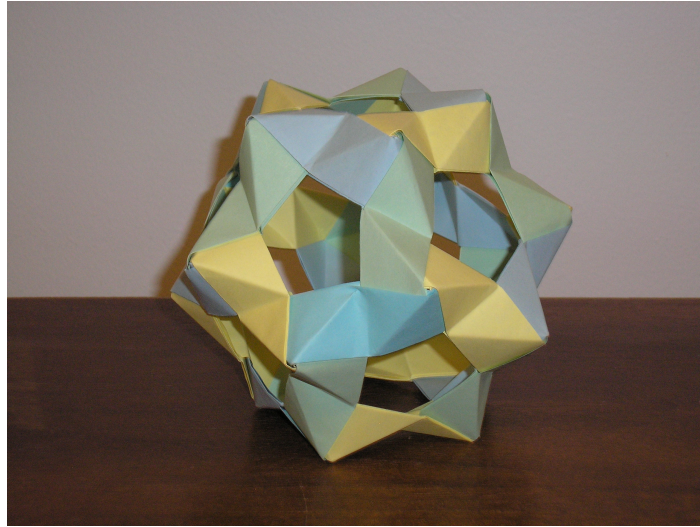
by Joel Brook



Do you like science? Do you like eating steak? If the answer to both of those questions is yes, this workshop is for you. In this workshop we will be examining the science behind cooking the perfect steak while also cooking a steak ourselves.

Origami Dodecahedra

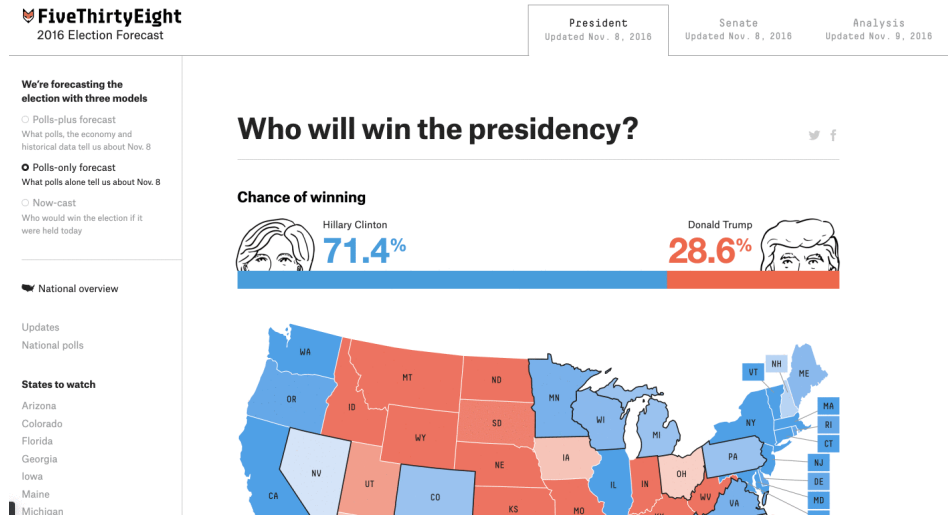
by Boyan Litchev



Have you ever wanted a cool-looking desktop figurine? Well, look no further! In this workshop, everyone will create their own colorful dodecahedron—a three-dimensional solid with twelve pentagonal faces—using modular origami. Optional math included.

How to Read Election Polls

by Alex Frenkel



Over the next three months you're going to see some absolutely unhinged takes in the news, especially regarding the state of the election. In this workshop we will go over what election polls actually mean, how much you should trust them, and how (competent) election forecasters pick them apart to figure out what's actually likely to happen.

Brigadeiro & Good Music

by Alice Rabello



In this workshop, we'll be going to mix, roll, and decorate Brazil's best sweet treat – the brigadeiro! All while listening to my playlist featuring the best of Brazilian music ever!! By the end, you'll get to taste your creations and take them home or share with your team (or just eat them all yourself – I won't judge).

Popsicle Engineering

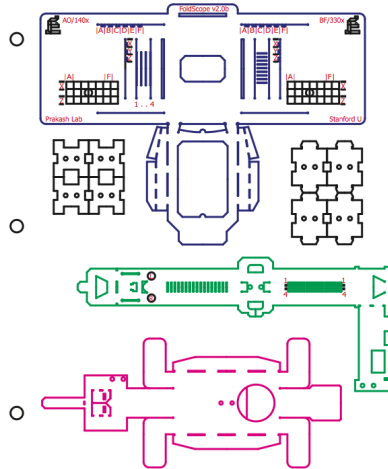
by Avitel Gaidukova



Join us at the Popsicle Stick Engineering Workshop where creativity meets construction! Here you will be able to unleash your inner architect as you take on an exciting challenge using popsicle sticks and glue. This hands-on workshop will ignite your imagination and push your engineering powers to new limits. Whether you're a budding builder or a seasoned creator, come discover the thrill of engineering with us at Sigma Camp's Popsicle Stick Engineering Workshop!

FoldScope field microscopy

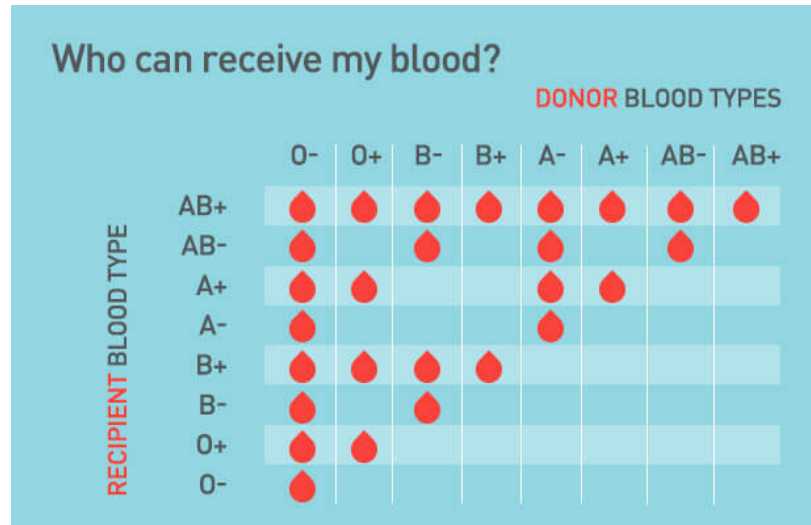
by Leon Peshkin



We will demonstrate how to assemble and put to a good use \$5 microscope made from paper and glue, and will try to immediately proceed to biological and pharmacological discovery by observing microorganisms we catch in the wild

Who can receive my blood?

by Varvara Boryushkina and Lena Yakubovskaya



Your blood type, determined by unique proteins on your red blood cells and passed down from your parents, is key for safe blood donation and transfusion. The Rh factor adds another layer to this fascinating mix. In this thrilling workshop, you'll collect your own blood sample, mix it with antibodies for different blood types, and watch the reactions unfold. See if your blood cells stick together or stay apart. Then, get an up-close view of your blood under a microscope. Discover if you're a universal donor, capable of saving countless lives, or find out which specific types can benefit from your blood.

Bitter or Not?

by Vladislava Sokolova and Lena Yakubovskaya



Single Nucleotide Polymorphisms (SNPs) are variations at a single position in a DNA sequence that can significantly influence traits such as taste perception. A notable example is the ability to taste the bitterness of phenylthiocarbamide (PTC), which is linked to SNPs in the *TAS2R38* gene encoding a bitter taste receptor. In this workshop, you will predict the variants of this gene you possess and isolate your own DNA to confirm the prediction through genetic analysis.