

CLUSTER 1: COMPUTERS IN EVERYDAY LIFE

On Day 1 of COSMOS, Cluster 1 had not only gotten a glimpse of what was in store for the next four weeks, but created an Android app! During this first week, we began to learn AppInventor. It is a scripting language with a graphical interface which allowed us to put together our simple app in a matter of hours. AppInventor allows us to develop applications for Android based devices, like cell phones. Some of our first applications for the Android phone included making a Whack-a-Mole game. Next we worked on our own unique app with our partner. If we wanted to, we could put our apps up for sale in the Android Market! We were paired up in teams and made a group app which we will present on Thursday afternoon to the cluster. In about three days, we had created an app and could see what other features we still had to work on.

Wednesday morning started with some students from the Explorers for Engineering (E4E) lab. They spoke about their projects and their journey. Curt is one of the directors for E4E. One of the project we learned about was monitoring baboon movements in Kenya. The students gave us great insight to their experience and projects and offered some useful advice such as joining clubs, doing independent side projects, participating in internships, co-ops, experiences, hackathons and conferences! We also had a chance to ask our own questions of these undergraduates (from UCSD, University of Mississippi and CSU San Bernadino) in smaller groups. Then we will began to learn about Python! It's a powerful language that is fast, friendly and easy to learn. In fact, our first lesson in programming on variables, controls, methods and functions resulted in us being able to read the

Python code and correctly concluding what it would do.

Thursday we heard a presentation from the Science and Engineering librarian that will help us do our research for our upcoming work. In the afternoon, we'll finish up our apps and present our work to our cluster. The presentations will be available on our blog - <http://ucsdcosmoscluster1-2019.blogspot.com/>. Our first presentation to the cluster will be on Thursday afternoon to share what each group did for their original app.

Friday we will learn about image processing. In lab, we'll begin programming in Python to take pictures and process the images. Videos of our app presentations and photos will be posted this weekend on our [blog](#).



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An update to Week 1's adventures can be found on our blog ucsd-cosmoscluster2-2018.blogspot.com. Demos of our labs, presentations, and photos and videos from Week 1 and COSMOlympics are now available. To see who was recognized with the Faculty's Choice and People's Choice awards check out our blog! Last Friday, we learned about Python and image processing. We learned how programs like paint and Photoshop do some of their basic functionality like finding a color and changing it to another or clearing the screen. We discovered how to do some image processing functions in Python. In lab, we began to work on creating our own unique image processing on photos – including using a green screen to superimpose ourselves into pictures with code. Then we began to work on tutorials for filters on images to do some basic image processing.

On Monday, Geoff Voelker was our guest speaker. Professor Voelker teaches operating systems and software systems courses. His research is on multiplayer network games. We had the opportunity to learn about what happens behind the scenes in massive multiplayer network games. For example, when you play these games, you are actually playing a game in the past (around 50 ms in the past) and there are several different ways for the system to handle lag times, predictions and interpolations so that it behaves as we expect. Afterwards, we learned about binary numbers and why we care about "base 2." We learned a little about encryption and the space on hard drives. Then we played "Around the World": converting binary to decimal, and Annie won "Around the World: Binary." After our Discovery Lecture on Tuesday about microbiomes, we got a chance to peer edit our ethics essay. It's due this week and the top COSMOS essays will be announced at the closing ceremony! Wish us luck! In the afternoon, we had our field trip to Sony Playstation. Our hosts True and Jessica are software engineers and Playstation Systems Architects and UCSD alumni. We got to learn a lot about Sony Playstation as a company, visit different departments and talk with many of its employees. It was a fun and invaluable experience! On Wednesday, we spent the day working in the lab on our image processing projects. We're excited to show off our work to our cluster and faculty on Thursday afternoon. You'll find the projects and presentations on our blog by this weekend. On Thursday afternoon, we'll learn about electronics, and on Friday we'll begin work on Arduinos!



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Late last week, we saw a demo of a cucumber sound board. A mini sound effect board Curt made from actual CUCUMBER SLICES. This was our intro into circuits and Arduinos. Then in lab, we got to begin working with tutorials so we can learn how to wire and program our circuits in C using push buttons, speakers, temperature sensors and servos to name a few. It was exciting to see our circuits working! We began **Monday** with a guest speaker, Julian McAuley who talked about his work in data mining. The field of data science is growing! There is so much data that is gathered today that can help guide us in things we do every day and to help us as a society. In the field of data science/mining, they build models to “help us understand data in order to gain insights and predictions”. For example, recommender systems are made to predict a rating a person will give on a product. This will allow a system to be built which will recommend products that people are interested in and gain insight on how opinions are influenced by gender, age and location. Some areas which use it today are social networks (such as trying to predict whether two users might be friends), advertising and medical informatics. Afterwards, we began learning about Boolean logic, gates and DeMorgan’s Law. We were challenged to create the logic for trying to escape campus given constraints such as two roads out, a booby trapped scooter and Shirley trying to catch us. In lab, we began working on our project this week – creating a musical instrument using an Arduino. **Wednesday** morning we learned about adders and made our cluster into a 20-bit adder!

We also learned that:

$$1 + 1 = 0$$

$$1 + 1 = 1$$

$$1 + 1 = 2$$

$$1 + 1 = 10$$

To find out why, watch the video on our blog! We wrapped up our morning lecture learning about transistors (switches) which are made with semi-conductors. We learned how nMOS and pMOS transistors can be configured together to build inverters and NAND gates.

Afterwards, we our guest speaker was Deian Stefan. His insights on cybersecurity helped us relate what security issues in the physical world to that of the cyber world. There are two main types of security – defensive and offensive. He spoke about the analysis and protection of computer systems in an adversarial setting. The main focus was the protection on confidentiality, integrity, and availability of a system against an adversary. A couple of the big tips we walked away with were use password managers (so you don’t use the same password for everything and they are complex) and don’t install too many extensions! On **Thursday**, we’ll present our musical instrument Arduino project. Videos and demos will be uploaded by the weekend! Then we’ll officially begin working on our final projects!



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A lot happened at the end of last week. Last Thursday, we presented our Arduinos musical instrument projects. Congratulations to the Faculty Choice Award winners: Clarice and Zarco for "Bop It!" for creating their own Bop It style game and instrument! Congratulations to the People's Choice award winners: Christine and Kevin D. for "Bunny Ears" for their instrument which plays musical notes based on the movement of a worn glove!

Last Friday, Sanjoy Dasgupta guest spoke about machine learning and how a computer can determine handwritten numbers. For example, the post office uses software which has to determine the addresses written on an envelope. However, not everyone writes the number 5 *exactly* the same. Some may curl more that it could be considered by a computer as the number six. There are different algorithms that can be used to most effectively and accurately determine the values. Later that morning we learned about computer architecture including registers, MUXs, memory and ALUs. Leo connected everything that we learned so we had a better understanding of how it all fit together.

The majority of this week, we focused on our final projects. We got to propose our own final project and get it approved. It had to involve ApplInventor, image processing or Arduinos. After many hours of hard work and some laughs at the weird things our programs would do, we are just about done with many of the milestones in our projects. One project involves an alarm clock which makes you get out of bed to turn it off! Another created their own trash can that will come to you.

Some teams will be using their mobile phones (with an app they created) to control their Arduinos with various sensors and many servos! We have projects that are autonomous driving robots, one that will track water usage, security systems, one inspired by skeeball, and a birthday cake "delivery" system, just to name a few! Students are using components on several technologies to interact with each other. There are many ways to apply the engineering and science from our final projects to larger robots. Some of us hope to continue to work on our projects after COSMOS and submit it to a science competition this coming school year, such as a science fair or Science Talent Search. These projects have a lot of work and heart in them and having great potential to do well in research project competitions. We look forward to sharing our projects with everyone on closing day. Our faculty was thoroughly impressed with our projects and it was difficult for them to select the Gordon Award winners for our cluster. The videos of our final presentations will be available on our blog.

We would really like to thank all those that helped make our cluster and COSMOS experience one we'll never forget. From faculty (Professor Curt Schurgers and Professor Leo Porter) to our TAs (Ravi Patel, Maria Parga-nina, and Anthony Yao) to our RAs (Matt and Isabelle), you helped us learn a lot and have a great time in the process! You can view our pictures on our Cluster's Blog (UCSD COSMOS Cluster 1 2019) <http://ucsdcosmoscluster1-2019.blogspot.com/> to see all the fun we had in class and on our field trip!

From the author: Thank you to my bright, appreciative and overall wonderful students in Cluster 1. You made my "vacation" fun and energizing! Keep up your curiosity and drive for excellence. I know you will go far in your journeys! Your Teacher Fellow, Shirley Miranda

