REU-CAAR:
You’re Here!
Credit where Credit is Due

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Cybersecurity Scholars Handbook.
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**Auguste:** Why are you telling them all that?
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  boring handbook into a fascinating \(\sim 280\)-slide talk!

Auguste: Why are you telling them all that?
Bill: In academia its very important to credit past work!
Purpose of This Talk

1. Who are the mentors?
2. What are the projects?
3. What is expected of you?
4. What should you expect of us?
5. Nuts and bolts of how the program works.
6. Advice on how to get the most out of this summer!
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REU: Research Experience for Undergraduates.
**REU-CAAR**

**REU:** Research Experience for Undergraduates.
**CAAR:** Combinatorics, Algorithms, and AI for Real Problems.

Discuss: Find a topic within CS that this title does not cover? Systems, HCI, Software Engineering, anything else?
REU: Research Experience for Undergradutes.
CAAR: Combinatorics, Algorithms, and AI for Real Problems.

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REU: Research Experience for Undergraduates.
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Systems, HCI, Software Engineering, anything else?
REU-CAAR: TEAM!
Mentors

1. Classical and Quantum Error Correction: Victor A and Phillip F.
2. Improved Machine Translation for Wikipedia: Marine C and Eleftheria B.
3. Parallel Algorithms for High Dimensional Clustering: Laxman D.
4. Fair Decision Making: Furong H.
5. Exploring the Hilbert Geometry: Auguste G. and Dave M.
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Admin

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  Wrote the grant,
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  Wrote the grant, finds the mentors,

- **Housing:** Jennifer Arseneault.

- **Your Salary:** Jodie Grey.

- **Lots of Stuff:** Sharron McElroy.

- **Arrange REU Lunches:** Deborah Jackson.

- **Lots of Stuff:** Auguste Gezalyan.

- **Airport, Amtrak Pickups:** Darling, Clyde, Alex, Auguste.

- **Help with Final Presentations:** Clyde.
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REU-CAAR: Very Brief History
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From 2013-2016 we had projects in

- Crypto and Security
- Data Science
- Ramsey + Something more Applied (AI, ML, SAT-Solvers)
- Applied Algorithmic Graph Theory
- Algorithmic Game Theory
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2017-2022

Big change. Projects in the fields above but also

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Quantum Computing
AI-fair allocation (e.g., Kidney Exchange)
AI-NLP
AI-Image Processings

The AI projects all had a mathematical component.

We changed the name to Combinatorics, Algorithms, and AI for Real Problems.
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5. For 2022-23-24 we got additional money for a helper. In 2022 Auguste is that helper. He will (1) co-mentor a group, and (2) help Bill with a lot of stuff.


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Program Goals and Expectations
Program Goals

1. **Research!** What is Research? Discuss!

   - Work on problems where the answers are not already known.
   - Expose you to a variety of career paths: Grad School, Industry, Government, Writer for the Simpsons, Hobo, Other.
   - Build skills: Team Work, Communication, Project Management.
   - Build a network with faculty and students. Useful for the future!
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   Work on problems where the answers are **not** already known.
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2. **Expose you to a variety of career paths.** Discuss!
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4. **Build a network** with faculty and students.
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What the Program Expects of You

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This is the Wrong Way To Look at the program
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1. This program should not be seen as a job where you put in your 8 hours a day and then you’re free to do what you want.
2. You are here because you care about Quantum or AI or Bias or Geometry or Mitigating Climate Change.
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3. So you should want to keep working on your projects, perhaps on a lower level, after you go back to the dorms.
4. Talk to each other in the dorms about your projects!
What the Program Expects of You: Restart

1. Show up every weekday.
What the Program Expects of You: Restart

1. **Show up** every weekday. On time AND sober.
What the Program Expects of You: Restart

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What the Program Expects of You: Restart

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3. **Actively contribute to your research project and your team.**

4. **Check e-mail.** Reminders, notices, requests will be emailed. (I hyphenated email? Why? The original handbook did this and I wanted you to see an interesting piece of history. X-ray and T-shirt kept the hyphen but email did not. Why?)

5. **Enthusiasm!**

6. **Attend lunches, talks, and other activities.** (Talks and some activities joint with REU-BRIDGE.)

7. **Great talks: Attend them and at the end of the semester you will give them.** (Joint presentation with REU-BRIDGE.)

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Your Mentor’s Role

1. **Role modeling:** Their experiences offer clues for your own professional success story.
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3. **Background:** Explain *why* the research is important! How it fits into other things!

4. **Connection:** Help connect you to their colleagues, graduate assistants, others.
What Faculty Mentors Expect from You

1. **Communication:**
   - Be clear in verbal & written comm.
   - Seek clarification, ask questions, provide suggestions.

2. **Assertiveness:**
   - Think for yourself and support your own ideas.

3. **Maturity:**
   - Be reliable for what your mentor asks you to do.

4. **Enthusiasm:**
   - Be interested in the project, field, and topic.

5. **Responsible:**
   - Tell your team changes that affect your participation.

6. **Adaptability:**
   - Be flexible and open minded.

First letters spell out CAMERa. Better for a Vision REU.

Credit Auguste thought of making the first letters spell words.
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Issues that Probably Won’t Arise But Need to be Discussed
Sexual Harassment and Discrimination

1. If you feel uncomfortable, seek advice and guidance from others. Bill G., Auguste G., or Furong H. (One of the REU-CAAR mentors) can offer assistance and direct you to campus resources for help. Note that in the United States, there is Mandatory Reporting: if a mentor or director hears about a case of sexual harassment, they must report it.

2. While this slide is about Sexual Harassment and Discrimination, feel free to talk to Bill G., John D., or Furong H. about any issue, even if it is uncomfortable.
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Do Your Part

Good News That You Know:
1. You get a stipend.
2. You get free room and some meal money.

If you do not do your part you could be asked to leave, which will mean you get less of your stipend. This is RARE! (once in 2014 and once in 2016).

What is 'your part':
SPACE AGE and CAMERA
Do Your Part

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Complain SOONER Rather than Later

Better to get a problem resolved EARLY, whatever they are.
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Key to a good relationship:
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In any problem or dispute that arises the important thing is
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NOT fixing it and making things work out
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Key to a good relationship:

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its finding whose to Blame :-)


Schedule and Activities
First Week++ Talks

You should all know about each others projects:
First Week++ Talks

You should all know about each others projects:

For all projects $p$
First Week++ Talks

You should all know about each others projects:

For all projects $p$
there exists a mentor $m$ for project $p$ and a day $d$ such that
You should all know about each others projects:

For all projects \( p \)
there exists a mentor \( m \) for project \( p \) and a day \( d \) such that mentor \( m \) gives a talk on project \( p \) on day \( d \).
First Week++ Talks

You should all know about each other's projects:

For all projects $p$
there exists a mentor $m$ for project $p$ and a day $d$ such that
mentor $m$ gives a talk on project $p$ on day $d$.

In symbols

$$(\forall p)(\exists m, d)[\text{MENTOR}(p, m) \land \text{TALK}(p, m, d)].$$
First Week - Lunch

1. Monday 12:00-1:00 lunch in IRB.
2. This lunch you will play telepictionary!
3. Tu,We,Th,Fr- Lunch in the union or IRB from your meal card.
4. Bill will join you for lunch some of the first week.
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First Week

1. Red Tape stuff (hopefully ends Tues).
2. Every day of the first week, at 4:00, a talk by a mentor on their project.
3. Research—Every day.
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Most Weeks

1. Get here by 10:00AM go to your projects room.
2. Research 10:00-12:00 (approx)
3. Lunch 12:00-1:00 (approx). MONDAY lunch IRB
4. Research 1:30-4:00.
5. Talks on Wednesday afternoons at 4:00.
6. Every other Friday you get your paycheck! Don’t blow it all on supercomputer time!
7. At night talk about Applying Quantum error correction, ML, and Geometry to Mitigate World Hunger
8. Weekends—Explore Washington DC! or College Park! (Check the metro website—lots of trains are not running at times.)
9. Some of these items may change (e.g., lunches, talks may be a different day).
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It will stop running around July 2.

**Upshot:** Visit President Biden and other DC sights in June.

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1. Discussion of Ethics of Research.
2. Discussion of graduate school (with guests).
3. Game Nights with Pizza!
4. Final presentation the last week.
5. Unexpected things will happen! Always expect the unexpected! (Is that a paradox? A project for Summer 2024 REU.)
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Summary of Projects and People
Alice wants to send Bob a string $x \in \{0, 1\}^n$. But the channel is noisy! There are ways to send $x$ such that errors will be detected and corrected (if there aren't too many of them.) One way is to send $xxx$. There are better ways. CLASSICALLY. What if you had QUANTUM methods! Can you do better?

Victor and Phillipe Quantum Project

Students Michael, Cella, Milan
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3. **Students** Michael, Cella, Milan
1. Improving Machine Translation for Wikipedia

2. Elevator Pitch

Machine Translation uses deep learning. This sounds great :-). But it's not :-(. If only we had a large set of texts to experiment on and see what goes wrong. OH. We do! Wikipedia. This project will use translations of Wikipedia pages to understand and evaluate different Machine Translation Services. The goal is to see when they do badly and find ways to make them better.

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Linh, Osama, Grace, Angela
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Clustering is taking a set of data and grouping it in meaningful subsets. EXAMPLE: take the set of students at UMCP and group them by major and by GPA and by GPA-in-the-major. For a very large dataset this is slow. What to do? What if we use a PARALLEL algorithm on a PARALLEL machine. We will implement state-of-the-art parallel algorithms and see how they do!

Students
Papa, Mohammad, Andrew
1. Parallel Algorithms for High-Dim Clustering

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Laxman Parallelism/Clustering Project

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3. **Students** Papa, Mohammad, Andrew
Furong’s Fair Decision Making

1. Fair Division Making

2. Elevator Pitch

At one point it was hoped that automating decisions would decrease human bias. But instead there are times when it inherits human bias.

Darn!

This project looks at how to deal with that (and reduce bias) in the context of ML/AI for decision making.

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3. **Students** Selena, Amy, David
Auguste-Dave Geometry Project

1. Exploring Hilbert Geometry

2. Elevator Pitch

Computational Geometry asks questions like, Given a set of lines find all of the points of intersection. It is assumed they mean lines in the plane or perhaps $\mathbb{R}^n$. What if you are in another space? A curved space? What can you do? You can do this project!

3. Students
Zofia, Sally, Daniel, Carlos.
Auguste-Dave Geometry Project

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3. **Students** Zofia, Sally, Daniel, Carlos.
Aviva’s Markov Decision for Climate Risk

1. Using Markov Decision Processes to Mitigate Climate Risk

2. Elevator Pitch

   Farmers in India need your help! Small changes in climate lead to big changes in when to plant crops. They need to predict the weather AND tie that into decision making for crop planting. We will use MATH and AI to do this!

3. Students

   Nick, Jasmine
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Funding
Who is Funding This?

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3. Ocular/Brendan Iribe (A Virtual Reality Company). This makes sense.
4. Other Schools mini-grants pay stipends. This makes sense.
5. KAUST: King Abdullah Univ. of Sci. and Tech. They want to foster good relations between Saudi Arabia and America. They fund students from Saudi Arabia who are already at American Schools, to go to REU programs. This makes sense.
6. Two HS students are in the program as unpaid interns. This makes sense.
7. The Winkler Foundation. Who are they?
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Bill Gasarch’s Mother is Pearl (Nee Winkler) Gasarch

1. Produced over 50 movies
2. Directed 7 movies
3. David Selznick Lifetime achievement award for producing
4. Produced Rocky, Goodfellows, Creed 1, 2, 3
5. For more about him: https://www.imdb.com/name/nm0005563/?ref_=fn_al_nm_1

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The Winkler Foundation

Irwin Winkler has established a charitable foundation that gives money to
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Irwin Winkler has established a charitable foundation that gives money to (a) many worth causes and (b) our REU!
Adam Winkler

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Show me the Money!

Where Does the Winkler Money Go?
Things the NSF won’t pay for:

- Money for housing for non-citizens.
- The REU Lunches.
Show me the Money!

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Does Where You Got Your Funding Matter? NO

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None of this will matter except:

1. Those funded by Google/Zhu or Iribe will be asked to write a letter thanking them. I will be asking this in September.
2. KAUST may ask their students to fill out forms.
3. The local HS students did not get those 100 emails asking for their travel plans.
Questions from You?

I welcome questions now and anytime!