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

Origin of this talk
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▷ In 2010 a Univ of MD Cybersecurity REU produced a 20-page document:

Cybersecurity Scholars Handbook.
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- In 2010 a Univ of MD Cybersecurity REU produced a 20-page document:
  
  **Cybersecurity Scholars Handbook.**

- Bill G modified this
  
  **boring** handbook into a **fascinating** ~ 220-slide talk!
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- In 2010 a Univ of MD Cybersecurity REU produced a 20-page document: 
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John: Why are you telling them all that?
Origin of this talk


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John: Why are you telling them all that?
Bill: In academia its very important to credit past work!
Purpose of This Talk
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1. Who are the mentors?
Purpose of This Talk

1. Who are the mentors?
2. What are the projects?
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1. Who are the mentors?
2. What are the projects?
3. What is expected of you?
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1. Who are the mentors?
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4. What should you expect of us?
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1. Who are the mentors?
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5. Nuts and bolts of how the program works.
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!
REU: Research Experience for Undergraduates.
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CAAR: Combinatorics, Algorithms, and AI for Real Problems.
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?
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-CAAR: TEAM!
Director and Mentors

1. REU-CAAR Director: William Gasarch
Director and Mentors

1. **REU-CAAR Director:** William Gasarch
2. **Projects and Mentors**
   - Verif. of Quantum Simulation: Andrew C, Dhurv D, Alexy G.
   - Security Estimation for Post-Quantum Crypto: Dana DS.
   - Differential Economics: John D and Ian M.
   - Comparing AI to Human Int. with Regard to Bias: Tom G.
   - Ramsey Theory on Ordered Sets: Bill G.
   - Fair Decision, Resource Allocation Bias: Furong H.
   - Exploring the Hilbert Geometry: Auguste G. and Dave M.
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Housing: Jennifer Arseneault
Admin

- **Housing**: Jennifer Arseneault
- **Your Salary**: Jodie Grey
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- **Your Salary**: Jodie Grey
- **Lots of Stuff**: Sharron McElroy
- **Monday Lunches**: 
Program Goals and Expectations
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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Program Goals

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What the Program Expects of You

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4. Talk to each other in the dorms about your projects!
What the Program Expects of You: Restart

1. **Show up every weekday.** On time and sober. 10A-4P. You should want to work longer, but prob back in the dorms.
What the Program Expects of You: Restart

1. **S**how up every weekday. On time and sober. 10A-4P. You should want to work longer, but prob back in the dorms.

2. **P**articipate in assessments such as surveys.

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

4. **C**heck e-mail. Reminders, notices, requests will be emailed. (Why? Why? The original handbook did this and I wanted you to see an interesting piece of history.)

5. **E**njoy items 1, 3, 4, 6 on this list.

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

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

8. **E**njoy yourselves!

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**Acronym SPACE AGE**
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Your Mentor’s Role

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2. **Communication**: Explain the project, answer questions, listen to your concerns and ideas, etc.

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. You will learn as much from them (or more!) as you do from your research tasks!
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. Be bold!

3. **Maturity:**

   - Be reliable for what your mentor asks you to do.

4. **Enthusiasm:**

   - Be interested in the project, field, and topic. Become familiar with background literature.

5. **Responsible:**

   - Tell team changes that affect your participation.

6. **Adaptability:**

   - Be flexible and open-minded.

Acronym

**CAMERA**

Credit

Auguste thought of making the words into an acronym.
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Acronym CAMRA.
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What if Issues Arise?
1. Speak directly to the individual in a respectful manner. This will let you immediately know if the different treatment is a misunderstanding or a major problem.

2. If you feel uncomfortable, seek advice and guidance from others. Bill Gasarch or Jacquelyn Michaelis (REU-BRIDGE director) 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.

3. While this slide is about Sexual Harassment and Discrimination, feel free to talk to Bill Gasarch or Jacquelyn Michaelis about any issue, even if it is uncomfortable.
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What is you Slack Off?

Good News That You Know:

1. You get a stipend.
2. You get free room, a meal card for the first week, and extra food money.

If you do not live up to your end of the deal 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 end of the deal':

SPACE AGE and CAMERA
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SPACE AGE and CAMERA
Complaints In the Past

Over the last year there was only THREE complaints:

- Being Virtual is a Real Downer
- This summer the program is in person!
- Talks should be at 4:00 instead of 3:00 so can get more done
- Done!
- Non Citizens Could not get ID cards
- and hence had to pay Full Price at the Gym
- Mihai Pop of REU-BRIDGE was amazed this was true. I had to remind him that incredibly stupid university rules are not unusual.
- Not enough meat pizza on Game Nights.
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Not enough meat pizza on Game Nights.
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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its finding whose to Blame :-)
Schedule and Activities
First Week++ Talks

You should all know about each others projects:
You should all know about each other's 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 $d$. 
You should all know about each others' projects:

For all projects $p$
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mentor $m$ gives a talk on project $p$ on day $d$.

In symbols

$$(\forall p)(\exists m, d)[MENTOR(p, m) \land TALK(p, m, d)].$$
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 Wed).
2. Research—Every afternoon.
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2. Research—Every afternoon.
Most Weeks

1. Get here by 10:00AM goto 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 Quantum ML for Security and Ramseyian Geometry
8. On your own on weekends— Explore Washington DC!
9. Some of these items may change (e.g., a talk on a Tuesday).
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1. Field Trip at Spy Museum (Prob a Monday in July).
2. Lunch where we discuss How to do Bad Science.
3. Lunch where we discuss graduate school (with guests).
4. Game Nights with Pizza!
5. Final presentation the last week.
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Summary of Projects and People
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

Madeline Bumpus, Caesar Dai, Samuel Monoz, Renita Santhoshkumar, Songyu Ye.
Auguste–Dave Geometry Project

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3. **Students** Madeline Bumpus, Caesar Dai, Samuel Monoz, Renita Santhoshkumar, Songyu Ye.
1. Verification of Quantum Simulation

2. Elevator Pitch

When we have quantum computers we will need to verify that their output is correct. One way to do this is to simulate a quantum computer on a classical device. This project will be about how to do that.

3. Student Ruozchen Gong

4. Misc

There may be grad students and one postdoc Zooming in from China.
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Andrew-Dhurv-Alexy Quantum Project

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1. Concrete Security Estimation for Post-Quantum Cryptosystems with Side Information

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Today's crypto systems rely on factoring being a hard problem. Quantum computers can, theoretically, factor very quickly. Hence people are already building post-quantum cryptosystems which means those not based on factoring being hard.

What about non-math attacks like side-channel? Are the new systems secure against those? Let's find out!

3. Students

Michael Gonzalez, Harikesh Kailad, Alexander Lindenbaum.
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1. Differentiable Economics

2. Elevator Pitch

How do we divide up goods (e.g., children to schools, organs to patients, muffins) in a fair way? What does fair mean? This project will apply AI/ML to these problems.

3. Students

Davidson Cheng, Yang Hong, Reem Al Marzoa, Abdulaziz Memesh.
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John-Ian Diff Eco Project

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3. **Students** Davidson Cheng, Yang Hong, Reem Al Marzoa, Abdulaziz Memesh.
1. Comparing AI to Human Intelligence with Regard to Bias

Humans are biased. AI systems are biased. We want to, of course, combat this for AI systems. (For humans also, but that would be a Psychology REU.)

In what ways are human bias and AI similar? different? Can we identify the source of AI bias? Correct it? We can try!

3. Students

Maya Murry, Anneke Wernerfelt, Dalal Ahmidouch.
1. Comparing AI to Human I with Regard to Bias
Tom’s AI-HI Project

1. Comparing AI to Human I with Regard to Bias
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1. **Comparing AI to Human I with Regard to Bias**

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   We can try!

3. **Students** Maya Murry, Anneke Wernerfelt, Dalal Ahmidouch.
1. Ramsey Theory on Ordered Sets

2. Elevator Pitch

If you color \( \mathbb{N} \) (the natural numbers) \underline{RED} and \underline{BLUE}, there will be an infinite \( A \subseteq \mathbb{N} \) that is all the same color. As an ordered set \( A \) looks just like \( \mathbb{N} \).

What happens if you color \( \mathbb{Z} \) (integers), \( \mathbb{Q} \) (rationals), \( \mathbb{R} \) (reals), \( \mathbb{N} \times \mathbb{N} \)? Other sets?

Bill’s Ramsey Project

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Furong’s Fair Div and Bias

1. Fair Division, Resource Allocation, and Bias

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 resource allocation.

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Suhani Agrawal, Justin Huang, Ben Kreiswirth.
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Funding
Who is Funding This?

1. National Science Foundation (NSF).

2. Andrew C had some spare quantum coins.

3. Google/An Zhu (An Zhu was an ugrad at UMCP who worked in Theory).


5. Other Schools mini-grants pay stipends.

6. The Winkler Foundation.
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Irwin Winkler

Bill Gasarch’s Mother is Pearl (Nee Winkler) Gasarch

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2. Directed 7 movies
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Why am I telling you this?
The Winkler Foundation

Irwin Winkler has established a Charitable foundation that gives money to

- Many worthy causes
- Our REU!

Adam Winkler is Irwin's son who administers the foundation. He's a law professor so he gets academia. (The other two sons are in the biz: a director and a writer.)

His most recent book: *We the Corporations: How American Businesses won their civil rights*

*It is deeply shocking that We the Corporations is not boring.*

Where Does the Winkler Money Go?

Things the NSF won't pay for:

- Money for housing for non-citizens.
- The Monday Lunches.
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Questions from You?

I welcome questions now and anytime!