

# RING: FREE CYBERSECURITY CURRICULUM

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**[maui.hawaii.edu/cybersecurity](http://maui.hawaii.edu/cybersecurity)**

# AGENDA

- Cybersecurity at UHMC
  - Cybersecurity across disciplines and student populations
- NSA/DHS Center for Academic Excellence (CAE)
  - UHWO, UHMC, HonCC, LeeCC
- RING Curriculum
- Pathways from RING to UH
- Cybersecurity Workforce Update

# CYBERSECURITY EDUCATION - TRADITIONAL

- Certificates in Cybersecurity
  - Low Level - Intro, Network+, Security+
  - Higher Level - Ethical Hacking, Forensics
- Internships
  - Government, banks, utilities
- Baccalaureate Degree
  - Applied Business and Info Tech
  - Cybersecurity courses are embedded
- Cyber competitions and Workshops
  - NSA GenCyber, US AFA CyberPatriot
- Supported by NSF Grants
  - ATE Program Award# 1700562



# CYBERSECURITY EDUCATION - ACROSS DISCIPLINES & SEGMENTS

- Cybersecurity education cuts across various segments
  - Community College program disciplines
  - Gender
  - Minorities
  - Background - high schools, professionals, returning veterans etc
  - Various Industries
    - Accounting, Hospitality, Law Enforcement, Utility, Tourism etc.
- One size education does not fit all types of students!

4





# CYBERSECURITY EDUCATION - ACROSS DISCIPLINES

- Focus on 5 disciplines at Associate Degree level
  - Accounting
  - Administration of Justice
  - Electronics
  - Hospitality, Travel and Culinary
  - Business
- Supported by NSF
  - ATE Grant, Award# 1700562
  - SFS Capacity Building Grant, Award# 1437514



# CYBERSECURITY EDUCATION - ACROSS STUDENT POPULATION

- Focus on students from a variety of backgrounds
  - Women
  - Minorities
  - Veterans
  - Working Professionals
  - High School Students
  - Remote students who rely totally on distance education
  - Economically disadvantaged
  - Low math/science proficiency
  - Non-technical
  - Non-traditional
  - Not interested in Cybersecurity as a career!



# DIVERSE CYBERSECURITY EDUCATION - OVERALL APPROACH

- Obtain administration and other institutional support
- Identify key faculty leaders in key disciplines
- Engage faculty and students
  - Guest Lectures in classes
- Engage employers who will hire students with cyber skills
  - Hotels, banks, tourism industry, law enforcement
- Identify one or two existing courses in each discipline
  - Explore cybersecurity modules that can be embedded
- Hold workshop with faculty from various disciplines
  - Stipend helps!
- Create modules and help faculty member teach it!



The National Centers of Academic Excellence in Cybersecurity (NCAE-C) program is managed by NSA's National Cryptologic School. Federal partners include the Cybersecurity and Infrastructure Security Agency (CISA), the Federal Bureau of Investigation (FBI), the National Institute of Standards and Technology (NIST)/National Initiative on Cybersecurity Education (NICE), the National Science Foundation (NSF), the Department of Defense Office of the Chief Information Officer (DoD-CIO), and U.S. Cyber Command (USCYBERCOM).

NCAE-C program aims to create and manage a collaborative cybersecurity educational program with community colleges, colleges, and universities that:

- Establishes standards for cybersecurity curriculum and academic excellence,
- Includes competency development among students and faculty,
- Values community outreach and leadership in professional development,
- Integrates cybersecurity practice within the institution across academic disciplines,
- Actively engages in solutions to challenges facing cybersecurity education.

## Center for Cybersecurity Education and Research (CCER)

The University of Hawaii Maui College (UHMC) has been designated as a National Center of Academic Excellence (CAE) in Cyber Defense Education (CDE) through academic year 2024 for the Bachelor of Applied Science (BAS) in Applied Business and Information Technology (ABIT) Degree. For details about the National Centers of Academic Excellence (CAE) click [here](#).



The **Center for Cybersecurity Education and Research (CCER)** was established at the University of Hawaii Maui College in 2015, to provide the local community and students with cybersecurity education, training and guidance. The mission of CCER is to provide cybersecurity guidance, training and workforce development activities to the local community, K-12 students and teachers, as well as students enrolled at UHMC.



## Certificate of Achievement in Information Assurance

Courses selected for this certificate meet the two-year core knowledge unit requirements for a college to become recognized as a [National Center of Academic Excellence in Cyber Defense Two-Year](#) (CAE2Y). This program, which is sponsored by the NSA and DHS, recognizes colleges that have met their standard of academic excellence in Information Assurance education. Honolulu Community College is currently recognized as a CAE2Y.



Bachelor of Applied Science

## Information Security and Assurance

### Overview

The concentration in Information Security and Assurance is the first of its kind at a public institution in Hawai'i and the Pacific. UH West O'ahu, in cooperation with University of Hawai'i Community Colleges, state and federal law enforcement agencies, state security officials, and local businesses, developed an expansive security education program covering a wide variety of technical and managerial aspects within the field.



# CYBERSECURITY CENTER



Leeward Community College's **Cybersecurity Center** showcases a variety of cybersecurity-related programs and resources available to students and faculty.

On August 28, 2018, the College received notification that is officially designated as a **National Center of Academic Excellence in Cyber Defense Education Two-Year (CAE2Y)**. This program recognizes collegiate institutions which have met their standards of excellence in Cyber Defense education.

The institutional award was established by the National Security Agency (NSA) and the Department of Homeland Security (DHS), with the support of the National Science Foundation (NSF) and CyberWatch for community colleges that have established a robust information assurance program.





# RING Update

# UAH RING Core Team



Jesse Hairston  
RING Director



Tania Williams  
Pedagogical Expert



Katherine MacGilvray  
Program Coordinator



Ashley Mahoney  
Student Org. Coord.



Karen Brown  
RING Counselor



Anna Rodgers  
RING Teacher



Amelia Adkins  
RING Teacher



Benjamin Cummins  
RING Teacher



Jessica Pockrus  
Instructional Support



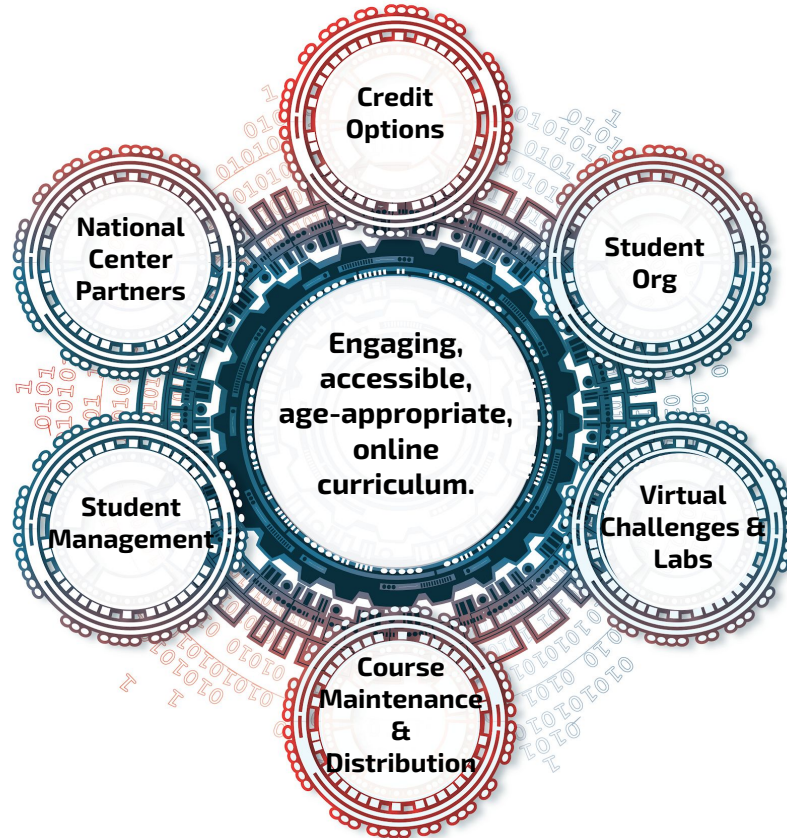
Carolyn Sanderlin  
Graphic Designer



# RING Overview



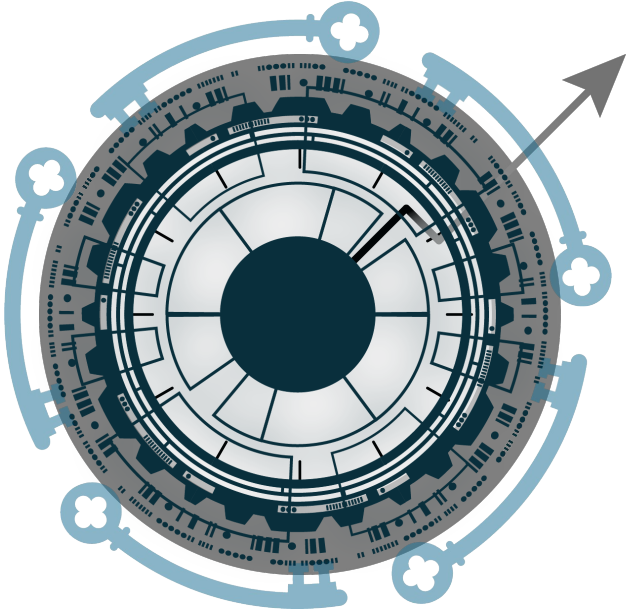
**Regions**  
**Investing in the**  
**Next**  
**Generation**



**RING is...**  
**Cybersecurity for students without access to a cyber program.**

- Rural
- Homeschool
- Under-resourced

# Timeline Highlights



## **Fall 2020 - Summer 2022**

Curriculum Development and Review

## **Fall 2021 - Spring 2022**

RING Pilot Course

## **Fall 2022**

Major Feedback/Reviews Implemented

Curriculum Released and Distributed

## **Fall 2022 - Present**

Full RING Courses Launched

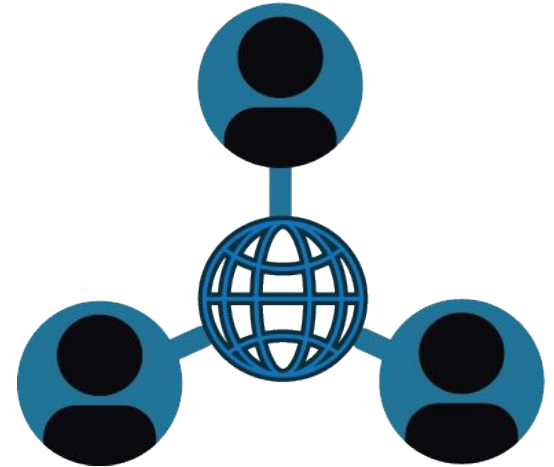
Ongoing Curriculum Maintenance

Continued Distribution

EPNC Collaborations

# Instructing RING

- 1) **EPNC Centralized Instruction** - seasoned RING teachers teach target demographic students in a proven virtual experience
- 2) **EPI Regional Courses** - EPI partners provide meaningful RING experiences to local area students
- 3) **External Instruction** - students learn cybersecurity from their school teachers with access to RING



# The Standards

## Cybersecurity Curriculum Guidelines (CCG)

- Ethics
- Establishing Trust
- Ubiquitous Connectivity
- Data Security
- System Security
- Adversarial Thinking
- Risk
- Implications

*“Guidelines created to encourage curriculum providers, teachers, and industry to create curriculum designed to inspire high school students to pursue a profession in cybersecurity, as well as develop thinkers with a cybersecurity mindset that will enhance any profession they pursue.”<sup>1</sup>*

## Targeted Foundational CAE Knowledge Units

<sup>1</sup><https://cryptologicfoundation.org/what-we-do/educate/high-school-cybersecurity-curriculum-guidelines.html>



# Curriculum Package

## Lesson Plans & Instructor Slides

**Lesson & Unit Planner** | Sharing & Class Website | Stan Tract

Tuesday  
**Sep 22, 2020**

Week | Month | Unit Timeline | Outline | Filter

### Unit Timeline

OCTOBER

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Ubiquitous Connectivity

**Day 3: 3.1**

**Standards and Objectives**

3.1 EU The Internet is a large, globally distributed network that is divided into L...

3.1.1 EO Students will explain how devices use layers to communicate across L...

3.1.1a EX Networks carry two types of information, those that allow for the co...

**CAE KUs**

**Lesson Delivery and Setup**

Instructor will need a computer, access to the Internet, and a projector (or appropriate screen sharing software if virtual). Student activities can be completed on paper or digitally. Students will need access to the Internet for some activities.

**Procedures**

**Warm Up Activity**

Have students work with a partner to describe a grocery store. They might list things like the customers, the employees, the cash

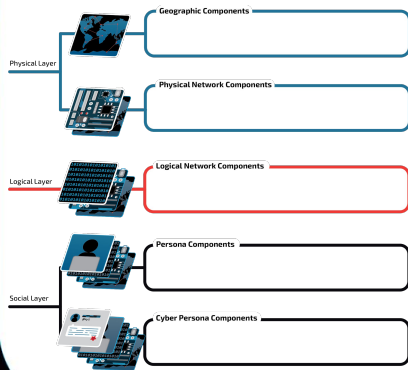
## Labs & Games



## Visually-Rich Content

Physical Layer	Logical Layer	Social Layer
Geographic Components	Logical Network Components	Persona Components
Physical Network Components	Cyber Persona Components	

## Graphic Organizers



Name: \_\_\_\_\_  
Date: \_\_\_\_\_  
Period/Block: \_\_\_\_\_

**Classify the CIA-Triad (Print)**

Objective: I can categorize the CIA Triad.

Part 1: Drag-and-drop each part of the CIA Triad to match the scenario.

**Confidentiality**   **Integrity**   **Availability**

**Fraudulent dollar bills.**

Which part of the Triad does this scenario VIOLATE?

**Glasses with a built-in microphone.**

Which part of the Triad does this scenario VIOLATE?

**A cell phone signal jammer.**

Which part of the Triad does this scenario VIOLATE?

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## Assessments

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_ ID: A

**Unit 11 Authentication and Identity Management**

**Multiple Choice**

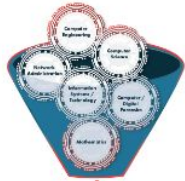
Identify the choice that best completes the statement or answers the question.

- This ties behavior to a specific user.
  - a. password
  - b. username
  - c. least privilege
  - d. multi-factor
- Which of the following is NOT a way to authenticate a user?
  - a. Something the user knows
  - b. Someone the user knows
  - c. Something the user is
  - d. Something the user has
- Which of the following is something the user does?
  - a. smartcard
  - b. fingerprint
  - c. signature recognition
  - d. retinal scan
- Which of the following is NOT a good password strategy?
  - a. Making a good password and using it over and over
  - b. Having a password that is easy to remember but difficult to guess
  - c. Having a password that is complex
  - d. Making a unique password for each account
- Which of the following is NOT a factor in password strength?
  - a. length
  - b. type of account
  - c. complexity
  - d. unpredictability
- Simone finds a briefcase that has a lock that is three numbers long (\_\_\_\_) what is the maximum number of tries it would take her to find the correct combination of the lock?
  - a. 10
  - b. 100
  - c. 1,000
  - d. 10,000
- Which password would take the longest to crack?
  - a. 123456
  - b. T!lk@11
  - c. apple1
  - d. qwerty
- Which of the following is an example of good password security?
  - a. changing passwords often
  - b. hiding the password underneath the keyboard
  - c. sharing your password with only your best friend
  - d. keeping your password the same as the default password

<b>Data Application</b>	End user layer: program opens	HTTP, FTP, DNS, Telnet	Software
<b>Data Presentation</b>	Syntax Layer: Encrypt / Decrypt	SSH, IMAP, JPEG, MPEG	
<b>Data Session</b>	Sync & Send: Interhost communication	SQL, PAP, API's, Sockets	
<b>Segments Transport</b>	TCP & Flow Control: Communication & Reliability	TCP, UDP	Hardware
<b>Packets Network</b>	Packets: Path Determination & IP Addressing	IPv4, IPv6, IPsec, ICMP, ICMP	
<b>Frames Data Link</b>	Frames: MAC & LLC (Physical) Addressing	Ethernet, ARP, STP, PPP	
<b>Bits Physical</b>	Physical Structure: Media, Signal, & Digital Transmission	Coax, Fiber, Wireless	

# RING Canvas

## RING Modules



Cybersecurity Career

[Unit 0: Introduction](#)

[Content List](#)



[Unit 1: Ethics](#)

[Content List](#)



[Unit 2: Establishing Trust](#)

[Content List](#)



[Unit 3: Ubiquitous Connectivity](#)

[Content List](#)



[Unit 4: Data Security](#)

[Content List](#)



[Unit 5: Introduction to Python  
Programming](#)

[Content List](#)



[Unit 6: System Security](#)

[Content List](#)



[Unit 7: Adversarial Thinking](#)

[Content List](#)



[Unit 8: Risk](#)

[Content List](#)



[Unit 9: Implications](#)

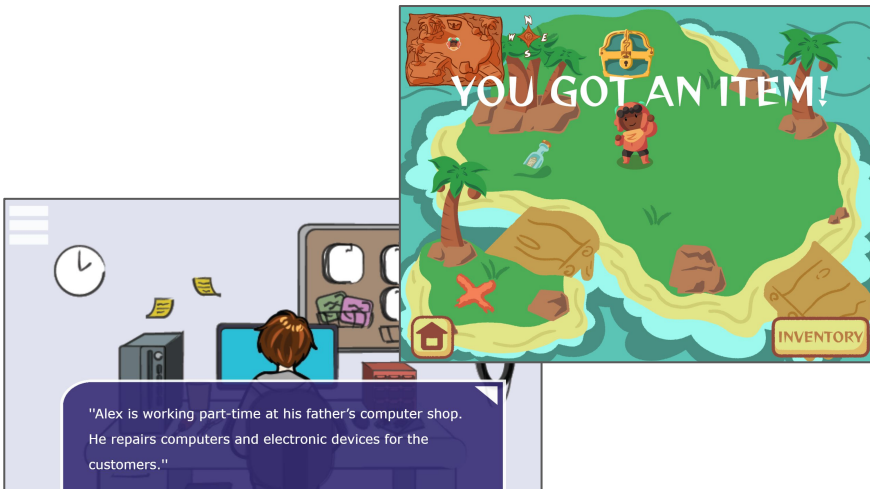
[Content List](#)



# Labs and Games

Labs provide hands-on learning through an online portal.

Games map to Big Ideas that drive the primary learning objectives.



## Asymmetric Practice

Name: \_\_\_\_\_  
Date: \_\_\_\_\_  
Period/Block: \_\_\_\_\_

### Objectives:

Explain the relationship between public and private keys in asymmetric cryptography.

Apply an asymmetric cryptographic tool to accomplish confidentiality and integrity in a practical scenario.

### Overview

RSA is a popular algorithm used for asymmetric cryptography. It can be used to generate public-private key pairs and both encrypt and decrypt information. You will explore RSA using a simple online tool to encrypt a message to your partner. In a future assignment, we will install and use a more realistic version of RSA.

### Setup

1. This is a paired activity. Grab a partner and work together!
2. Both you and your partner visit the website: <https://www.javainuse.com/rsagenerator>  
(Note: if the website is down, use the backup site: <https://www.codeusingjava.com/tools/rsa>)
3. You and your partner will need a way to copy and paste data back and forth (e.g., Zoom, Slack, email).

### 1. Key Generation

You and your partner will each generate your RSA public and private keys: click **Generate Keys**.

RSA Generate: Keys

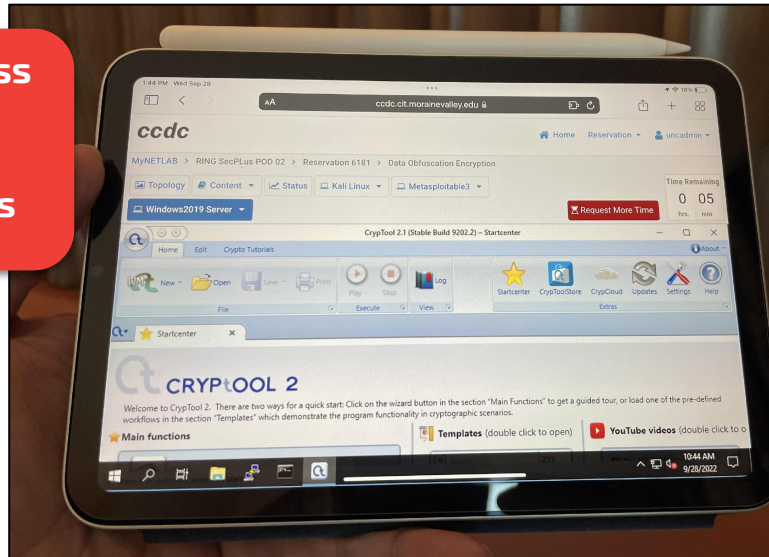
This tool generates RSA public key as well as the private key of sizes - 512 bit, 1024 bit, 2048 bit, 3072 bit and 4096 bit with Base64 encoded. The generated private key is generated in PKCS#8 format and the generated public key is generated in X.509 format.

# Lab Access

Netlabs offer virtual machines on any device.  
Coastline Community College hosts Netlab access  
for RING teachers across the country.

## RING Netlab Access

- 18 teachers
- 12 states
- 350 students



### Competency Lab 3 – Hashing, Encryption, and Password Cracking

After your excellent work on the network, the agency is loaning you to help law enforcement to take down a ransomware group. As part of the sting operation, we have to send the file 'Meeting' from the StingOps folder located on Kali Linux desktop. We suspect that the group will try to change the contents of the message in-transit so your job is to make sure our agent inside has a way to verify the integrity of the document he receives.

1. Produce text file 'HASH' that can be sent via secure channel for verification purposes. Please make sure the file ONLY contain the SHA256 hash of the secret file (i.e., get rid of the file's name). Take a screenshot of the open HASH file.

Command: sha256sum <filename> | awk '{print \$1}' > HASH

```
student@kali-lite:~/Desktop/StingOps$ sha256sum Meeting | awk '{print $1}' > HASH
student@kali-lite:~/Desktop/StingOps$
```

2. Count the number of characters in the HASH file. Is the number correct? Why?  
Command: wc -m HASH

```
student@kali-lite:~/Desktop/StingOps$ wc -m HASH
64 12345
student@kali-lite:~/Desktop/StingOps$
```

Excellent job. We sent the document and our agent already replied. For security purposes he used the polynstantiation strategy and sent multiple documents as part of the package. The documents, along with the hash file Verification we received through secure channel were saved to Reply folder on the Linux Kali desktop. We need your help to detect the correct document.

3. Please identify the correct document.

Command: sha256sum <file(s)> >> Candidates OR find -type f -exec sha256sum {} |> Candidates  
grep -f <sent\_hash\_file> Candidates

# Course Layout and Formatting

Assignments and lectures are grouped by week.

- Assignments open on Monday morning and are due the following Saturday at 6 p.m.
- Assignments in a unit can be accessed, submitted, or resubmitted through the end of the unit.

The front page of the course only contains the week's assignments and pertinent information for the course that week.

**100% of students who completed an end-of-semester survey reported a score of 3 or above on the statement: "The class is organized in a way that I always know what is expected of me and can find all materials and resources easily."**

## Week of December 9 - December 13, 2022

### Announcements

- Quick Access:
  - [NetLab Info](#)
  - [Guest Speaker Recordings](#)
  - [RING Student Org Information](#)
- There will be no class on January 16th.

CLICK TO MAKE  
AN OFFICE HOURS  
APPOINTMENT

### [Unit 5: Introduction to Python Programming.](#)

[Optional For Fun Discussion Post: A Day in the \(Not\) Life](#)

#### Monday (1/13)

- [Activity: User-Defined Functions](#)

#### Tuesday (1/14)

- Lecture only

#### Wednesday (1/15)

- [Activity: Truth Table Sort](#)
- [Activity: Nested Conditionals](#)

#### Thursday (1/16)

- Lecture only

#### Friday (1/17)

- [Activity: Loops](#)



# Student Contact & Engagement

Student contact is an ongoing priority. These efforts look like:

- Weekly announcements
- Monday missing work emails
- Office hours
- Personalized positive emails each semester
- Synchronous test review sessions
- Lectures involving props and personal examples relevant to the students
- “Fun” optional weekly discussion posts
- Frequent polls requesting student feedback on the course and adapting the course based on the suggestion

**Of the students who responded to the end-of-semester poll, 45% specifically noted that they find the lectures helpful and engaging.**



# Parent Engagement & Contact

Parent engagement and contact occurs mostly through email.

- At least one positive email is sent to parents throughout the course of the RING course – Student emails have been very well received by parents and have helped to develop stronger rapport with the parents.
- Parent emails are sent for late work and/or an unresponsive student if the student is falling behind significantly or has been unresponsive for an extended period of time.
- Parent night

# Assessment

Both formative and summative assessment is ongoing throughout the course.

- There are no late penalties for assignments
- Missing assignments are graded as a 40%
- Formative assessments can be resubmitted with corrections after grading so long as the correction shows a change in thinking and application of feedback
- One retake is allowed for each summative assessment, but the retake is different from the initial assessment

Group	Weight
Graphic Organizers	5%
Discussion Questions	5%
Homework/Activities	10%
Quizzes	10%
Labs/Projects	40%
Exams	30%
Total	100%

**The average overall grade for the class is a 92.8% and the average test score is 87.2%**

# Virtual Adaptations

Teaching in a virtual environment has unique challenges due to the varying schedules, needs, and learning styles of the students.

- Frequent student input and feedback is essential
- Being adaptable to the needs of the students

## Adaptations

- Lightening workload
- Ample discussion posts, both graded and ungraded
- Catch-up opportunities beyond the course
- Flexibility in due dates and assignments

# Teach with RING!

## Teacher Curriculum Request Form



**Educators\*** can gain full access to the curriculum package

- All Units available
- Gain access to virtual labs
- RING Student Org events
- Provide feedback

\*Educators who request access must provide proof of their school/homeschool affiliation.





# Enroll Students in RING!

**Option A: Spring 2023 (single semester)** Enroll in the RING course from January 2023 through May 2023.

**Option B: Fall 2023 (single semester)** Enroll in the RING course from August 2023 through December 2023.

**Option C: Academic Year (2023-2024)** Enroll in the RING course from August 2023 through May 2024.

**Special Option: Summer 2023 (single semester)** Enroll in the RING course from May 30 to August 3.

**RING Website:**

**[caecommunity.org/initiative/k12-ring](https://caecommunity.org/initiative/k12-ring)**

**Student  
Enrollment  
Request Form**



# RING Centralized Course

**74 students across the nation are enrolled in RING or have completed the course through the centralized program.**

- Pilot course: 14 students completed
- 2022-23: 37 students participating
- Spring 2023: 23 enrolled

**"I just like it so much I can't stop myself from looking up more about the topic...this is probably my favorite class this year."  
-RING Pilot Student**



# RING Course Maintenance

An EPI curriculum review committee will be established to review:

- Formal processes for institutions, educators, and professionals to recommend RING edits
- Major changes to the RING course

RING updates and news will be shared with subscribers and EPIs for dissemination.

RING EPNC centralized splash page will summarize the program and updates.

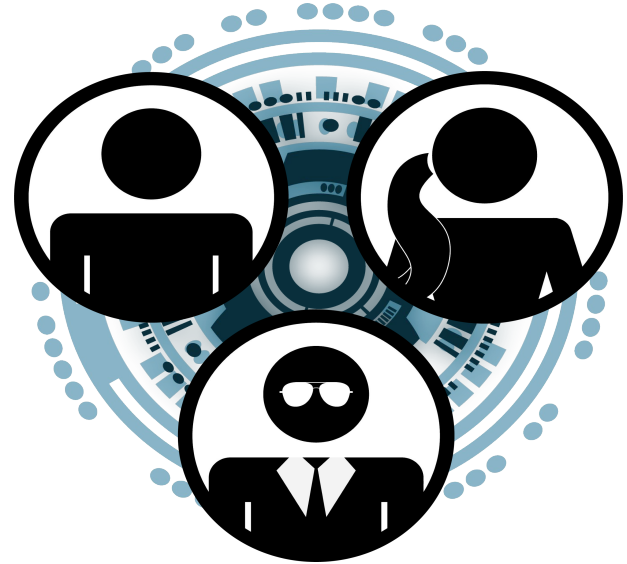


# RING Student Org

Students will receive entry to their own student organization.

- Connected to the online course
- Webinars
- Online discussion groups
- Mentorship
- Career pathway advice
- Certification guidance
- Other opportunities & activities

Students can complete a learning/community service portfolio to also be considered for the honor society.






# NICE Work Roles

NICE Work Roles are highlighted through RING student org events and guest presenters.



**Systems Security Analyst** RING 1



**Northrup Grumman** **Romell Foster**

○○○ **Sr. Cyber System Engineer**

**IT Security** While working for Jacobs Technology, Romell found a passion for Information Technology and Security.

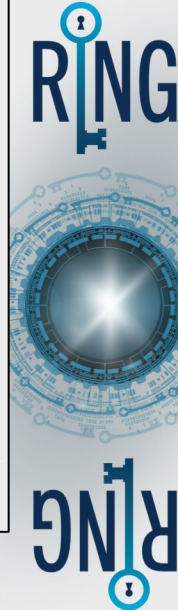
**Program Manager** RING 2



**UAH CCRE** **Jesse Hairston**

○○○ **Assistant Director**

**Certified Ethical Hacker** Jesse works to expand cyber education by creating curricula and opportunities that are accessible to new learners.



# Pathways from RING to UHMC and other UHCCs

For high school juniors, seniors and college students who want to explore the field of cybersecurity – a growing field with the potential for great careers and futures! Learn through hands-on activities that are used by cybersecurity professionals to protect information and defend from cyber thieves and attacks.

**Certificate of Competence (CO) in Information Security (12 credits):**

*(All courses are taught completely online via the WWW)*

- **ICS 101** – Digital Tools for an Information World (3 credits)...introduction to digital technology.
- **ICS 169** – Introduction to Information Security (3 credits)...covers 10 core areas of **ISC2**
- **ICS 184** – Introduction to Networking (3 credits)...covers CompTIA **Network+**
- **ICS 171** – Introduction to Computer Security (3 credits)...covers CompTIA **Security+**

### CYBERSECURITY SUPPLY/DEMAND HEAT MAP

All

Public Sector Data

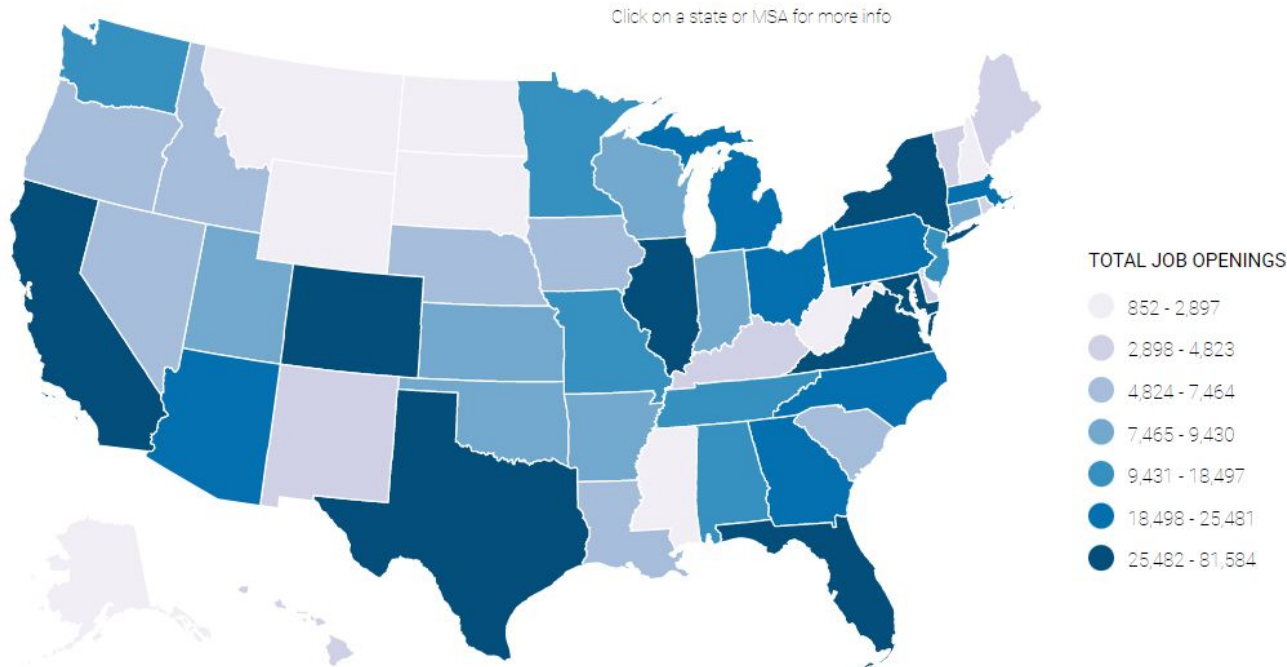
Private Sector...

Total job openings

States Metro Areas Search State

Cybersecurity talent gaps exist across the country. Closing these gaps requires detailed knowledge of the cybersecurity workforce in your region. This interactive heat map provides a granular snapshot of demand and supply data for cybersecurity jobs at the state and metro area levels, and can be used to grasp the challenges and opportunities facing your local cybersecurity workforce.

Share



# Hawaii

TOTAL CYBERSECURITY JOB OPENINGS ⓘ

4,053

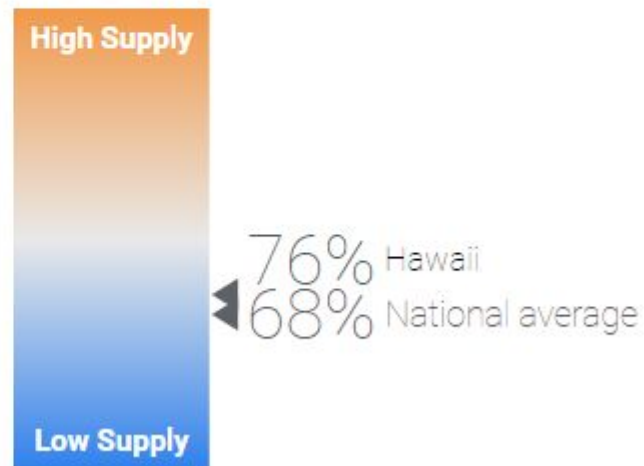


TOTAL EMPLOYED CYBERSECURITY  
WORKFORCE ⓘ

6,340



SUPPLY/DEMAND RATIO ⓘ

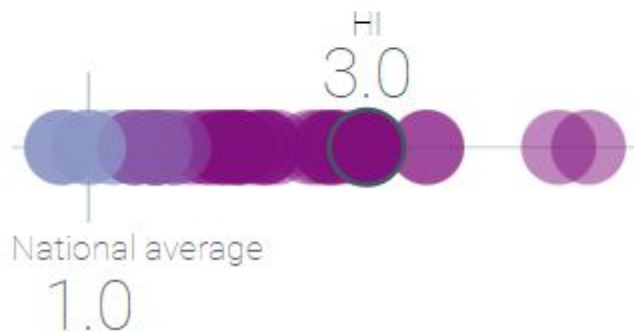




## GEOGRAPHIC CONCENTRATION ⓘ

Very High

### LOCATION QUOTIENT



## TOP CYBERSECURITY JOB TITLES ⓘ

- Network Engineer
- Cybersecurity Consultant
- Cybersecurity Analyst
- Software Developer
- Cybersecurity Manager
- Cybersecurity Specialist
- Systems Administrator
- Systems Engineer
- Penetration & Vulnerability Tester

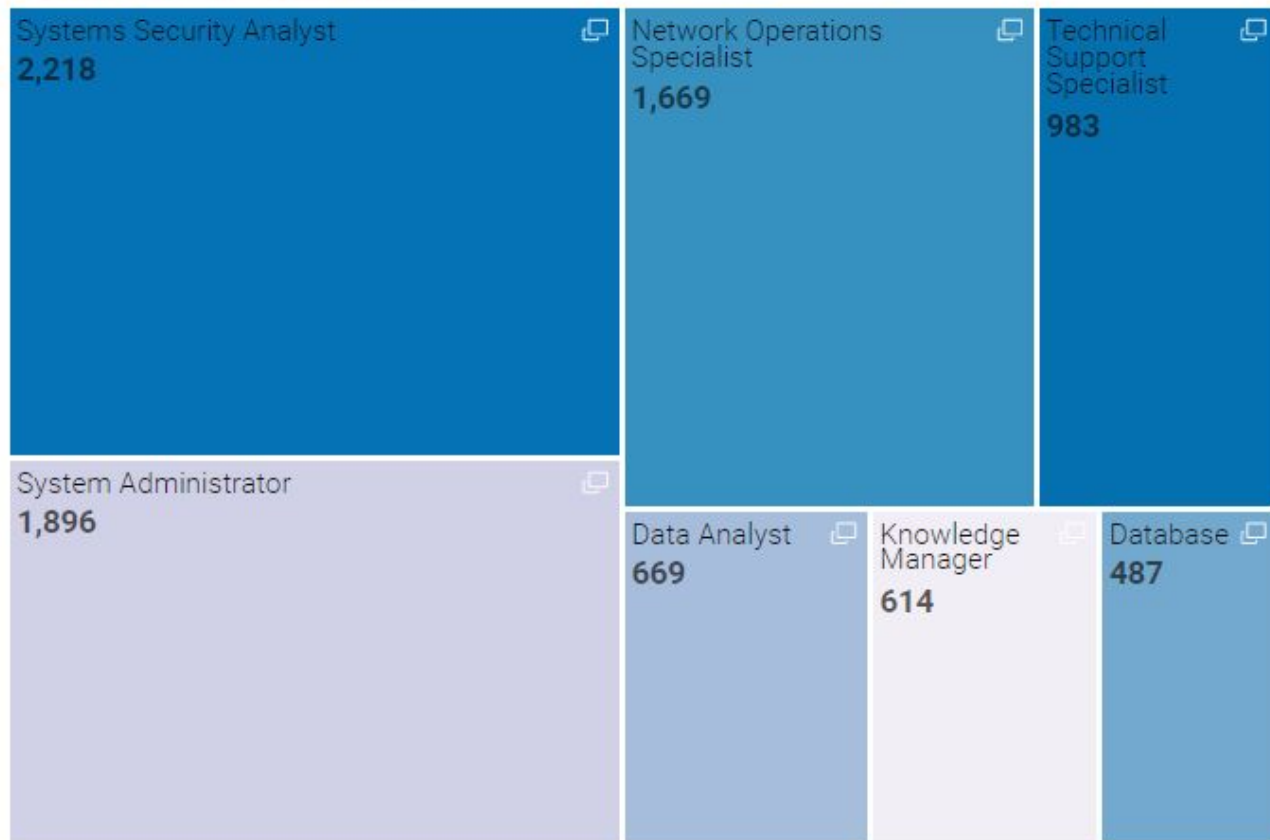
## JOB OPENINGS BY NICE CYBERSECURITY WORKFORCE FRAMEWORK CATEGORY

### NICE



Notes: The NICE Workforce Categories are not mutually exclusive- one job could perform multiple roles within the framework. The data shown here are not intended to be aggregated.

## ↑ NICE - Operate & Maintain

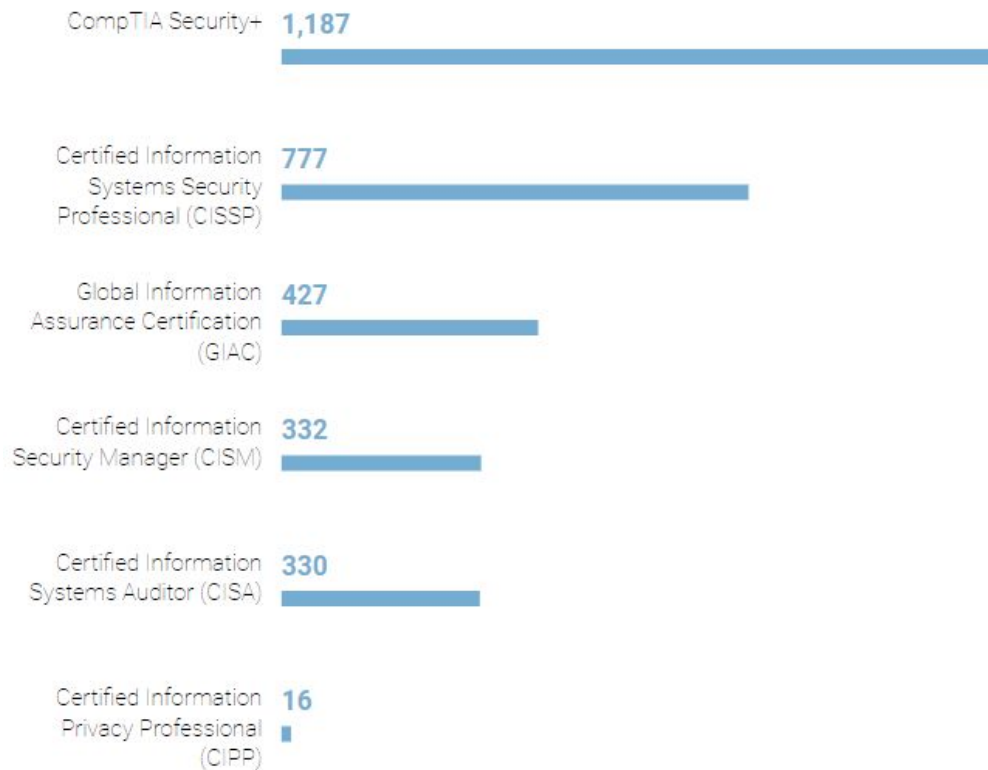


Notes: The NICE Workforce Categories are not mutually exclusive- one job could perform multiple roles within the framework. The data shown here are not intended to be aggregated.

## CERTIFICATION HOLDERS / OPENINGS REQUESTING CERTIFICATION ⓘ

■ Certification holders

■ Openings requesting certification



# QUESTIONS? COMMENTS?!

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