The Future of Work: Integrating Emerging and Cross-Cutting Technologies: Cybersecurity

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Preparing Technicians for the
FUTURE OF WORK
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Leading Change in Education

Project Goals

1. Empower community colleges to prepare technicians for the work of the future.
2. Promote regional collaboration between community colleges and industry to determine the technical demands of work of the future.
3. Support ATE Regional Networks focused on technician education for the work of the future.
4. Foster implementation of the cross-disciplinary STEM core to maximize impact on technician education

What's Happening?

- Nature of work changing at unprecedented speeds
- Technology advancements in machine learning, AI, IoT, and robotics eliminating some jobs, creating others
- Technicians sit at the center of much of this disruption
- Education must keep up
- Our students' career paths will evolve

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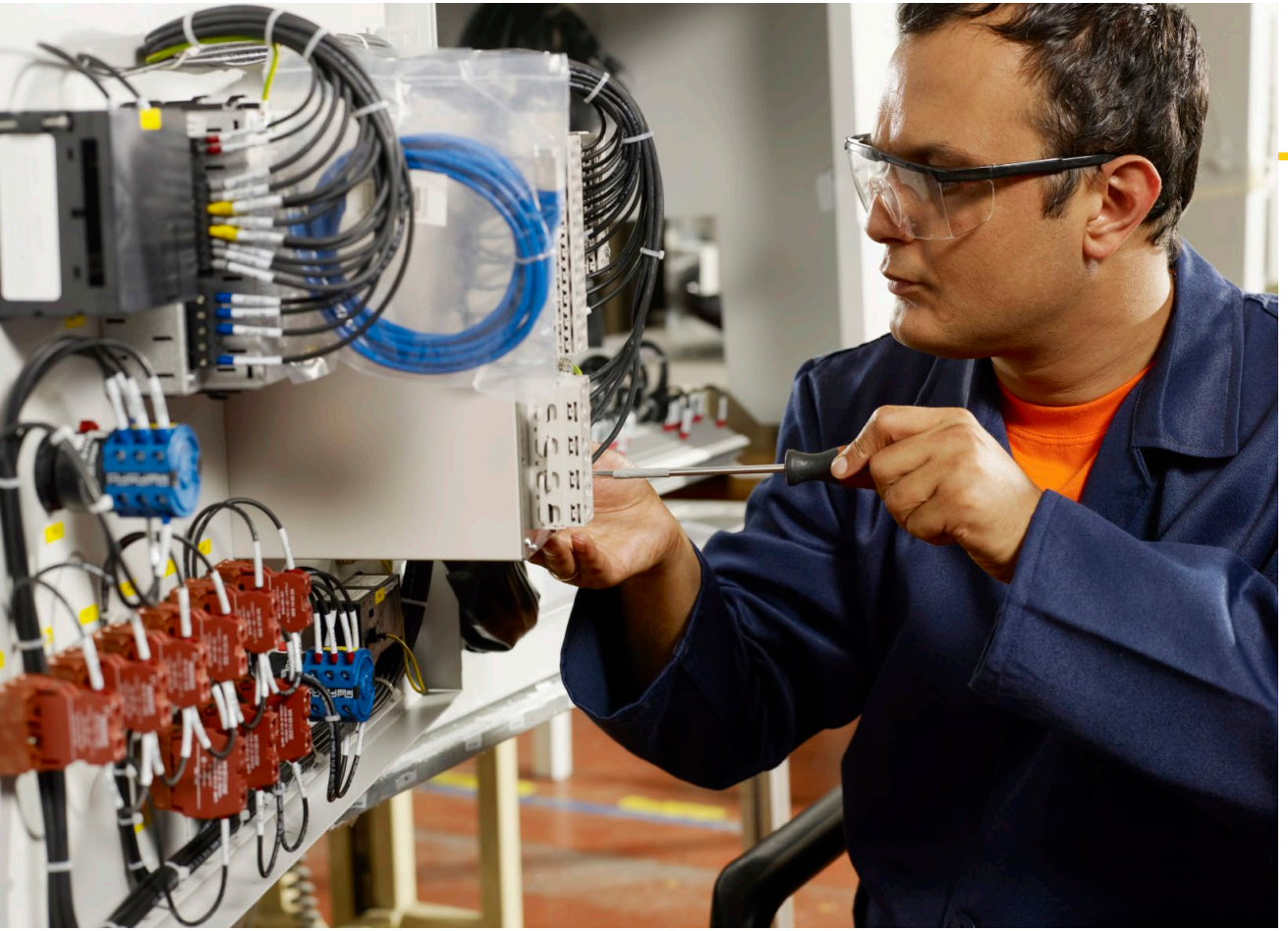
Future-proofing STEM Technicians



The Cross-Disciplinary STEM Core:

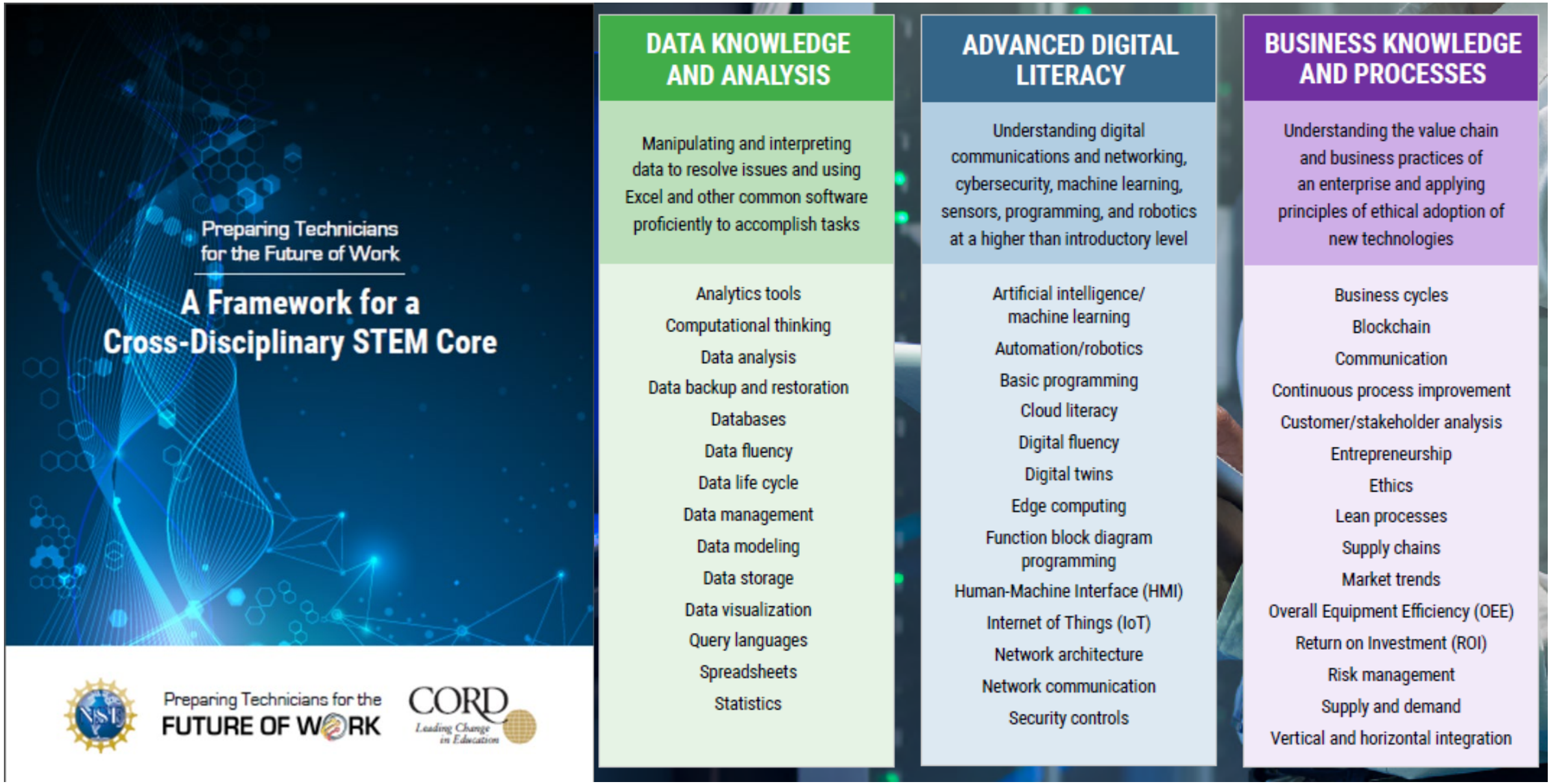
Skill Area 1: Data Knowledge and Analysis

Skill Area 2: Advanced Digital Literacy

Skill Area 3: Business Knowledge and Processes

By Integrating the Cross-Disciplinary STEM Core into Technical Programs

A Framework for a Cross-Disciplinary STEM Core



Welcome John Sands

Preparing Technicians for the FUTURE OF WORK

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At the Project Website:
Preparingtechnicians.org
Tools and Resources to Help You Take Action

- Read and share *A Framework for a Cross-Disciplinary STEM Core*
- Download, share and implement cross-disciplinary instructional cards in your class
- Listen to podcasts featuring cutting-edge industry interviews
- Share recorded webinars

Cross-Disciplinary Instructional Cards

Data Knowledge and Analysis

Manipulating and interpreting data to resolve issues and using Excel and other common software proficiently to accomplish tasks


DATA KNOWLEDGE AND ANALYSIS — For Students

Data Visualization

What Is Data Visualization?

Data visualization represents information in the form of a chart, diagram, picture, or infographic so that the data can be quickly and easily understood. Technicians use data visualization software to create graphics that communicate complex and relational information to a variety of audiences.

Vocabulary

- Dataset – a collection of data, often organized in a spreadsheet or database
- Chart – a graphic representations of data; examples are charts, pie charts, histograms, line graphs for example
- Scale – marks on a visualization that indicate the range of data values presented. A scale on a graph reflects the magnitude of the data presented.

Common Types of Data Visualization

- A pie chart uses "pie slices" to show relative sizes of data.
- A histogram uses bars of different heights to group data into ranges.
- A scatter plot uses points plotted on an XY axis to show the relationship between two sets of data.

How will a technician use data visualization?

Evan Garcia is a technician for Green Mountain Power Company. He is responsible for tracking increased system outages over time across a metropolitan network, collects outage statistics, including system logs, environmental information, and helpdesk ticket details from network nodes and service centers in order to determine the cause. Evan stores the data in an Excel workbook, then imports data into SAS, Tableau, or MS Power BI visualization tools and creates a dashboard to present to management. The data dashboard provides an interactive geographical heat map showing outage details and other graphical representations of his data analysis of the event. The heat map allows management to make real-time decisions and troubleshoot problems.

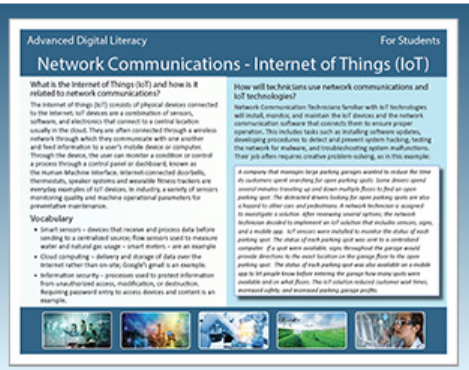
A heat map uses a warm to cool color spectrum to represent data values by color.

Instructional Activity Cards:

- Data Visualization
- Data Literacy/Fluency
- Spreadsheets
- Analytics Tools

Advanced Digital Literacy

Understanding digital communications and networking, cybersecurity, machine learning, sensors, programming, and robotics at a higher than introductory level


Advanced Digital Literacy — For Students

Network Communications - Internet of Things (IoT)

What is the Internet of Things (IoT) and how is it related to network communications?

The Internet of things (IoT) consists of physical devices connected to the Internet, IoT devices are a combination of sensors, software, and electronics that connect to a central location usually in the cloud. They are often connected through a wireless network through which they communicate with one another and feed information to a user's mobile device or computer. Through the device, the user can monitor a condition or control a process through a control panel or dashboard, known as the Human Machine Interface. Internet-connected doorbells, thermostats, speaker systems and wearable fitness trackers are everyday examples of IoT devices. In industry, a variety of sensors monitoring quality and machine operational parameters for preventative maintenance.

Vocabulary

- Smart sensors – devices that receive and process data before sending to a centralized source; flow sensors used to measure water and natural gas usage – smart meters – are an example
- Cloud computing – delivery and storage of data over the Internet rather than on-site; Google's gmail is an example.
- Information security – processes used to protect information from unauthorized access, modification, or destruction. Requiring password entry to access devices and content is an example.

How will technicians use network communications and IoT technologies?

Network Communication Technicians familiar with IoT technologies will install, monitor, and maintain the IoT devices and the network communication software that connects them to ensure proper operation. This includes tasks such as installing software updates, developing procedures to detect and prevent system hacking, testing the network for malware, and troubleshooting system malfunctions. Their job often requires creative problem-solving, as in this example:

A company that manages large parking garages wanted to reduce the time its customers spent searching for open parking spots. Some drivers spend several minutes traveling up and down multiple floors to find an open parking spot. The distracted drivers looking for open parking spots are also a hazard to other cars and pedestrians. A network technician is assigned to investigate a solution. After reviewing several options, the network technician decided to implement an IoT solution that includes sensors, signs, and a mobile app. IoT sensors were installed to monitor the status of each parking spot. The status of each parking spot was sent to a centralized computer. If a spot were available, signs throughout the garage would provide directions to the most location on the garage floor to the open parking spot. The status of each parking spot was also available on a mobile app so lot people know before entering the garage how many spots were available and on what floors. The IoT solution reduced customer wait times, increased safety, and increased parking garage profits.

Instructional Activity Cards:

- Network Communications – Internet of Things
- Automation/Robotics/HMI
- Basic Programming-Python
- Digital Twins
- Network Architecture

Business Knowledge and Processes

Understanding the value chain and business practices of an enterprise and applying principles of ethical adoption of new technologies


Business Knowledge & Processes — Student Resource

ENTREPRENEURSHIP

What Is Entrepreneurship?

Entrepreneurship is the concept of developing and overseeing a new business for profit. Working inside a company and thinking like an entrepreneur by asking "how can we improve this process?" is just as important. Entrepreneurship means thinking beyond troubleshooting or problem solving. It involves taking extra effort that yields potential new products, services or processes.

Vocabulary

- Entrepreneur—An individual who starts a new business venture. Typically, the individual who takes on most of the risk and develops the business concept.
- Venture—A business enterprise in which the expectation of gain is accompanied by the risk of loss or failure.
- Capital—The wealth or assets available to invest in a business.
- Business Model—A description of how a business will be able to create and deliver value and become profitable.
- Market Research—Relevant data that helps demonstrate market potential for a business venture.
- Intellectual Property—Works or inventions that is the result of creativity to which one has rights and can apply for a patent, copyright, or trademark.

How will an entrepreneurial mindset be used in the workplace?

An Industry 4.0 technician of tomorrow needs creative entrepreneurial thinking as a new, expected skill. John Gruene is an automotive technician at Advanced Auto. Lately John and his team have experienced several customer complaints regarding repair times. Using an entrepreneurial mindset, John identified the problem and then researched possible solutions and their value propositions. He asked questions like: how much is customer satisfaction and loyalty worth? and how much time and money can be saved through more accurate diagnosis and efficient repair? He then approached his supervisor about a potential solution he has researched that will provide better customer service, shorter wait times, and fewer errors by the technicians, resulting in higher profits for the business.

In another example, Casey Sanders is a robotics technician at Cooper Biologic, an automated filling and packaging company. Over the last seven days, a robot gripper has been dropping every hundredth vial. The fault affected everything down the line, to the point at which several boxes shipped to a customer were short a few vials. This is clearly not an acceptable business practice. Casey applied troubleshooting skills to

Instructional Activity Cards:

- Entrepreneurship
- Communication
- Lean Processes
- Supply and Demand

Podcasts

Episode 38: Technicians in the New Blue Economy
Podcast Guest: Justin Manley, President of Just Innovation, Inc. April 2022 |

Read More »

Episode 37: Incorporating the Internet of Things
Podcast Guests: Kristine Christensen, Director of Faculty Development, Professor of MIS, Moraine

Read More »

Episode 36: Supply Chain Automation In Transition
Podcast Guest: Phil Gilkes, Regional Maintenance Manager, Dollar Tree Distribution Centers February 2022

Read More »

What Should Educators Know and Do about Preparing Technicians for the Future of Work?
Podcast Interviews Provide Direction

www.preparingtechnicians.org/podcasts

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i. **Podcasts: Automation, Robotics, and Advanced Manufacturing**
ii. **Podcasts: Digital Skills, Digital Mastery. Digital Twins, Simulation**
iii. **Podcasts: Industry, Factory, and Education Trends**
iv. **Podcasts: New Skills, New Generations of Students**

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i. **Podcasts: Automation, Robotics, and Advanced Manufacturing**

AUTOMATION, ROBOTICS, AND ADVANCED MANUFACTURING		
Topic and Episode(s)	**Discovery**	**Recommended Action**
1. A Robot for Every Technician? PC13 and PC22	A robot for every technician is an emerging trend in the workplace.	Ask yourself if it is possible for you to consider something similar in your education and training space? A robot (or an automated system) for every student, in every learning situation?

Recordings of This Webinar Series

1. Preparing Technicians Using the Cross-Disciplinary STEM Core
2. Professional Development and Instructional Resources
3. Future of Work: Integrating Emerging Technologies

https://www.preparingtechnicians.org/webinars/

Cybersecurity Across the CTE Curriculum

NCyTE CENTER

December 14, 2023

NCyTE CENTER

Dr. John Sands

Co-PI, National Cybersecurity Training and Education Center (NCyTE)
Moraine Valley Community College

Cybersecurity Taught Across Multiple Disciplines

The Future of Work

Topics

WHY CYBERSECURITY AS A CROSS DISCIPLINARY SKILLS

CHALLENGES AND BARRIERS TO TEACHING CYBERSECURITY ACROSS TECHNICAL DISCIPLINES

TIPS, RECOMMENDATIONS AND SOLUTIONS

EXAMPLES OF SUCCESSFUL FUTURE OF WORK CROSS DISCIPLINARY PROGRAMS

THE OPPORTUNITY AND THE APPROACH THAT WAS TAKEN

CYBERSECURITY RESOURCES AVAILABLE

CALL TO ACTION (CYAD)
JUNE 12-13TH MVCC

Why should cybersecurity be taught as a multiple disciplinary topics?

- Interconnectedness and Modern Systems
- Growing Types Threats
- Recent Impact of Attacks
- Ethical Responsibility
- Expansion of Regulations and Compliance (CMMC)
- Future Workforce Needs and Demands

What is Multi-disciplinary Cybersecurity Education?

OPERATIONAL TECHNOLOGY (OT) IS THE USE OF INFORMATION SYSTEMS TO INCREASE THE EFFICIENCY AND PRODUCTIVITY OF THE ORGANIZATIONS OPERATIONS. THESE TECHNOLOGIES DETECTS OR CONTROL THE THROUGH THE DIRECT MONITORING AND/OR CONTROL OF INDUSTRIAL EQUIPMENT, ASSETS, INFORMATION, PROCESSES AND EVENTS.

MANY MODERN JOB ROLES WILL REQUIRE KNOWLEDGE BEYOND TRADITION SKILLS AND ABILITIES. A TOP CANDIDATE SHOULD HAVE KNOWLEDGE OF THE BOTH OPERATIONAL TECHNOLOGIES AND THE THREATS AND RISK THAT ACCOMPANY THESE TECHNOLOGIES (CYBERSECURITY).

Complexity of the National Cybersecurity Workforce

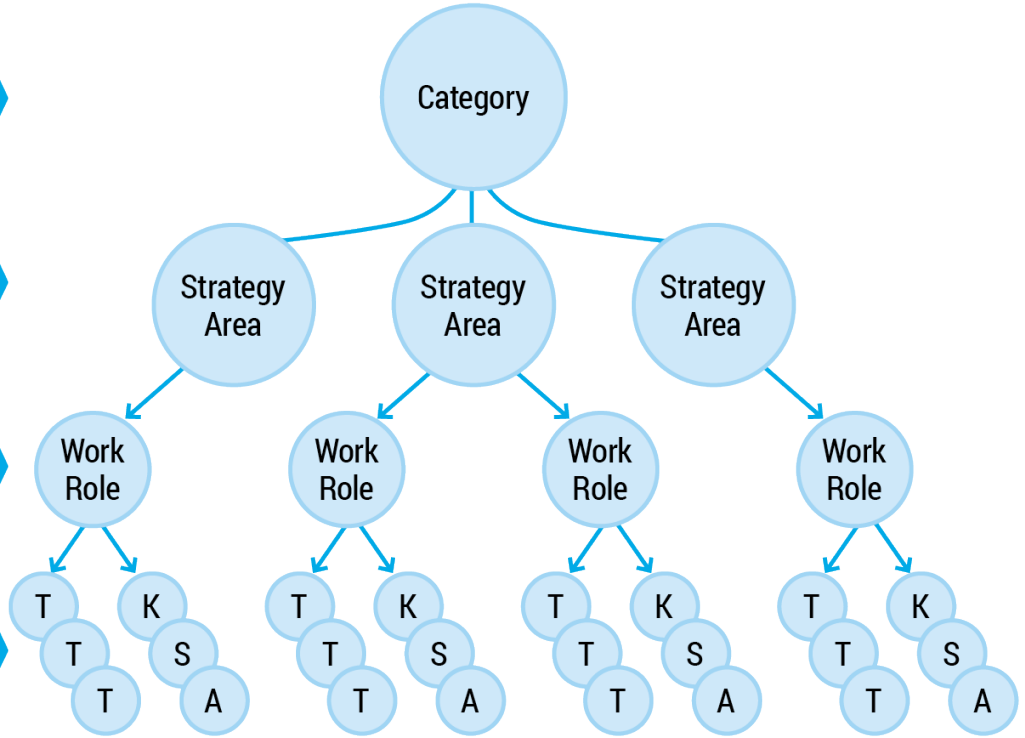
The National Initiative for Cybersecurity Education (NICE) Workforce Framework

7 categories of work

- Analyse
- Collect and Operate
- Investigate
- Operate and Maintain
- Oversee and Govern
- Protect and Defend
- Securely Provision

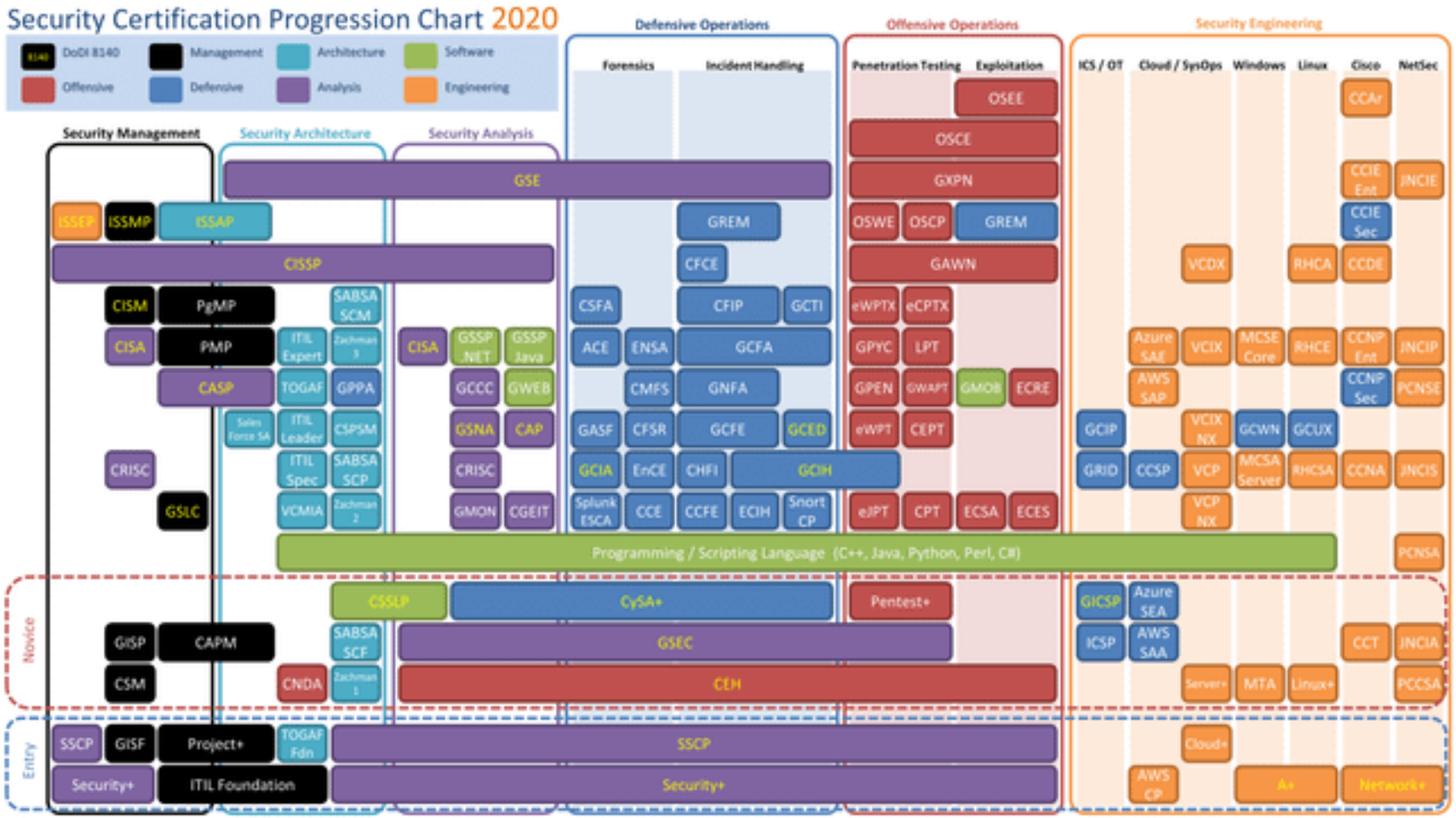
Structure of the Framework

- 7 Categories
- 32 Specialty Areas
- 52 Work Roles
- Tasks, knowledge, skills and abilities



SOURCE: Nice Framework

Complexity of Industry Credentials



Challenges and Barriers

- Classroom hours and prioritizing content
- Faculty knowledge and credentials
- Instructional content and student engagement
- Credentials and competencies

Tips, Recommendations and Solutions

- Teach the principles (CIA)
- Use case studies
- Promote student engagement
- Extra curricular activities
- Form learning communities

Recourses and Services

EMATES

Cryptography Exercises/Activities

Cybersecurity Games

3D/2D VR/ER/AR

Embedded AI

Virtual Labs and Lab Environment

Cybersecurity Case Studies

Relevant
Accessible
Rigorous
Engaging
Comprehensive

EMATE Library

myEMATES

Home | Cybersecurity | Cryptography | CMMC | Networking | Programming | Mathematics | Electronics

EMATE Interactives help students learn difficult concepts using animation. EMATES were first developed under the leadership of Mike Qaissaunee at the Brookdale Cyber Center and Dr. John Sands at CSSIA with funding from an NSF Grant (DUE 1601612). Use the interactives to help teach students and to develop their skills in a variety of disciplines.

ETHICS

MATH

BETTER WAY TO LEARN

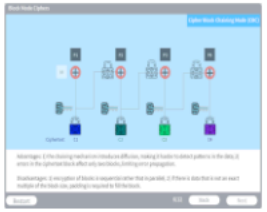
DIVERSE LEARNING STYLES

COMPUTER SCIENCE

ENGINEERING

Take a look at the new EMATES created and posted this summer

A Cryptography page has been added



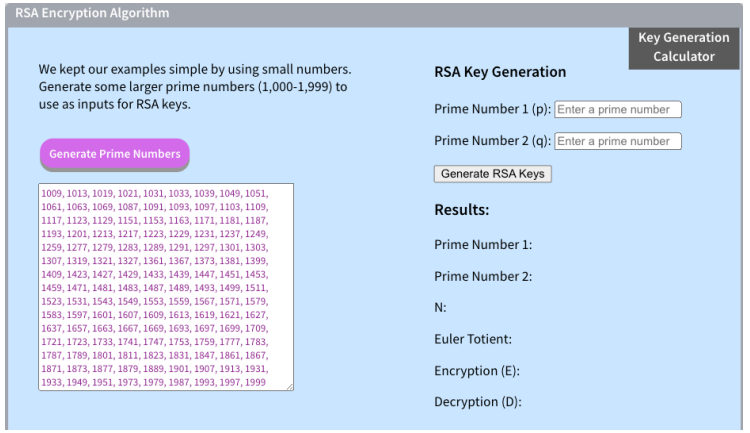
Block Mode ciphers used in symmetric encryption algorithms

Digital Signatures

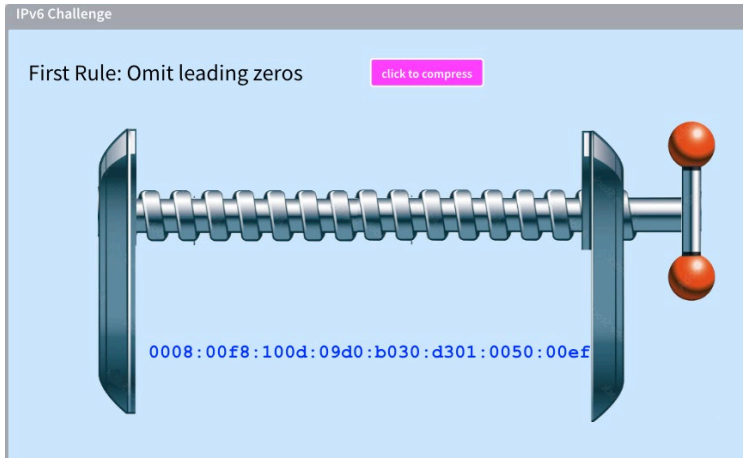
Encryption and Data Formatting

RSA Encryption Algorithm

Factoring and Prime Numbers are the building blocks for asymmetrical encryption algorithms

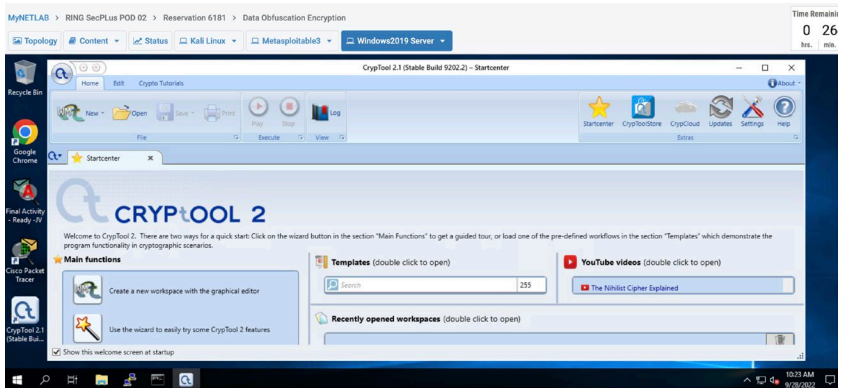


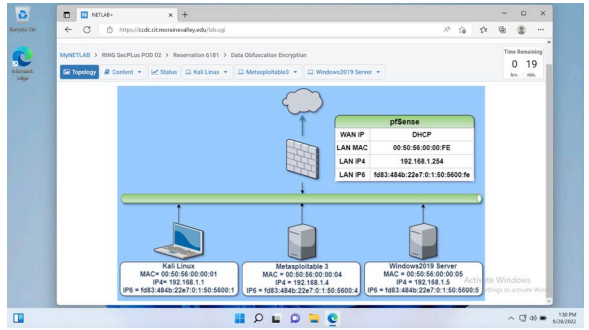
CYBERSECURITY PRINCIPLES

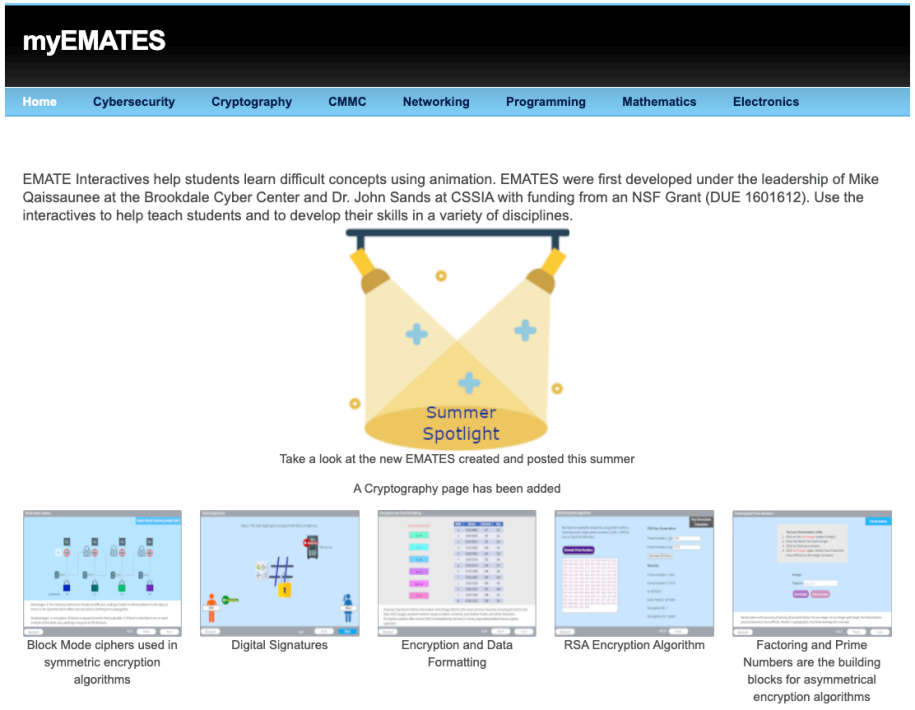


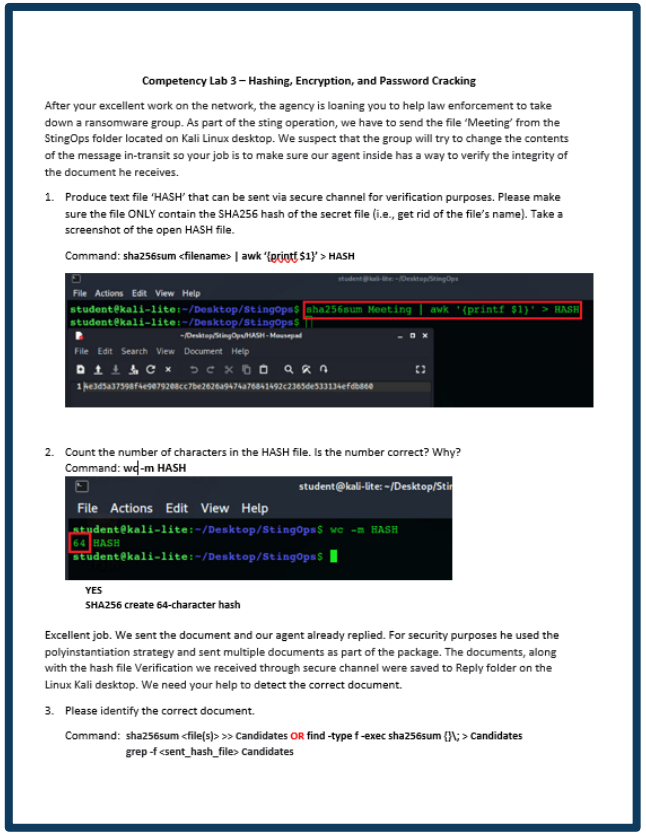
Teaching Technologies and Platforms









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 '{printf $1}' > HASH**

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

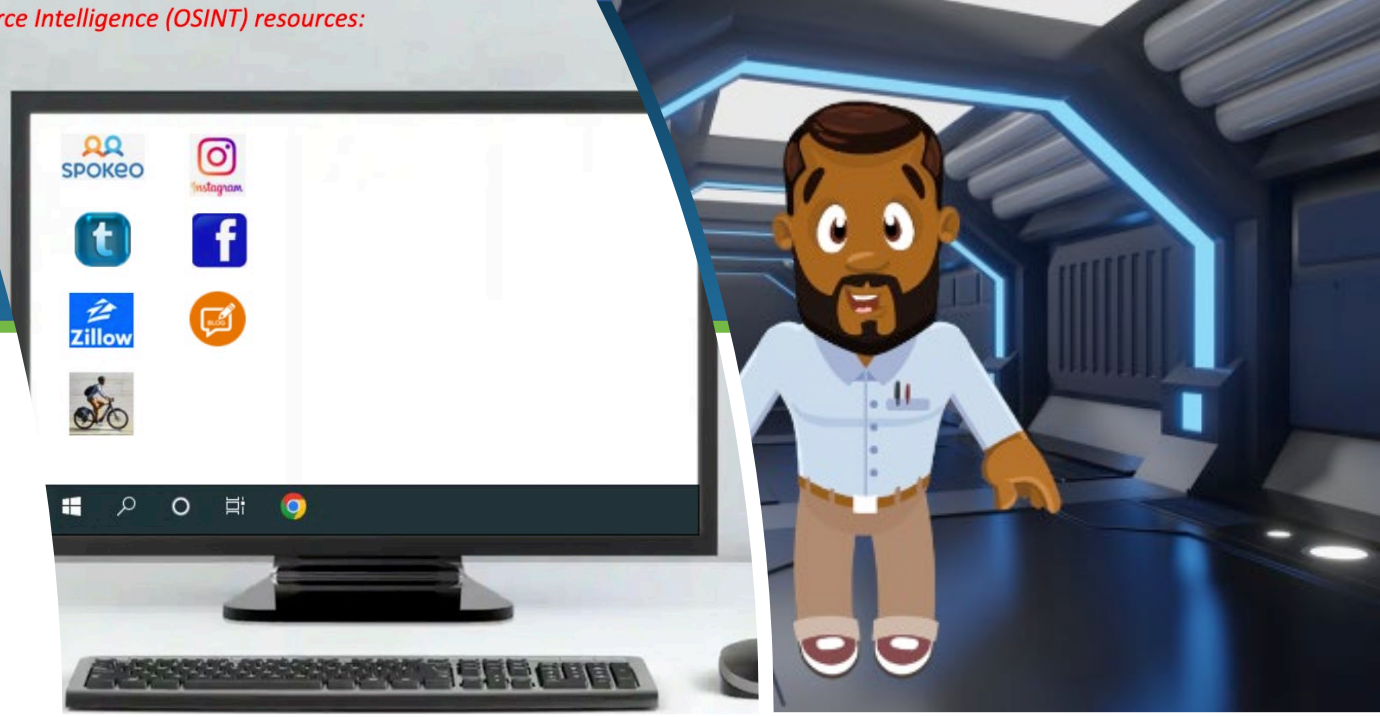
   YES
   SHA256 create 64-character hash

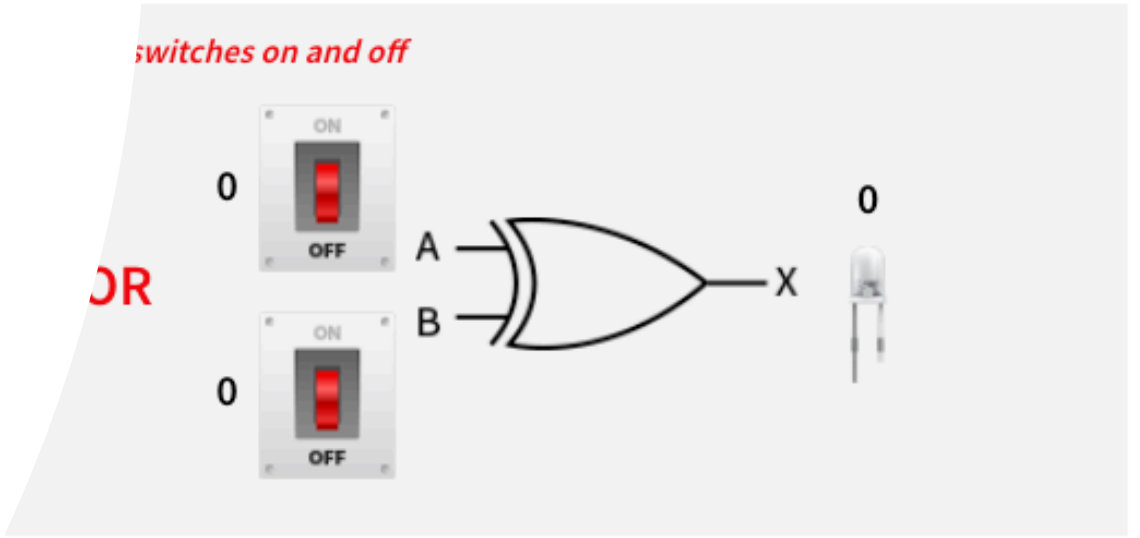
Excellent job. We sent the document and our agent already replied. For security purposes he used the polyinstantiation strategy and sent multiple documents as part of the package. The documents, along with the hash file Verification we received through secure channel were saved to Reply folder on the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

Cybersecurity Games





Boolean Expres

$X = A \oplus B$

INPUTS		OU
A	*B*	
0	0	
1	0	
0	1	
1	1	

Action Items

- **Find a community of practice (multi-disciplinary education) CYAD**
- **Engage NSA Centers of Academic Excellence**
- **NCyTE National Faculty Development Academy**
- **NCyTE Cybersecurity Content Library**

Future of Work
Is
Here

Questions / Comments ?