Unit 4 Cryptography & Linux

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 2**
Length: **4-6 weeks**
Status: **Published**

Brief Summary of Unit

Students begin by learning about how information is encoded in a computer. They learn about binary and hexadecimal encoding, among others. We then talk about cryptography by analyzing various historical ciphers, as well as steganography. Students will also learn about a kind of competition called "Capture the Flag," and tips for being successful in such competitions. We conclude by re-examining the Linux CLI learning how to search through files with the GREP command as well as scripting in Linux.

Revised Date: July 2025

Standards

MATH.K-12.1	Make sense of problems and persevere in solving them
ELA.L.SS.11–12.1	Demonstrate command of the system and structure of the English language when writing or speaking.
MATH.K-12.2	Reason abstractly and quantitatively
ELA.L.KL.11–12.2	Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.
MATH.K-12.6	Attend to precision
CS.6-8.8.1.8.DA.1	Organize and transform data collected using computational tools to make it usable for a specific purpose.
CS.6-8.8.1.8.DA.2	Explain the difference between how the computer stores data as bits and how the data is displayed.
CS.9-12.8.1.12.CS.1	Describe ways in which integrated systems hide underlying implementation details to simplify user experiences.
CS.9-12.8.1.12.CS.2	Model interactions between application software, system software, and hardware.
CS.9-12.8.1.12.DA.3	Translate between decimal numbers and binary numbers.
CS.9-12.8.1.12.DA.4	Explain the relationship between binary numbers and the storage and use of data in a computing device.
CS.9-12.8.1.12.NI.2	Evaluate security measures to address various common security threats.
CS.9-12.8.1.12.NI.3	Explain how the needs of users and the sensitivity of data determine the level of security implemented.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.

TECH.9.4.12.DC.3	Evaluate the social and economic implications of privacy in the context of safety, law, or ethics (e.g., 6.3.12.HistoryCA.1).
TECH.9.4.12.DC.5	Debate laws and regulations that impact the development and use of software.
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).

Essential Questions

- How do hexadecimal numbers work and how can we convert back and forth from decimal numbers?
- How have various cryptography methods been used from ancient history to modern day to protect vital information?
- What are bits, bytes, and binary numbers?
- What are different ways to encode data to help secure data?
- What are scripts and what commands can I use to find files on a Linux system?
- What is steganography and what are the tools that can be used to implement steganography?
- What is the purpose of the grep, >, and >> commands in Linux and where can they be used?

Enduring Understandings

- Bits are on/off states that are the basic building blocks for how computers process information. Bytes are groups of 8 bits. Binary numbers are the ones and zeros we use to symbolize bits.
- Cryptography has evolved over time as ciphers have been broken. Newer ciphers are developed, which are then "cracked," and the cycle continues. Currently, we use what is called asymmetric public key encryption as a core component of Internet security.
- GREP allows one to search through a text file. The ">" sends the output of a command to a file. The ">>" appends output to the end of content already in a file.
- Hexadecimal numbers are based off of 16 where every place value in a number is a power of 16.
- Scripts are mini programs that can be run in a command line. There are a few important commands we can use to help us determine if malware is active on a system.
- Steganography focuses on hiding information and not scrambling it. There are many tools that can be used.
- There are a wide variety ways to encode information depending on the use case.

Students Will Know

- Different ways to employ steganography.
- Historical ciphers and how they can be "cracked."
- How to interpret binary code.
- How to interpret hexadecimal code.
- Some different kinds of encoding commonly used by computers.
- The role that privacy and security play in our society.
- Various advanced Linux commands.

Students Will Be Skilled At

- Converting between binary, hexadecimal, and decimal values.
- Encrypting and decrypting for a given cipher.
- Identifying how a given piece of information has been encoded.
- Using various Linux commands for data manipulation and file analysis.

Assessment

Assessments

- Formative: Teacher observations, student-centered discussions, classwork, student-centered labs.
- Summative: Quizzes, tests, projects.
- Alternative: Verbal discussions and debrief.

Learning Plan

This curriculum follows cyber.org's "Cybersecurity 1" course as listed in the "One Semester Plan." Go to https://cyber.instructure.com/login/canvas and apply for a teacher account. Under "High School 9-12," you will find the Cybersecurity 1 course with detailed lesson plans and pacing. They assume roughly 45 minute classes. Below is a modified pacing guide to align more smoothly with our rotating drop schedule.

There are 5 assessment days that can be used throughout the course with the timing below if none of the "if time allows" lessons are taught. These days can be used for quizzes/tests as the teacher sees fit.

- Section 4.1 - Bits, Binary, and Encoding
    - 4.1.1 - Bits, Bytes, and Binary **(2 Classes)**
    - 4.1.2 - Hexadecimal Numbers **(1 Class)**
    - 4.1.3 - Encoding **(2 Classes)**
- Section 4.2 - Cryptography Basic Concepts
    - 4.2.1 - Cryptography Basic Concepts **(3 Classes)**
    - 4.2.2 - Steganography **(2 Classes)**
- Section 4.3 - Advanced Linux CLI
    - 4.3.1 - Advanced Linux CLI **(3 Classes)**
    - 4.3.2 - Scripting **(2 Classes)**
- Section 4.4 - Privacy vs Security
    - 4.4.1 - Privacy vs Security Debate **(3-4 Classes)**
        - If time allows

Materials

- Core instructional materials: Core Book List
- Supplemental materials: Resources from the cyber.org curriculum "Cybersecurity 1."

- Computers
- Teacher created activiites
- Teacher created notes
- Websites to research current events

Integrated Accommodation & Modifications

Possible accommodations/modification for Introduction to Cybersecurity