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CYBER SECURITY BOOT CAMP

Encryption

Session 4

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Teacher Lesson Plan

Session Name:

Encryption

Summary:

Students learn how alphanumeric symbols can be encoded for a multitude of fun purposes and computer security. In this session students learn about codes, and are asked to make their own with a limited number of symbols. Students discover the relationship among encryption, decryption, and shared keys.

Time Allotment:

75 minutes

Learning Objectives:

- History of Encryption
- Introduce students to simple codes
- Symmetric encryption and decryption workings
- The relationship between encryption and decryption
- Encryption schemes such as Cipher Wheels / the Enigma Machine

Supplies:

- Scrap paper / notepad to take notes
- Binary cipher activity worksheet (print)
- Paper enigma craft (print - 2 pages)
- Cipher strips (print)
- Laptop / computer with Internet access to research topic of selected project

Learning Activities:

- (2 - 5 minutes) - Teacher Introduction

  Introduce yourself to students if you are new to the classroom. If you are continuing from a previous session, start with welcome back.

- (2 - 5 minutes) - Volunteer Introductions

  Introduce any new volunteers that might be present. Teachers will be provided with a quick bio of each volunteer who are helping in the classroom. Only new volunteers need to be introduced.

- (5 minutes) - Session overview

  In computing, encryption is the method by which plaintext or any other type of data is converted from a readable form to an encoded version that can only be decoded by another entity if they have access to a decryption key. Encryption is one of the most important methods for providing data security, especially for end-to-end protection of data transmitted across networks.

  Encryption is widely used on the internet to protect user information being sent between a browser and a server, including passwords, payment information and other personal information that should be considered private. Organizations and individuals also commonly use encryption to protect sensitive data stored on computers, servers and mobile devices like phones or tablets.

- (5 minutes) - Student activity - Secret messages
  - *Students can use their cell phones or laptops to do this*
  - *Teacher can also demonstrate this on their screen*
  - *https://codemoji.org/*

- (6:44 minutes) - Video: Mary Queen of Scot's Cipher
  - *Codes have been used throughout history to keep messages secret. One famous example is Mary Queen of Scots.*
  - *https://www.youtube.com/watch?v=_htopuN4pCk*

- (10 minutes) - Student Activity: Simple encryption with binary
  - *Pass binary encryption worksheets to students*
  - *Give students overview of activity*

- *Instruct students to use the table to come up with their own encrypted word*
- *After 5 minutes, have the students pass the worksheet to different student*
- *Now it is time to decrypt the word*
- *Have students use the table to figure out encrypted word*

- (5 minutes) - Binary activity review

  Take few minutes to review how binary code hid the simple word

- (5 minutes) - Types of Encryption discussion

  Unencrypted data, often referred to as plaintext, is encrypted using an encryption algorithm and an encryption key. This process generates ciphertext that can only be viewed in its original form if decrypted with the correct key. Decryption is simply the inverse of encryption, following the same steps but reversing the order in which the keys are applied. Today's most widely used encryption algorithms fall into two categories: symmetric and asymmetric.

- (8 minutes) - Video: Enigma in Pringles Can

  https://www.youtube.com/watch?v=pZsuxZXN33g

  Pass "Papercraft Enigma" sheets for students to take home

- (15 minutes) - Student activity, Cipher Strips
  - *Pass cipher strips worksheet and encryption worksheet 2*
  - *Provide instructions to students on how to use strips by moving letters*
  - *Advanced students can come up with their own characters to fill in*
  - *Students can use different strips for each word in plain text*
  - *Inform student to write their key method on worksheet two*
  - *Have them encrypt a plain text sentence into encrypted text*

- (5 minutes) - Public Key / Private key examples

  Give a brief overview of PKI to students, and show some private key examples

- (5 minutes) - Movie Trailer - The Imitation Game
  - *https://youtu.be/S5CjKEFb-sM?t=18*
  - *Teacher can stop it at any time past 1:00 timestamp.*
  - *Recommend students to watch the movie in their spare time*

- (5 minutes) Wrap Up

  Remind students about importance of Encryption as it pertains to history, and the current implementations in cyber security

  The primary purpose of encryption is to protect the confidentiality of digital data stored on computer systems or transmitted via the internet or any other computer network. The Payment Card Industry Data Security Standard requires merchants to encrypt customers' payment card data when it is both stored at rest and transmitted across public networks.

- (2 minutes) - Session Feedback

  Have volunteers distribute feedback form to students, and give them a few minutes to fill out the survey.

  Volunteers to collect feedback forms and save them for event manager.

- (2 minutes) - What's next?

  Inform students that this is end of the day. All students must head back to Cafetaria before being picked up by their parents / guardians.

Encryption with binary

Although it is not very secret, binary numbers are a code. (Why do you think they call it 'coding'?). To give you practice encoding and decoding a message, use this Unicode chart for the upper case letters as a cipher strip. For example, the word "HELLO" can be coded as:

1001000100010110011001001100100111 1

Decoding:

Each letter above uses seven digits. Circle the digits for each letter, look up the number in the chart, and write the letter beneath the number.

Encoding:

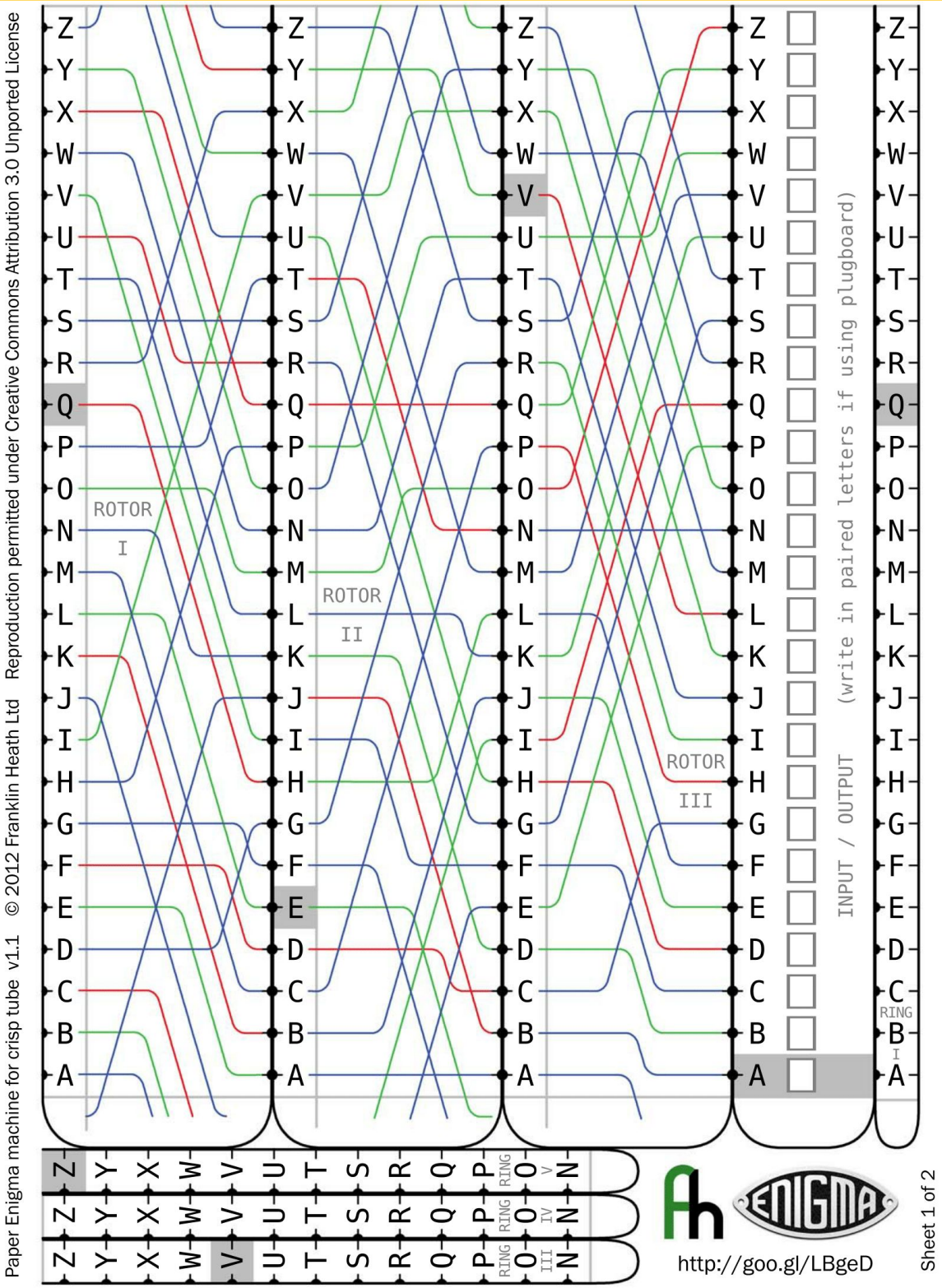
Write a word here that is at least 5 and no more than 8 characters

_____ _____ _____ _____ _____ _____ _____ _____

Using the table, write out the word on a separate piece of paper. Have your partner check that you correctly encoded your work.

Give your paper to another member of your class. Challenge them to decode it.

A	1000001
B	1000010
C	1000011
D	1000100
E	1000101
F	1000110
G	1000111
H	1001000
I	1001001
J	1001010
K	1001011
L	1001100
M	1001101
N	1001110
O	1001111
P	1010000
Q	1010001
R	1010010
S	1010011
T	1010100
U	1010101
V	1010110
W	1010111
X	1011000
Y	1011001
Z	1011010


ROTOR I
ROTOR II
ROTOR III
INPUT / OUTPUT (write in paired letters if using plugboard)
RING
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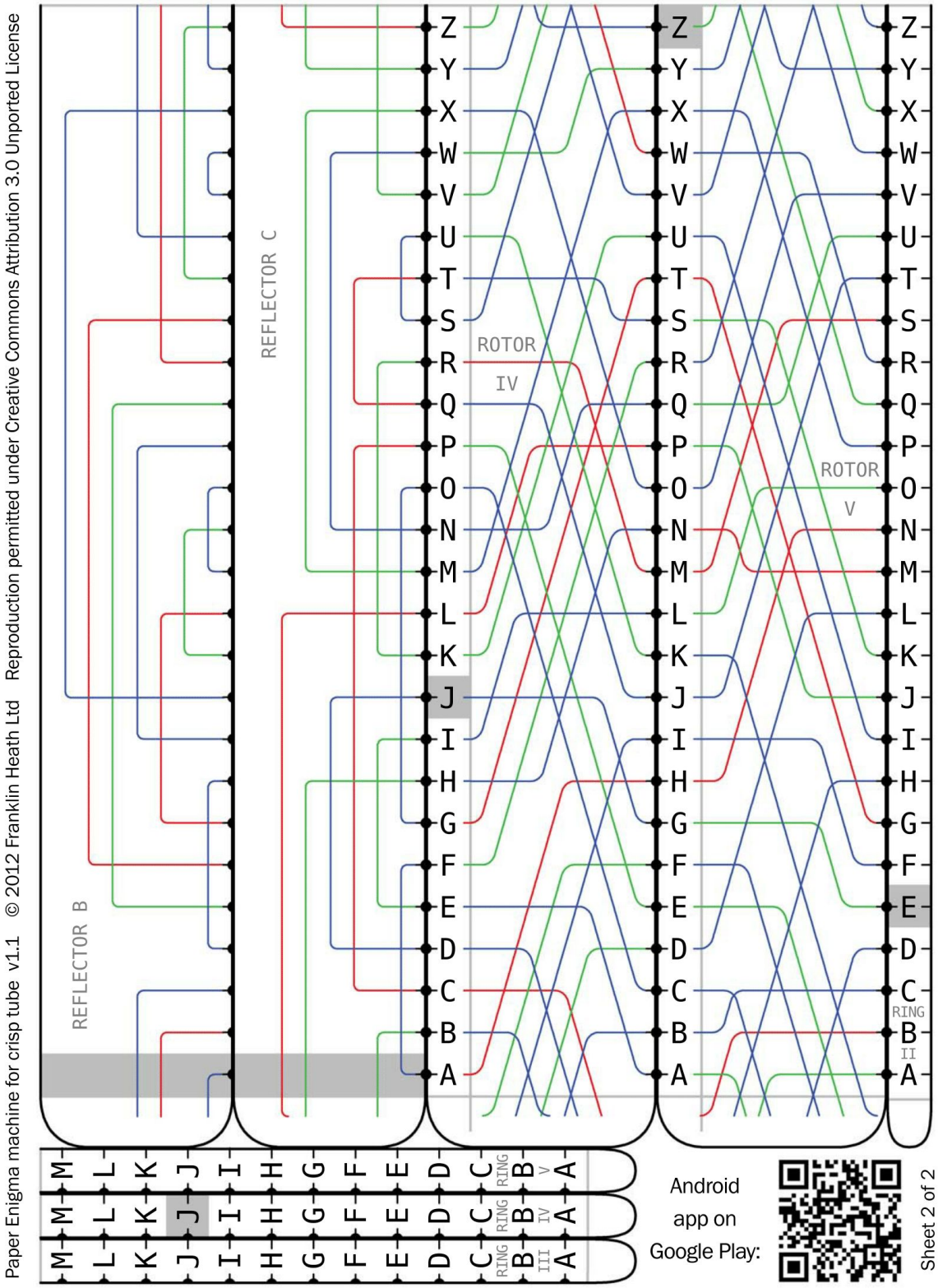
http://goo.gl/LBgeD
Sheet 1 of 2



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Cipher Strips

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z