Mason Competitive Cyber

Meeting 1: Welcome Back!

Welcome (or Welcome Back)!

- We're The Executive Board
  - **Michael Bailey** – President – Likely Speaker
  - **Paul Benoit** – Co President – Likely Speaker
  - **Ammar Al-Kahfah** – Secretary
  - **Ali Sharaf** – Treasurer
- Faculty Advisor: Jim Jones

What are we?

- Our Official Status: Tier II Registered Student Organization
- Cybersecurity Focus
- Competition Focus
- No barrier to entry

What do we do?

- Weekly meetings (you're at one)
- Different topics every week
  - Linked at competitivecyber.club
- Competes, largely over weekends, largely online

What's coming up?

- Metropolis – Feb 18th
  - Big competition and job/internship fair at UMD
  - Can't guarantee there'll be an in-person after this
  - Seems to be largely jeopardy-style CTF (see next slide)
  - Join **#metropolis** for more
- CryptoParty – Feb 25th
  - SRCT-LUG-CC co-run
  - Zero-experience-needed Cryptography workshop
  - Not related to competition, just for public awareness
  - Join **#cryptoparty** for more

AlexCTF: Disperse

- If you are done with this or know basic ciphers already, go to compete in AlexCTF
- Slides will be available on Slack/GDrive
- **Competing? JC Room D**

What's a CTF?

- Jeopardy Style
  - Question-Answer version
  - Questions worth points, sometimes bounty
  - Cryptography, Forensics, Reverse Engineering, etc
- Attack Defense Style
  - Less common
  - Harder to organize
  - Harder to compete in
  - Often in-person

What's a CND?

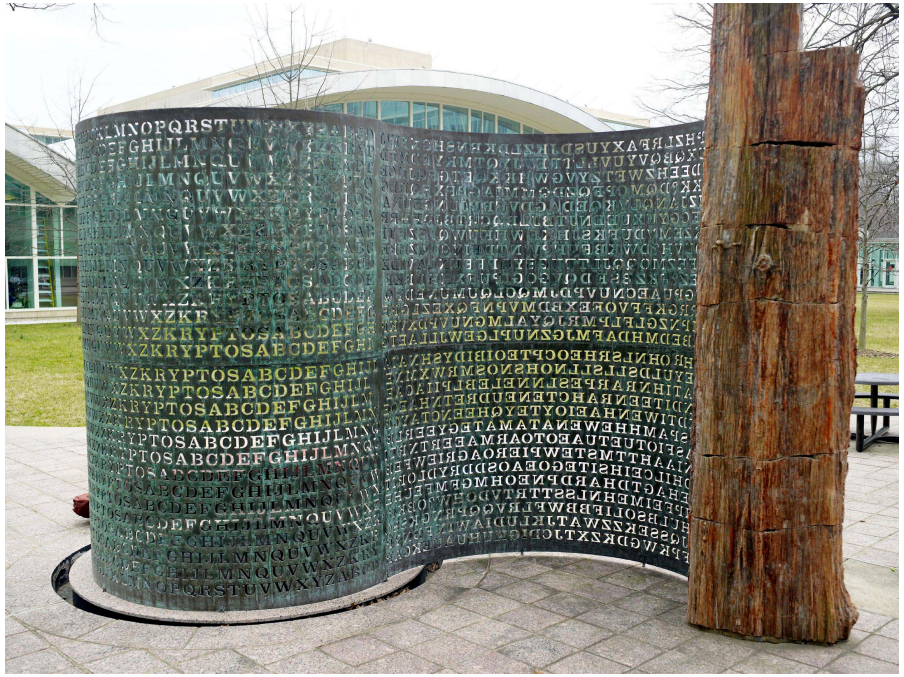
- Computer Network Defense
  - "Blue Team" – Common Industry Term beyond
  - Defending Computer Networks/Systems from Attackers
- CCDC
  - We are working on acquiring the rights to it
- MDC3
  - Defunct as of 2017 due to poor organization

Ciphers

- What are they?
  - Oftentimes (not always) shitty ways to protect information (pretty much except for OTP)
  - Oftentimes basic CTF problems
- Mason CC -> cc nosam
- More common in early historical wartime when nobody had real encryption
- Many kinds, some require keys, some require a code, some require literally just clear text
- **Ciphertext:** Ciphered text you can't immediately get ("cc nosam")
- **Clear text/Plain text:** Basic text you and I read (the "Mason CC")

CIA Statue Kryptos

- Huge statue of ciphertext in front of Langley CIA, partially solved
- Wikipedia has a solid breakdown



Rumkin

- rumkin.com/tools/cipher
- The mecca of basic cipher cracking
- Has every tool ever
- Try each one on all possible combinations, profit

- **Also useful, Cryptogram Solver: http://quipqiup.com/**

Spamming Online Solvers = You Suck at Crypto

- Many of the ciphers we will talk about can be easily solved online **if they are used on their own**
- Seeing ciphers is like “reading the field” in sports
  - It takes practice
  - Not everyone can do it

AlexCTF Crypto1

- ZERO ONE ZERO ZERO ONE ONE ZERO ZERO ZERO ONE ONE ZERO ONE ZERO ZERO ONE ZERO ZERO ONE ONE ZERO ZERO ZERO
- Decode to Binary → 01001100011010010011000001100111
- Decode to ASCII → Li0gLi0uLiAuIC0uLi0gLS4tLiAtIC4uLS4gLSAuLi4uIC4tLS0tIC4uLi4uIC0tLSAuLS0tLSAuLi4gLS0tIC4uLi4uIC4uLSAuLS0uIC4uLi0tIC4tLiAtLS0gLi4uLi4gLiAtLi0uIC4tLiAtIC4uLS4gLSAuLi4uIC4tLi4gLiAtLi0uIC4tLiAuLi4tLSAtIC0uLS4gLQ==
- Base64 decoded → .- .-.. . -..- -.-. - ..-. - .... .-
- Morse decoded → ALEXCTFTH15O1SO5UP3RO5ECR3TOTXT
- Flag → AlexCTF{TH15_1S_5UP3R_5ECR3T_TXT}

“An Enigma” by Edgar Allan Poe

"Seldom we find," says Solomon Don Dunce,
"Half an idea in the profoundest sonnet.
Through all the flimsy things we see at once
As easily as through a Naples bonnet-
Trash of all trash!- how can a lady don it?
Yet heavier far than your Petrarchan stuff-
Owl-downy nonsense that the faintest puff
Twirls into trunk-paper the while you con it."
And, veritably, Sol is right enough.
The general tuckermanities are arrant
Bubbles- ephemeral and so transparent-
But this is, now- you may depend upon it-
Stable, opaque, immortal- all by dint
Of the dear names that he concealed within 't.

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- Go there now

Caesar

- Regular Caesar: Shift every letter over one letter
- ROT13: So easy, literally just Caesar with a key shift of 13
- Affine Cipher: Adds multiplier to Caesar
- Keyed Caesar Cipher: Encodes alphabet with a key

Example Alphabets, No Shift	
Standard	ABCDEFGHIJKLMNOPQRSTUVWXYZ ABCDEFGHIJKLMNOPQRSTUVWXYZ
Keyed	ABCDEFGHIJKLMNOPQRSTUVWXYZ **rumkinco**ABDEFGHJLPQSTVWXYZ

- **To identify: Same character patterns and the like, just different characters**

Vigenere

- Vigenere Cipher: Like Caesar, changes shift number with each letter, kinda hard at least for beginners, uses a key
- Gronsfeld: Vigenere, but with numbers instead of a key
- Keyed Vigenere: Uses two keys to offset alphabet, for Kryptos sculpture
- Vigenere Autokey: Uses password once, then plaintext to encode

Atbash

- Reverse character set
- A<->Z, B<->Y, etc

Baconian

- Super common in CTFs
- All B's and A's
- Mason CC: ABBAAAAAAABAABAABBBAABBAB AAABAAAABA
- Two versions, one uses distinct codes for all whereas the other uses I and J as the same and U and V as the same
- Typefaces of 5 characters of As and/or Bs

Base64

- Form of encoding to make binary data safe to transport
- **Extremely common** in CTFs
- masoncc -> bWFzb25jYwo=
- How to identify: Alphanumeric blog ending in either nothing, or =’s
- Needs a certain character length so it pads the remainder with =s

Bifid

- Breaks message into row-column coordinate pairs
- Resets the coordinates in a linear format
- Optional alphabet key
- Often omits one letter like J

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

```
letter: A B C D
   row: 1 1 1 1
column: 1 2 3 4

The numbers: 1 1 1 1 1 2 3 4
    Encoded:  A   A   B   O
```

Columnar Transposition

- Write onto column, move columns around
- Simple, on Kryptos statue
- **Double Transposition: Do it twice**
- Übch: Adds number to pad characters

	Unencoded	Rearranged
Column #:	4 2 5 3 1 W H I C H W R I S T W A T C H E S A R E S W I S S W R I S T W A T C H E S	1 2 3 4 5 H H C W I T R S W I H A C W T E S R E A S W S S I T R S W I H A C W T S E

Morse Code

- Pretty sure we all know what this looks like
- “Dit”s and “Dah”s
- Direct conversion
- Pretty distinct
- CTF example: ”Boop Boop” MP3

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 --..	0 -----	1 .----	2 ..---	3 ...--
4 ....-	5	6 -....	7 --...	8 ---..	9 ----.	. .-.-.-	, --..--	? ..--..	- -....-
= -...-	: ---...	; -.-.-.	(-.--.	) -.--.-	/ -..-.	" .-..-.	$ ...-..-	' .----.	¶ .-.-..
_ ..--.-	@ .--.-.	! ---.	! -.-.--	+ .-.-.	~ .-...	# ...-.-	&	⁄ -..-.	

Letters Numbers

- Replace each letter with the number of its position in the alphabet
- Really easy
- masoncc is fun -> 13-1-19-15-14-3-3 9-19 6-21-14

One Time Pad

- The best one
- Pretty much uncrackable if done right
- Relies on truly random key (“the pad”) to encrypt message
- masoncc is fun -> mvsrsey yu jzd

Playfair

- As seen in National Treasure
- “Sliding square” function
  - Feel free to Google particulars
- Takes Optional Alphabet Key

Railfence

- Rearranges the text in a “wave”
- Squash it together
- Concatenate remaining stuff
- Takes number of “rails” (wave lines) and offset (what wave to start on)

Rotate

- Simple, just write text in rectangle grid and rotate 90 degrees left or right

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- **Solve on your own or go play in CTF in JC Room D**
- We'll be coming around to sign for CS101