

# Codebusters Division A Workshop

Trial Event

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# Codebusters

- Introduction
- Event rules
- Review of code types
- Coaching for success
- Test tools
- Questions

# Codebusters Introduction

## Definitions:

- Plaintext (Unencoded) - **This is plaintext**
- Ciphertext (Encoded) - **CGGOR AOXFS REC**
- Key - Information used to **Encrypt Plaintext** specific to a particular cipher
- Decrypt - Convert **Ciphertext** into **Plaintext** with or without a **Key**
- Crib - a few known **Plaintext** letters for some **Ciphertext**
- Decryption Table – a table used to **Decrypt Ciphertext**
- Cryptanalysis - Analyzing **Ciphertext** to determine the **Key** then **Decrypt**

# Codebusters Rules Summary (See Official Rules)

## **Description:**

- “Students will be tested on their ability to decode encrypted messages using cryptanalysis techniques and show skills with ciphers by decrypting a message”
- Team of up to 2 students
- Teams only need pencils and erasers
- Students will not be able to finish the test
- Students may answer the questions in any order



# Codebusters Cipher Types

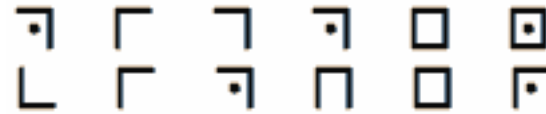
• **Atbash** - Mono-alphabetic substitution ATBASH  $\rightleftharpoons$  ZGYZHS

• **Caesar** - Mono-alphabetic substitution CAESAR  $\rightleftharpoons$  DBFTBS

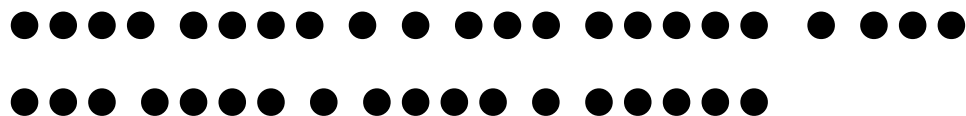
• **Vigenère** - Mono-alphabetic substitution with a key

VIGENERE  $\rightleftharpoons$  FMEORCBI

• **PigPen/Masonic** - Symbol based substitution



• **Tap Code** - Substitution Cipher



• **Aristocrat** - Mono-alphabetic substitution



# Codebusters Caesar

- Letter shifts will only be 1-5 characters
- Pick a short word and try all the options

<b>Shift</b>	<b>C</b>	<b>A</b>	<b>E</b>	<b>S</b>	<b>A</b>	<b>R</b>
<b>-3 (23)</b>	Z	X	B	P	X	O
<b>-2 (24)</b>	A	Y	C	Q	Y	P
<b>-1 (25)</b>	B	Z	D	R	Z	Q
<b>1</b>	D	B	F	T	B	S
<b>2</b>	E	C	G	U	C	T
<b>3</b>	F	D	H	V	D	U



3) [26 points] Solve this Caesar with a shift between -5 and 5.

G	R	Q	,	W	M	X	V	W	Z	L	V	K	I	R	U	L	W	,	Z	R	U	N
			,															,				

I	R	U	L	W	.
					.

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

3) [26 points] Solve this Caesar with a shift between -5 and 5.

G	R	Q	,	W	M	X	V	W	Z	L	V	K	I	R	U	L	W	,	Z	R	U	N	
I	R	U		L	W	.																	
						.																	

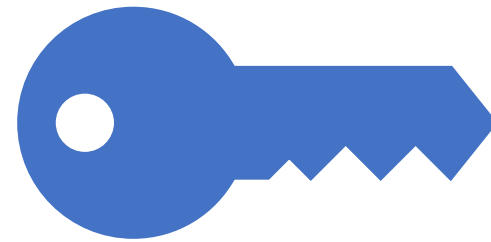
G	R
J	S
I	T
J	U
K	V
L	W
M	X
N	Y
O	Z
P	A
Q	B

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
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

# Codebusters

## Vegenère

- Standard substitution cipher with a key
- Write the key on top of the letters making sure to skip spaces, etc.
- Use the key letter as the row in the table to look up the ciphered letter and find the deciphered letter in the column top
- Most common mistakes: Skipping letters when copying the key, looking up the wrong column



# Codebusters Vegenère

KEY



PLAIN TEXT



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

CIPHER TEXT



# Codebusters Vegenère

4) [31 points] Decrypt this Vigenère Cipher using the keyword of CARE

C	A	R	E	C	A	R	E	C	A	R	E	C	A	R	E
O	A	B	I	V	O	U	E	A	A	D	E	B	I	E	K



	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	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
B	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
C	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
D	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
E	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
F	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
G	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
H	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
I	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
J	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



# Codebusters Vegenère

C	A	R	E	C	A	R	E	C	A	R	E	C	A	R	E
O	A	B	I	V	O	U	E	A	A	D	E	B	I	E	K
<b>M</b>	<b>A</b>	<b>K</b>	<b>E</b>	<b>T</b>	<b>O</b>	<b>D</b>	<b>A</b>	<b>Y</b>	<b>A</b>	<b>M</b>	<b>A</b>	<b>Z</b>	<b>I</b>	<b>N</b>	<b>G</b>

Answer:

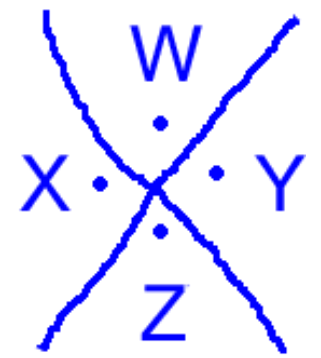
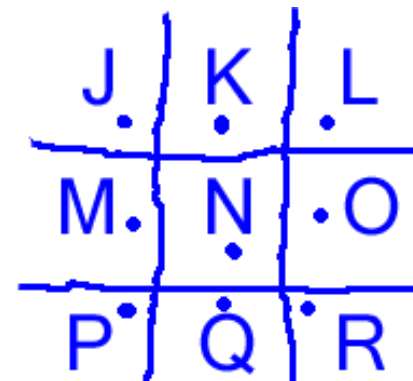
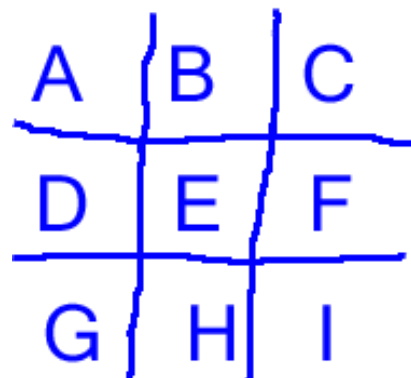
**MAKE TODAY AMAZING**

# Codebusters PigPen

6) [50 points] Solve this zPigPen.

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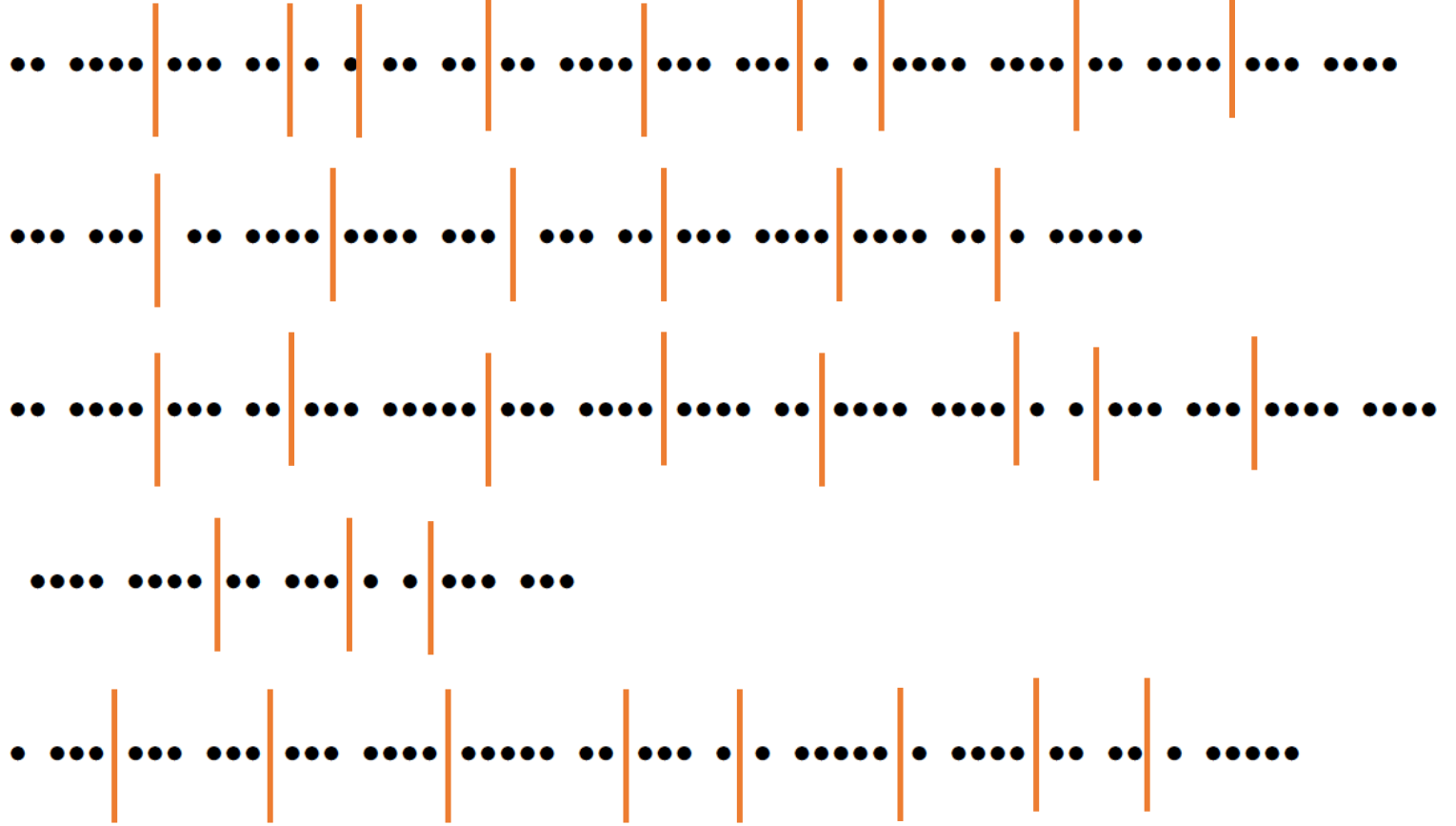
# Codebusters Tapcode

The row is the 1st number of taps/dots and the column is the 2nd  
Have the team put marks between each group of 2 and then decode.

	1	2	3	4	5
1	A	B	C/K	D	E
2	F	G	H	I	J
3	L	M	N	O	P
4	Q	R	S	T	U
5	V	W	X	Y	Z

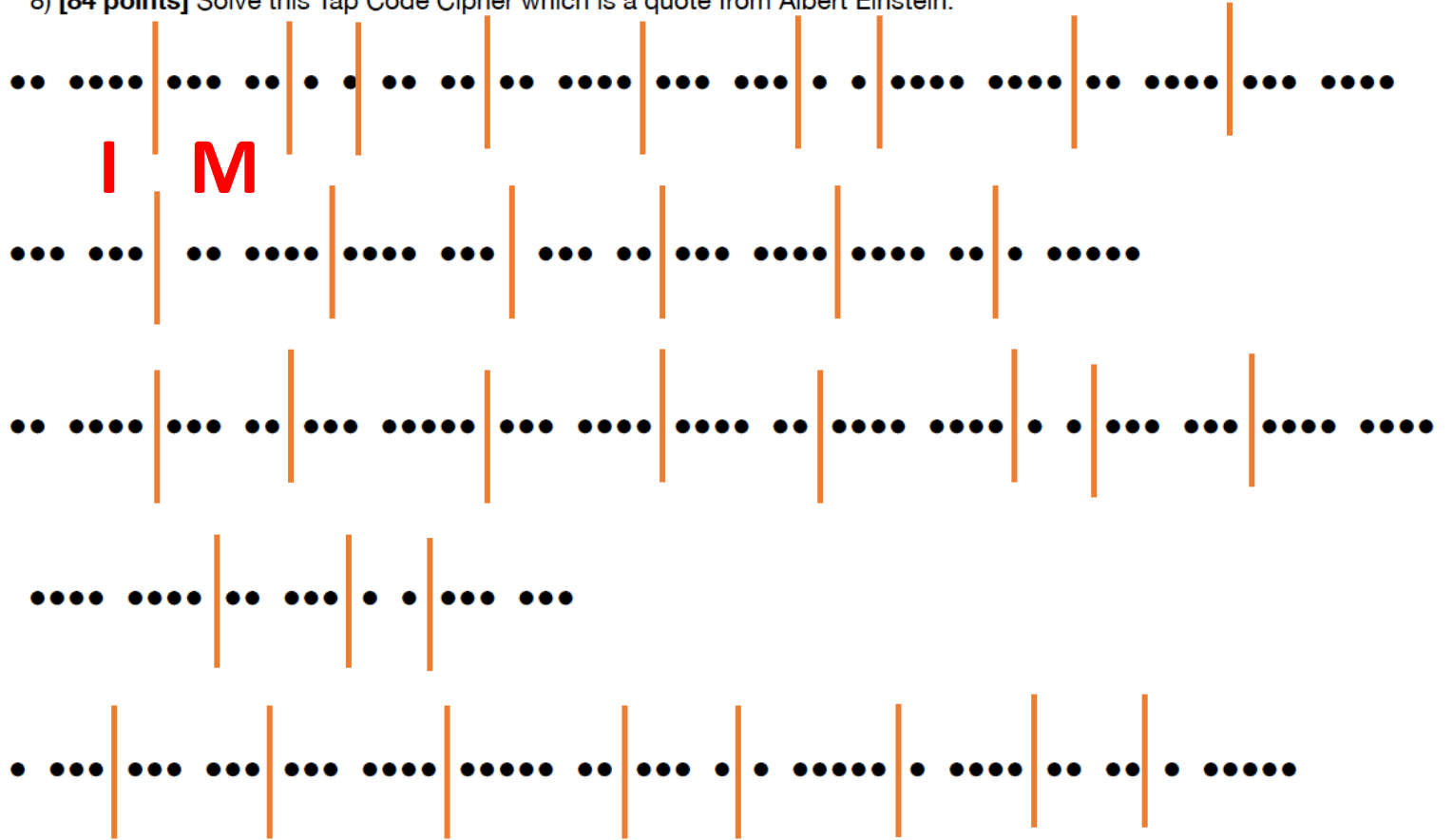
# Codebusters Tapcode

8) [84 points] Solve this Tap Code Cipher which is a quote from Albert Einstein.



# Codebusters Tapcode

8) [84 points] Solve this Tap Code Cipher which is a quote from Albert Einstein.



# Codebusters Aristocrat

- Standard Substitution cipher – random alphabet
- Probably the hardest, but the most rewarding
- Highly correlated to the frequency table
- Look for short and common words

## Frequency Table of English letters:

E - 12.51%	S - 6.54%	C - 3.06%	G - 1.96%	K - 0.67%
T - 9.25%	R - 6.12%	U - 2.71%	W - 1.92%	X - 0.19%
A - 8.04%	H - 5.49%	M - 2.53%	Y - 1.73%	J - 0.16%
O - 7.60%	L - 4.14%	F - 2.30%	B - 1.54%	Q - 0.11%
I - 7.26%	D - 3.99%	P - 2.00%	V - 0.99%	Z - 0.09%
N - 7.09%				

# Codebusters Aristocrat

In General, the strategy for an Aristocrat is:

- Fill in letters from any clues you are given
- Look for single letter words which will generally be A or I
- Check the frequency. The most common letters in English are ETAOIN
- Look for contractions (DON'T, IT'S)
- Look for two and three letter words. Look for common words like THE, YOU, IT, IS
- Look for patterns "IT IS", "THAT", "PEOPLE", SCIENCE.
- Look for double letters "ALL", "TOO", "LITTLE", "WILL", "SUCCESS"
- Guess a word. See how that affects other words





# Codebusters Aristocrat



10) [149 points] Solve this Aristocrat Cipher which was written by Elenor Roosevelt.

**AWO UTATNO GOQHMFED AH AWHDO IWH**  
**THE T E E T TH E H**

**GOQBOLO BM AWO GOXTAV HU AWOBN**  
**E E E THE E T THE**

**YNOXCD.**  
**E**

	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
Frequency	7	3	1	3		1	3	5	1			1	2	3	11		2			3	2	1	5	2	1	
Replacement	<b>T</b>														<b>E</b>								<b>H</b>			



# Codebusters Aristocrat

10) [149 points] Solve this Aristocrat Cipher which is quote for Roots

AWO UTATNO GOQHMFED AH AWHDO IWH  
 THE T E E O TO THO E HO

GOQBOLO BM AWO GOXTAV HU AWOBN  
 E E E THE E T O THE

YNOXCD.  
 E

	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
Frequency	7	3	1	3		1	3	5	1			1	2	3	11		2			3	2	1	5	2	1	
Replacement	T							O							E								H			

# Codebusters Aristocrat

10) [149 points] Solve this Aristocrat Cipher which is quote by Elenor Roosevelt.

AWO UTATNO GOQHMFED AH AWHDO IWH  
 THE T E E O S TO THOSE WHO



GOQBOLO BM AWO GOXTAV HU AWOBN  
 E E E THE E T O THE

YNOXCD.  
 E S

	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
Frequency	7	3	1	3		1	3	5	1			1	2	3	11		2			3	2	1	5	2	1	
Replacement	T			S				O	W						E								H			

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10) [149 points] Solve this Aristocrat Cipher which is quote by Elenor Roosevelt.

**AWO UTATNO GOQHMFED AH AWHDO IWH**  
 THE F T E E ON S TO THOSE WHO



**GOQBOLO BM AWO GOXTAV HU AWOBN**  
 E I E E IN THE E T OF THEI

**YNOXCD.**  
 E S

	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
Frequency	7	3	1	3		1	3	5	1			1	2	3	11		2			3	2	1	5	2	1	
Replacement	T	I		S				O	W				N		E						F		H			

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**THE F T RE E ON S TO THOSE WHO**

**GOQBOLO BM AWO GOXTAV HU AWOBN**  
**E I E E IN THE E T OF THEIR**

**YNOXCD.**  
**RE S**

	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
Frequency	7	3	1	3		1	3	5	1			1	2	3	11		2			3	2	1	5	2	1	
Replacement	<b>T</b>	<b>I</b>		<b>S</b>				<b>O</b>	<b>W</b>				<b>N</b>	<b>R</b>	<b>E</b>						<b>F</b>		<b>H</b>			

# Codebusters Aristocrat

10) [149 points] Solve this Aristocrat cipher which is quote by Elenor Roosevelt.

**AWO UTATNO GOQHMFED AH AWHDO IWH**  
**THE FUTURE BELONGS TO THOSE WHO**

**GOQBOLO BM AWO GOXTAV HU AWOBN**  
**BELIEVE IN THE BEAUTY OF THEIR**

**YNOXCD.**  
**RES**

	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
Frequency	7	3	1	3		1	3	5	1			1	2	3	11		2			3	2	1	5	2	1	
Replacement	T	I		S			B	O	W			V	N	R	E		L			U	F		H			

# Codebusters Aristocrat

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**AWO UTATNO GOQHMF D AH AWHDO IWH**  
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**GOQBOLO BM AWO GOXTAV HU AWOBN**  
**BELIEVE IN THE BEAUTY OF THEIR**



**YNOXCD.**  
**REAS**

	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
Frequency	7	3	1	3		1	3	5	1			1	2	3	11		2			3	2	1	5	2	1	
Replacement	T	I		S		G	B	O	W			V	N	R	E		L			U	F	Y	H	A		

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**AWO UTATNO GOQHMF D AH AWHDO IWH**  
**THE FUTURE BELONGS TO THOSE WHO**

**GOQBOLO BM AWO GOXTAV HU AWOBN**  
**BELIEVE IN THE BEAUTY OF THEIR**

**YNOXCD .**  
**DREAMS**

	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
Frequency	7	3	1	3		1	3	5	1			1	2	3	11		2			3	2	1	5	2	1	
Replacement	T	I		S		G	B	O	W			V	N	R	E		L			U	F	Y	H	A		

# Codebusters Coaching for Success

- Practice, practice, practice.
- Put two students on the team.
- Divide and conquer ... split the test up with team.
- Learn Pigpen and Tap Code tables
- If stuck on Aristocrat, just **try** something!
- Learn pattern words
- What works best for the team?
  - One high point question
  - or five low point questions?



# Codebusters Additional Resources

- Macomb Science Olympiad website  
<https://macombso.org/codebusters>
  - Sample test
  - Video resources
- Science Olympiad CodeBusters  
<https://toebes.com/codebusters/index.html>
  - Help with how each cipher works
  - Help creating practice test
- YouTube
- Puzzle Baron's Cryptograms  
<https://cryptograms.puzzlebaron.com/>
- Apps – Cryptograms



Codebusters  
Website  
Demo &  
Questions

# Codebusters Additional Aristocrat Explained

11) [153 points] Solve this Aristocrat, which is a quote from Winnie the Pooh.

CQHPPFKHPC FDP CHBGGPCF FDKLWC

FBMP VY FDP HQCF SQQH KL NQVS

DPBSF.

	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
Frequency		3	6	4		8	2	5			3	2	1	1		7	5		3			2	1		1	
Replacement				H		T										E										

Look at frequency table.  $F=8$  and  $P=7$  Since these are close, I look to see where they show up in the cipher. I notice that FDP shows up twice and the most common 3-letter word is THE, so I guess that  $F=T$  and  $P=E$  and  $D=H$ . I input those letters.

# Codebusters Additional Aristocrat Explained

11) [153 points] Solve this Aristocrat, which is a quote from Winnie the Pooh.

ET E THE E T TH  
CQHPFKHPC FDP CHBGGPCF FDKLWC

T E THE T  
FBMP VY FDP HQCF SQQH KL NQVS

HE T  
DPBSF.

	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
Frequency		3	6	4		8	2	5			3	2	1	1		7	5		3			2	1		1	
Replacement				H		T										E	O									

The next thing I notice is the double Q in SQQH. I know this is going to be a vowel and the most common is OO or EE. We already used the E so I'm going to guess that Q=O and fill that in.

# Codebusters Additional Aristocrat Explained

11) [153 points] Solve this Aristocrat, which is a quote from Winnie the Pooh.

O ET E THE E T TH  
CQHPFKHPC FDP CHBGGPCF FDKLWC

T E THE O T OO O  
FBMP VY FDP HQCF SQQH KL NQVS

HE T  
DPBSF.

	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
Frequency		3	6	4		8	2	5			3	2	1	1		7	5		3			2	1		1	
Replacement			S	H		T		M			I					E	O									

I notice that the first word has a unique pattern. The first and last letter are the same and the third letter and seven letter are the same. Common ends of words with an E are ED or ES. So I look to see if either of those letters work. When I look at the S I see that the first part of the word might be SOME so I try C=S and H=M.

When I put those letters in I see that the K=I

# Codebusters Additional Aristocrat Explained

11) [153 points] Solve this Aristocrat, which is a quote from Winnie the Pooh.

SOMETIMES THE SM EST TH S  
CQHPFKHPC FDP CHBGGPCF FDKLWC

T E THE MOST OOM I O  
FBMP VY FDP HQCF SQQH KL NQVS

HE T  
DPBSF.

	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
Frequency		3	6	4		8	2	5			3	2	1	1		7	5		3			2	1		1	
Replacement		A	S	H		T	L	M			I					E	O									

I notice that the third word has a double G. Since it comes right before the E, I don't think it's another vowel. The most common double letters are SS, TT, FF, LL, and MM. We already used S, T and M so our only options are FF and LL. We see that only LL works, so G=L and that makes B=A.

# Codebusters Additional Aristocrat Explained

11) [153 points] Solve this Aristocrat, which is a quote from Winnie the Pooh.

SOMETIMES THE SMALLEST THINGS  
CQHPFKHPC FDP CHBGGPCF FDKLWC

TAKE THE MOST IMPORTANT  
FBMP VY FDP HQCF SQQH KL NQVS

HEART  
DPBSF.

	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
Frequency		3	6	4		8	2	5			3	2	1	1		7	5		3			2	1		1	
Replacement		A	S	H		T	L	M			I	N				E	O		R							

I see a 2-letter word KL that starts with an I. We already used T and S so I'm going to guess that this word is IN, so L=N. I also see the last word is missing one letter, I'm going to guess that S=R to make that word heart.

# Codebusters Additional Aristocrat Explained

11) [153 points] Solve this Aristocrat, which is a quote from Winnie the Pooh.

SOMETIMES THE SMALLEST THIN S  
CQHPFKHPC FDP CHBGGPCF FDKLWC

TA E THE MOST ROOM IN O R  
FBMP VY FDP HQCF SQQH KL NQVS

HEART  
DPBSF.

	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
Frequency		3	6	4		8	2	5			3	2	1	1		7	5		3			2	1		1	
Replacement		A	S	H		T	L	M			I	N				E	O		R							

Now we can figure out the rest of the puzzle by reading it and filling in the words.



# Codebusters Additional Aristocrat Explained

11) [153 points] Solve this Aristocrat, which is a quote from Winnie the Pooh.

SOMETIMES THE SMALLEST THINGS  
CQHPPFKHPC FDP CHBGGPCF FDKLWC

TAK UP THE MOST ROOM IN YOUR  
FBMP VY FDP HQCF SQQH KL NQVS

HEART  
DPBSF.

	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
Frequency		3	6	4		8	2	5			3	2	1	1		7	5		3			2	1		1	
Replacement		A	S	H		T	L	M			I	N				E	O		R							

Now we have several words that are only missing one letter and we have many words complete that will help us solve the rest of the puzzle.

# Codebusters Additional Aristocrat Explained

12) [161 points] Solve this Aristocrat which is a quote from Neil deGrasse Tyson.

QVF AZZB QVMGA RUZLQ KOMFGOF MK

QVRQ MQ'K QILF EVFQVFI ZI GZQ

WZL UFPMFHF MG MQ.

	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
Frequency	2	1			1	9	4	1	3		3	3	7		2	1	10	2			2	5	1			6
Replacement											S		I				T	A				H				

First thing I see the is the contraction MQ'K. I also notice the two 2-letter words at the end MG MQ and I see the word QVRQ which is a unique pattern.

The most common 2-letter contraction is IT'S and M=I makes sense with the MG MQ pattern. Also the QVRQ is a common pattern for the word THAT. So I will try that M=I, Q=T, K=S, V=H, R=A.

# Codebusters Additional Aristocrat Explained

12) [161 points] Solve this Aristocrat which is a quote from Neil deGrasse Tyson.  
**TH** **THI** **A** **T S I** **IS**  
**QVF AZZB QVMGA RUZLQ KOMFGOF MK**

**THAT** **IT'S** **T** **H** **TH** **T**  
**QVRQ MQ'K QILF EVFQVFI ZI GZQ**

**I** **I** **IT**  
**WZL UFPMFHF MG MQ.**

	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
Frequency	2	1			1	9	4	1	3		3	3	7		2	1	10	2			2	5	1			6
Replacement						<b>E</b>	<b>N</b>				<b>S</b>		<b>I</b>				<b>T</b>	<b>A</b>				<b>H</b>				

The first word starts with TH so I would guess F=E. Also, the 2-letter word MG, I'm guessing is IN since IT and IS is already used, so I will put G=N.

# Codebusters Additional Aristocrat Explained

12) [161 points] Solve this Aristocrat which is a quote from Neil deGrasse Tyson.  
**THE THIN A T S IEN E IS**  
**QVF AZZB QVMGA RUZLQ KOMFGOF MK**

**THAT IT'S T E HETHE N T**  
**QVRQ MQ'K QILF EVFQVFI ZI GZQ**

**E IE E IN IT**  
**WZL UFPMFHF MG MQ.**

	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
Frequency	2	1			1	9	4	1	3		3	3	7		2	1	10	2			2	5	1			6
Replacement						<b>E</b>	<b>N</b>				<b>S</b>		<b>I</b>		<b>C</b>		<b>T</b>	<b>A</b>				<b>H</b>				<b>O</b>

I see that the fifth word is missing two letters that are the same and I see that O=C. I also see the double letters in the second word, and I know they will be vowels, since E is already used, I'm guessing it's O, so Z=O.

# Codebusters Additional Aristocrat Explained

12) [161 points] Solve this Aristocrat which is a quote from Neil deGrasse Tyson.  
**THE OO THIN AOT SCIENCE IS**  
**QVF AZZB QVMGA RUZLQ KOMFGOF MK**

**THAT IT'S T E HETHE O NOT**  
**QVRQ MQ'K QILF EVFQVFI ZI GZQ**

**O E IE E IN IT**  
**WZL UFPMFHF MG MQ.**

	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
Frequency	2	1			1	9	4	1	3		3	3	7		2	1	10	2			2	5	1			6
Replacement						<b>E</b>	<b>N</b>		<b>R</b>		<b>S</b>	<b>U</b>	<b>I</b>		<b>C</b>		<b>T</b>	<b>A</b>				<b>H</b>	<b>Y</b>			<b>O</b>

Now I look at the 2-letter word ZI. We know that it starts with O, so that leaves us the words ON, OF, OR. We know it's not ON since we used N already. We also know that it appears 3 times in the puzzle based on the frequency table. We look to see if R or F will work in those other words. We see that only R will work, so I=R

I also see the 3-letter work WZL, the middle letter equals O. The most common words would be YOU, FOR, NOT. Since we already used N,T,R we will guess that this word is YOU, so W=Y and L=U

# Codebusters Additional Aristocrat Explained

12) [161 points] Solve this Aristocrat which is a quote from Neil deGrasse Tyson.  
**THE OO THIN A OUT SCIENCE IS**  
**QVF AZZB QVMGA RUZLQ KOMFGOF MK**

**THAT IT'S TRUE HETHER OR NOT**  
**QVRQ MQ'K QILF EVFQVFI ZI GZQ**

**YOU E IE E IN IT**  
**WZL UFPMFHF MG MQ.**

	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
Frequency	2	1			1	9	4	1	3		3	3	7		2	1	10	2			2	5	1			6
Replacement						<b>E</b>	<b>N</b>		<b>R</b>		<b>S</b>	<b>U</b>	<b>I</b>		<b>C</b>		<b>T</b>	<b>A</b>				<b>H</b>	<b>Y</b>			<b>O</b>

At this point we have many of the words to help us make sense of the quote and we can fill in the rest of the words.

# Codebusters Additional Aristocrat Explained

12) [161 points] Solve this Aristocrat which is a quote from Neil deGrasse Tyson.  
**THE GOOD THING ABOUT SCIENCE IS**  
**QVF AZZB QVMGA RUZLQ KOMFGOF MK**

**THAT IT'S TRUE WHETHER OR NOT**  
**QVRQ MQ'K QILF EVFQVFI ZI GZQ**

**YOU BELIEVE IN IT**  
**WZL UFPMFHF MG MQ.**

	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
Frequency	2	1			1	9	4	1	3		3	3	7		2	1	10	2			2	5	1			6
Replacement	<b>G</b>	<b>D</b>			<b>W</b>	<b>E</b>	<b>N</b>	<b>V</b>	<b>R</b>		<b>S</b>	<b>U</b>	<b>I</b>		<b>C</b>	<b>L</b>	<b>T</b>	<b>A</b>			<b>B</b>	<b>H</b>	<b>Y</b>			<b>O</b>

At this point we have many of the words to help us make sense of the quote and we can fill in the rest of the words.