

Codebusters Division A Workshop

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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**

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

Cipher Types

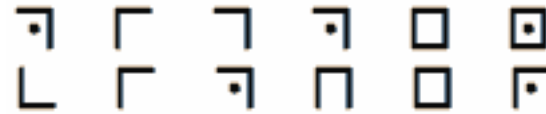
• **Atbash** - Mono-alphabetic substitution ATBASH \rightleftharpoons ZGYZHS

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

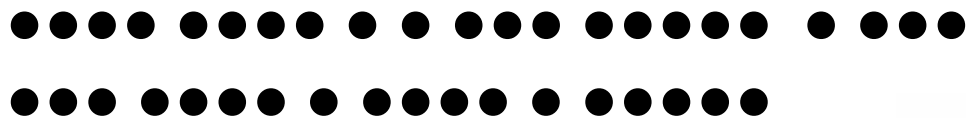
• **Vigenère** - Mono-alphabetic substitution with a key

VIGENERE \rightleftharpoons FMEORCBI

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



• **Tap Code** - Substitution Cipher



• **Dancing Men** – Substitution Cipher



• **Aristocrat** - Mono-alphabetic substitution



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Atbash

- The mapping is always the same and reversible $A \rightleftharpoons Z$ $B \rightleftharpoons Y$ $E \rightleftharpoons V$
- Look up each letter in the table and fill in all the matches for that letter.

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

1) [65 points] Decode this quote which has been encoded using the Atbash Cipher.

O	R	U	V	R	H	Z	Y	Z	O	Z	M	X	V	L	U	S	L	O	W	R	M	T

L	M	Z	M	W	O	V	G	G	R	M	T	T	L	.
														.

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Caesar

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

3) [106 points] Solve this Caesar with a shift between -5 and 5.



F	Q	P	,	V	F	G	E	K	F	G	V	J	C	V	A	Q	W	E	C	P	,	V

D	G	H	Q	T	G	A	Q	W	F	K	U	E	Q	X	G	T	V	J	C	V	A	Q	W

E	C	P	.
			.



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



3) [106 points] Solve this Caesar with a shift between -5 and 5.



F	Q	P	'	V	F	G	E	K	F	G	V	J	C	V	A	Q	W	E	C	P	'	V
															Y	O	U					

D	G	H	Q	T	G	A	Q	W	F	K	U	E	Q	X	G	T	V	J	C	V	A	Q	W

E	C	P	.

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

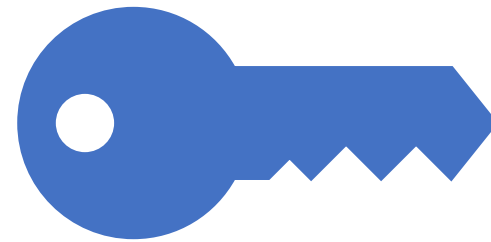


A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X

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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

5) [58 points] The following quote needs to be decoded with the Vigenère Cipher with a keyword of DREAM

D R E A M					D R E A M					D R E A M					D R E A M					D
L	D	E	G	U	Q	V	A	H	M	W	P	S	U	O	R	L	P	D	P	R



	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

Codebusters PigPen

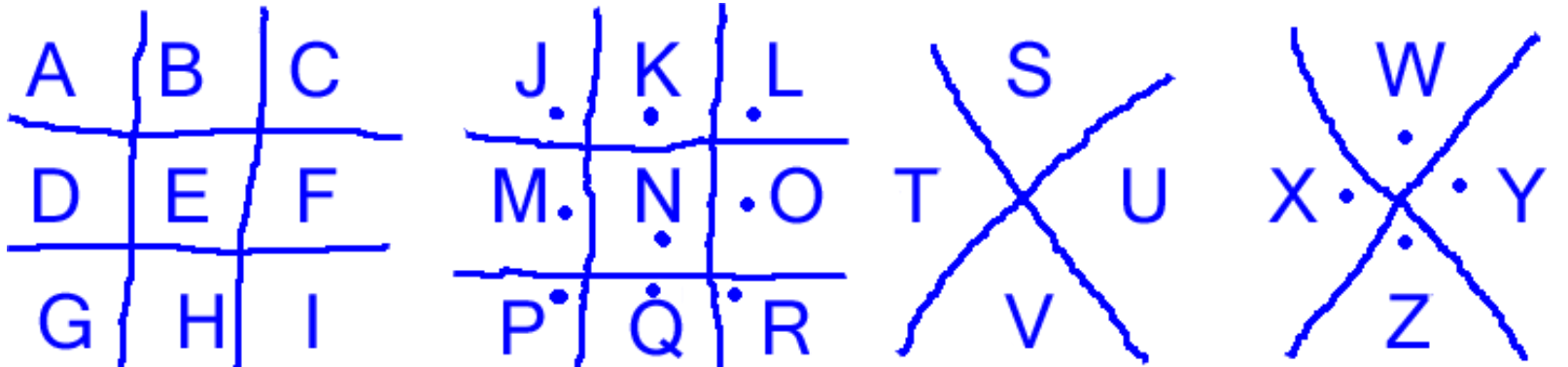
6) [65 points] A quote has been encoded using the Pig Pen Cipher for you to decode.

< E < J L V J < V 7 J V V □ J 7 L < F □ E □

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

> □ □ V J < > E V < L L □ V V .

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--



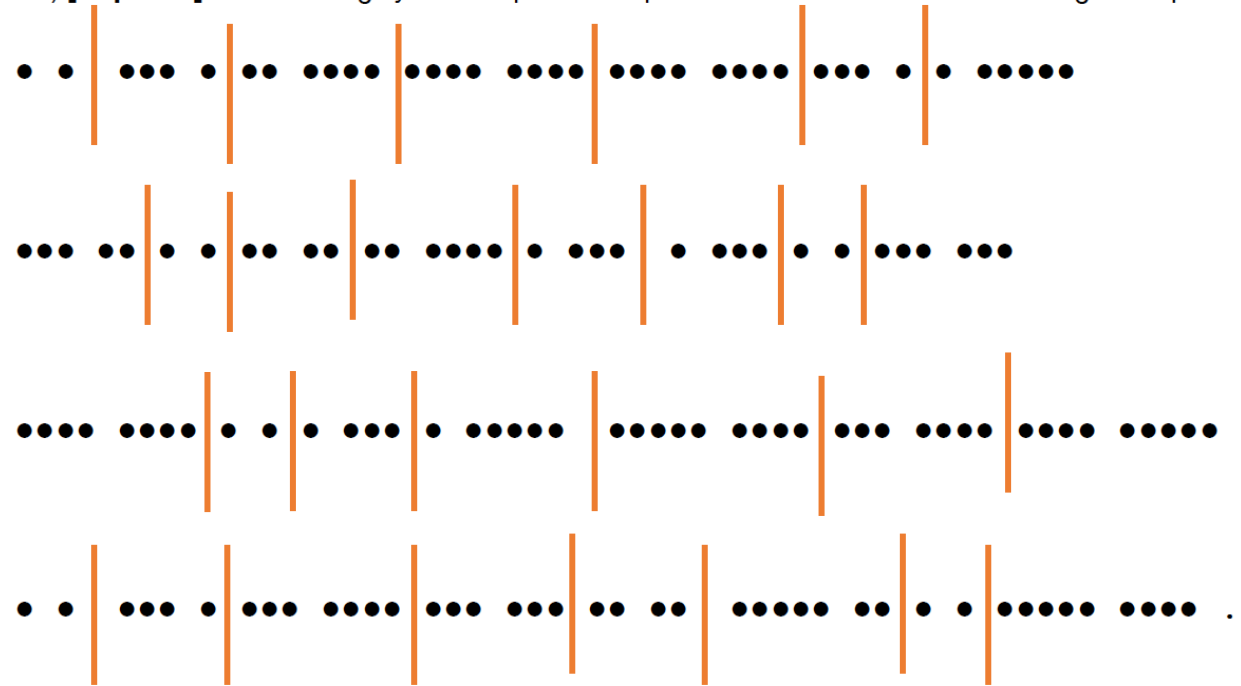
Codebusters Tapcode

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

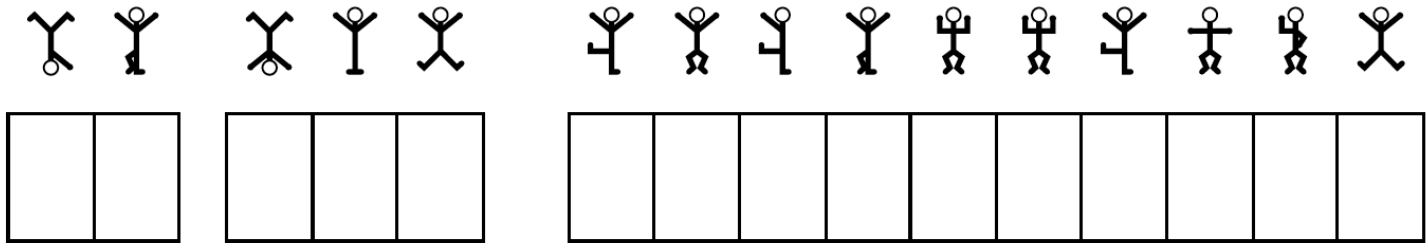
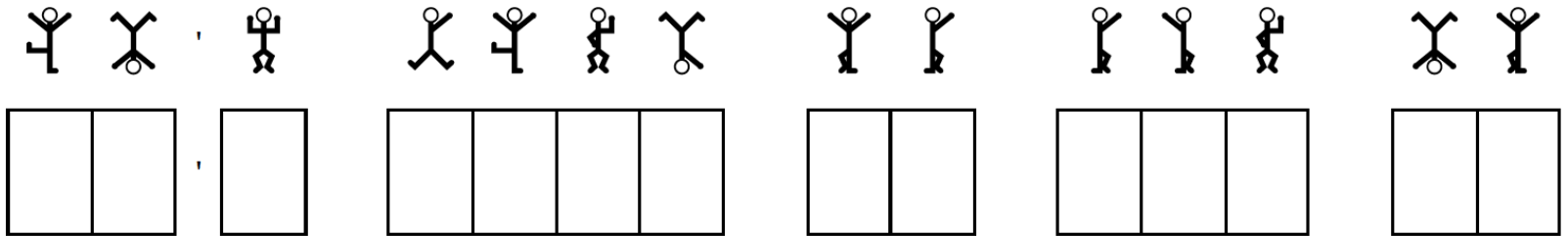
Codebusters Tapcode

8) [55 points] The following symbols represent a quote which has been encoded using the Tap Code Cipher for you to decode.



Codebusters Dancing Men

11) [64 points] A quote by Walt Disney has been encoded using the Dancing Men Cipher for you to decode.



Codebusters Dancing Men

11) [64 points] A quote by Walt Disney has been encoded using the Dancing Men Cipher for you to decode.

I T , 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

0 1 2 3 4 5 6 7 8 9

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

12) [188 points] A quote has been encoded using the Aristocrat Cipher for you to decode.

IWOM AWO UBND A GXGV QXTFWOY UHN

AWO UBND ABCO, BA'D QXTFW GNHRO



BMAH X AWHTDXMY JBOSOD, XMY AWOV

XQQ IOMA DRBJJBMF XGHTA, XMY

AWXA IXD AWO GOFBMMBMF HU AWO

UXBNBOD .



	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	15	12	1	8		5	5	6	3	3			10	5	14		4	2	1	4	5	2	10	12	4		
Replacement																											

Codebusters Aristocrat

12) [188 points] A quote has been encoded using the Aristocrat Cipher for you to decode.

IWOM AWO UBND A GXGV QXTFWOY UHN
 he the t a | a he



AWO UBND ABCO, BA'D QXTFW GNHRO
 the t t e t | a h e



BMAH X AWHTDXMY JBOSOD, XMY AWOV
 t a th a e e a the

XQQ IOMA DRBJJBMF XGHTA, XMY
 all e t a t a

AWXA IXD AWO GOFBMMBMF HU AWO
 that a the e the

UXBNBOD .
 a e

Codebusters Aristocrat

	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	15	12	1	8		5	5	6	3	3			10	5	14		4	2	1	4	5	2	10	12	4	
Replacement	t														e		l						h	a		

Codebusters Aristocrat

12) [188 points] A quote has been encoded using the Aristocrat Cipher for you to decode.

IWOM AWO UBND A GXGV QXTFWOY UHN
 hen the i s t a y | a hed

AWO UBND A ABCO, BA'D QXTFW GNHRO
 the i s t t i e it's | a h e

BMAH X AWHTDXMY JBOSOD, XMY AWOV
 int a th s and i e e s and they

XQQ IOMA DRBJJBMF XGHTA, XMY
 all e nt s i in a t and

AWXA IXD AWO GOFBMMBMF HU AWO
 that a s the e in n in the

UXBNBOD.
 a i i 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	15	12	1	8		5	5	6	3	3			10	5	14		4	2	1	4	5	2	10	12	4	
Replacement	t	i		s									n		e		l					y	h	a	d	

Codebusters Aristocrat

12) [188 points] A quote has been encoded using the Aristocrat Cipher for you to decode.

IWOM AWO UBNDAGXGV QXTFWOY UHN
 when the ist a y la gh ed o

AWO UBNDABCO, BA'D QXTFW GNHRO
 the ist time it's la gh o e

BMAH X AWHTDXMY JBOSOD, XMY AWOV
 into a tho sand ie es and they

XQQ IOMA DRBJJBMF XGHTA, XMY
 all we nt s i ing a o t and

AWXA IXD AWO GOFBMMBMF HU AWO
 that wa s the eg in n ing o the

UXBNBOD.
 a i ie 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	15	12	1	8		5	5	6	3	3			10	5	14		4	2	1	4	5	2	10	12	4	
Replacement	t	i	m	s		g		o	w				n		e		l					y	h	a	d	

Codebusters Aristocrat

12) [188 points] A quote has been encoded using the Aristocrat Cipher for you to decode.

IWOM AWO UBND A GXGV QXTFWOY UHN
 when the first baby laughed fo

AWO UBND ABCO, BA'D QXTFW GNHRO
 the first time it's laugh boe

BMAH X AWHTDXMY JBOSOD, XMY AWOV
 into a thousand ies and they

XQQ IOMA DRBJJBMF XGHTA, XMY
 all went sing about and

AWXA IXD AWO GOFBMMBMF HU AWO
 that was the beginning of the

UXBNBOD.
 faies

	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	15	12	1	8		5	5	6	3	3			10	5	14		4	2	1	4	5	2	10	12	4	
Replacement	t	i	m	s		g	b	o	w				n		e		l			u	f	y	h	a	d	

12) [188 points] A quote has been encoded using the Aristocrat Cipher for you to decode.

IWOM AWO UBND A GXGV QXTFWOY UHN
when the first baby laughed for



AWO UBND ABCO, BA'D QXTFW GNHRO
the first time it's laugh bro e



BMAH X AWHTDXMY JBOSOD, XMY AWOV
into a thousand iees and they



XQQ IOMA DRBJJBMF XGHTA, XMY
all went sitting about and

AWXA IXD AWO GOFBMMBMF HU AWO
that was the beginning of the

UXBNBOD.
fairies

	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	15	12	1	8		5	5	6	3	3			10	5	14		4	2	1	4	5	2	10	12	4	
Replacement	t	i	m	s			g	b	o	w			n	r	e		l			u	f	y	h	a	d	

Codebusters Aristocrat

Codebusters Aristocrat

12) [188 points] A quote has been encoded using the Aristocrat Cipher for you to decode.

IWOM AWO UBND A GXGV QXTFWOY UHN
when the first baby laughed for

AWO UBND A ABCO, BA'D QXTFW GNHRO
the first time it's laugh broke

BMAH X AWHTDXMY JBOSOD, XMY AWOV
into a thousand pieces and they

XQQ IOMA DRBJJBMF XGHTA, XMY
all went skipping about and

AWXA IXD AWO GOFBMMBMF HU AWO
that was the beginning of the

UXBNBOD.
fairies

When the first baby laughed for the first time it's laugh broke into a thousand pieces, and they all went skipping about and that was the beginning of the fairies.

	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	15	12	1	8		5	5	6	3	3			10	5	14		4	2	1	4	5	2	10	12	4	
Replacement	t	i	m	s		g	b	o	w	p			n	r	e		l	k	c	u	f	y	h	a	d	

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