North Carolina Science Olympiad — Code Busters

2016-2017

Names of participants: (Please print neatly)

_____

_____

_____

School Name: _____

V JV1 JV2 JV3

Warning: Do not open this packet until given permission to do so.

Note: There are useful notes after this page.

Scoring:
Time to solve first problem in seconds: _____

Question	Value	Incorrect letters	Score
Timed	100		
1	160		
2	250		
3	400		
4	100		
5	100		
6	50		
7	100		
8	100		
9	300		
10	140		
11	60		
12	100		
13	180		
14	125		
15	400		
16	250		
17	250		
18	180		
Bonus			
Final Score			

The following tables might be useful during the event.

	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

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	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

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%								

Frequency Table of Spanish letters:

E	14.08%	I	5.98%	M	3.08%	Y	1.09%	Z	0.47%
A	12.16%	L	5.24%	P	2.89%	V	1.05%	Ñ	0.17%
O	9.20%	D	4.67%	B	1.49%	G	1.00%	X	0.14%
S	7.20%	T	4.60%	H	1.18%	F	0.69%	K	0.11%
N	6.83%	U	4.69%	Q	1.11%	J	0.52%	W	0.04%
R	6.41%	C	3.87%						

For the purposes of cryptograms it is customary to treat n and ñ as distinct letters, but a and á are the same letter. Likewise for e and é, and i and í. In other words, all the accent marks get amputated when working with cryptograms. Also, while some older Spanish dictionaries consider ch, ll, and rr, to be their own letters—this has fallen out of modern usage. Accordingly, "burro" is considered as five letters: "b-u-r-r-o" and not as four letters "b-u-rr-o."

Timed question **[100 Points]**: Solve this Cryptogram which is a quote by Aaron Machado. When you have solved it, raise your hand so that the time can be recorded and the solution checked.

```
HYU  SCQBSEQLP  TLSUEVZ  S  YQV  QZ  Q  RSV  VLJIIUV  CU
```

```
FUXQMZU  HYUSL  TLSUEVZ  HYJMBYH  S  VSVE'H  UKSZH.
```

	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
Freq		2	2		4	1		6	2	2	1	5	2			1	6	1	10	2	9	8		1	5	5

1) **[160 Points]** A message encrypted with the Affine Cipher using an alphabet of 26 characters has been intercepted. You have been told that the last two characters of the message are the letters **OX**. With that knowledge, what does this message say?

K	M	T	F	T	H	B	V	B	Y	K	M	T	G	T	E	A	N	S

2) **[250 Points]** Solve this Spanish Cryptogram which is a quote by Benjamin Disraeli.

PO TQDXTQO DA MOWO DP VCXKJ VJKDWXJ PJ LCD

DP OWGD BCD MOWO DP OXGQFCJ.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Ñ	O	P	Q	R	S	T	U	V	W	X	Y	Z
Freq	1	1	4	9		1	2			5	2	1	2			8	5	3			2		2	4	4		

3) **[400 Points]** Solve this Patristocrat. The word **YOU** appears four times.

AUVMD IUEUU NVIBD RRAUV HMDHE UUNHR RCRXH IXHIN CGAUV

HMDAU VMDXU UEUUN XUSDH IHRRC RXHIX.

	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
Freq	4	1	3	6	3		1	9	6				4	4				8	1		14	5		6		

4) **[100 Points]** Encode the string **PRIVATEDETECTIVEAGENCY** using the Affine Cipher with *a=7* and *b=9*.

P	R	I	V	A	T	E	D	E	T	E	C	T	I	V	E	A	G	E	N	C	Y

5) **[100 Points]** Using a key of **FIXT** encode the string **QUIZMASTERS** using the Hill Cipher with a 26 character alphabet. e.g.

$$\begin{pmatrix} F & I \\ X & T \end{pmatrix} \equiv \begin{pmatrix} 5 & 8 \\ 23 & 19 \end{pmatrix}$$

Q	U	I	Z	M	A	S	T	E	R	S	

6) **[50 Points]** Using a code word of **THINK**, encode the following quote from Stephen Hawking using the Vigenère cipher.

I	N	T	E	L	L	I	G	E	N	C	E		I	S		T	H	E

A	B	I	L	I	T	Y		T	O		A	D	A	P	T		T	O		C	H	A	N	G	E

7) **[100 Points]** Solve this Cryptogram which is a quote by Wayne Heizenga and where the last word is `HAPPEN`.

```
DAES XSAXHS PJSCE AQ DWNNSDD, ITYHS AGTSJ
```

```
XSAXHS VSG WX SOSJM EAJRYRV CRP ECBS YG TCXXSR.
```

	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
Freq																										

8) **[100 Points]** Napoleon Bonaparte once said this about a the value of treasures. It has been encoded using the Vigenère cipher using a very common five letter word. You have been told that the 36th through the 43rd letters in the code (`ORPUWPRP`) actually is the word `TREASURE`. What does the message decode to?

M	I	N	B	I

N	D	Z	H	S

O	C	Z	H	W

D	S	E	C	R

O	H	P	J	S

N	S	P	M	W

D	O	Y	I	J

O	R	P	U	W

P	R	P	M	F

P	T	T	H	X

C	E	F	M	I

H	A	O	Y	S

A	T	S	Y	Q

9) **[300 Points]** Solve this Cryptogram which is a quote by Thomas Edison.

LJWKVNW! OCX, QZI, Y CZDJ HFNNJI Z VFN FA LJWKVNW. Y

MIFO WJDJLZV NCFKWZIE NCYIHW NCZN OFI'N OFLM.

	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
Freq	1		5	2	1	7		2	6	6	3	4	2	10	4		1					4	7	1	3	6

10) **[140 Points]** Solve this Cryptogram which is a quote by Bernie Siegel, M.D. The word **YOU** appears twice.

BG JLR KQWTC CLK FQWRZU EUQVM KBWC QEPUZMBWJ,

TLFWBFRQVVJ ZUFUKBFD BWMUVG,

JLR TQF'W CUVX YRW VUQZF.

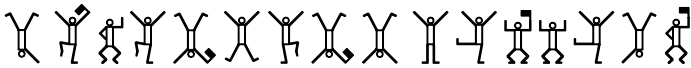		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Freq		6	4	1	2	7	2			4	4	4	3			1	7	5		3	8	6	8	1	1	4

11) **[60 Points]** You know that a message has been encrypted using the Affine Cipher with an alphabet of 26 characters. You have discovered that the message **GCUPCX** decodes to say **SECRET**. What are the values of a and b in the function $ax + b$ that were used to encode the message?

$a=$_____ $b=$ _____

12) **[100 Points]** Your teacher laughs whenever they look at this sign on the wall. What does it say?

Answer: _____

13) **[180 Points]** Solve this Patristocrat which quotes George Santayana   It starts with **THE DISEASES**.

MFRYC AROAR ANFCG FYRAM XIVOT OHOXR HIWRA AHOMZ XOWMF

OHMFR CHAMC HGMAN FCGFK XRARX ERFCT.

	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
Freq	9		6		1	8	3	6	2		1		7	2	7			10		2		1	2	5	2	1

14) **[125 Points]** Using a key of **WHODIDITZ** encode the string **ALGEBRAICALLY** using the Hill Cipher with a 26 character alphabet. e.g.

$$\begin{pmatrix} W & H & O \\ D & I & D \\ I & T & Z \end{pmatrix} \equiv \begin{pmatrix} 22 & 7 & 20 \\ 3 & 8 & 3 \\ 8 & 19 & 25 \end{pmatrix}$$

A	L	G	E	B	R	A	I	C	A	L	L	Y		

15) **[400 Points]** Your phone badly misheard this quote from engineer and astronaut Buzz Aldrin but got a few words wrong before encrypting it.   What does it say?

```
EM MXGVXBV IPX WUC DX MKEJV JEKMCUVM EBZ DIQJV UEBZVZ


QBB DPV XJVEB, VAV JEB EDDVMD WOXG KVOMXBEU VSKVOQVBJV


PXI GCJP UXYQMDQJM IXON QM BVVZVZ DIX YVD VIV PXGV.
```

	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
Freq	1	10	3	9	9		4		6	8	4		10	1	4	5	6		1		5	23	2	12	2	5

16) **[250 Points]** Solve this Patristocrat containing a quote by Dean Koontz. In it, you will find the word **BELIEVE** appear twice.

```
HWSIH STSHX BJSDZ NNHWH IHBPZ ARHEK FISNW VBRZE


SBZBJ SDZHX BHWSI HSTSH XZVEX SSCAZ EBJSR
```

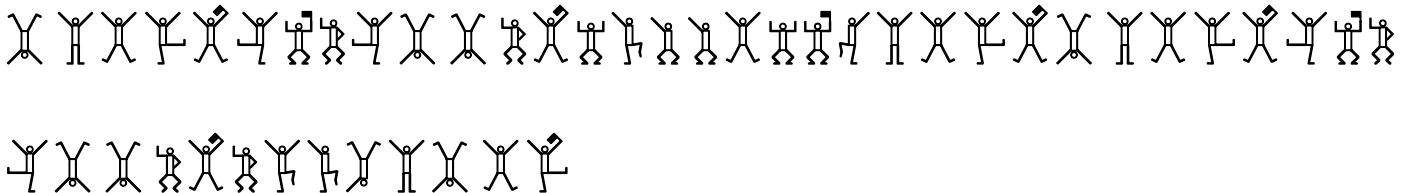|	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Freq	2	7	1	2	4	1		11	4	3	1		3		1			3	13	2		2	4	4		7

17) **[250 Points]** Solve this Cryptogram which is quote by Sean Stewart.

DUS RBSKSPD XK G BVRS KDBSDNUSJ VQSB DUS RGKD. DUS

KSNBSD DV IGWAXPY XD XK, EVC PSQSB WVVA JVIP.

	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
Freq	2	6	1	10	1		3		2	2	6			2		4	2	3	13		4	7	2	4	1	

18) **[180 Points]** Andrew Carnegie once said this. What was it?

Answer: _____