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

The following tables might be useful during the event.

A B C	A B C D E	B C D E	C D E	D E	E E F	F F	G	H	I	J	K	L	M	N	0	P	Q	R	S	T	Ū	V	W	Х	Y	Z
B C	B C D	C D	D	E		F	G							_`)		æ									
С	C D	D			됴)	Η	Ι	J	K	L	M	N	0	Р	Q	R	S	Т	U	V	W	Х	Y	Z
	D		E		T.	G	Η	Ι	J	K	L	M	N	0	Р	Q	R	S	Τ	U	V	W	Х	Y	Z	Α
D		F.		F	G	Η	Ι	J	K	L	M	Ν	0	Ρ	Q	R	S	Τ	U	V	W	Χ	Y	Z	Α	В
	F	-	F	G	Η	Ι	J	K	L	M	Ν	0	Р	Q	R	S	Т	U	V	W	Χ	Y	Z	Α	В	С
E	ш	F	G	Н	Ι	J	K	L	M	N	0	Р	Q	R	S	Т	U	V	W	Χ	Y	Z	Α	В	С	D
F	F	Ŋ	Н	Ι	J	K	L	M	N	0	Р	Q	R	S	Т	U	V	M	Х	Y	Z	Α	В	С	D	Ε
G	G	Η	Ι	J	K	L	M	Ν	0	Р	Q	R	S	Т	U	V	M	Χ	Y	Z	Α	В	С	D	Ε	F
H	Н	Ι	J	K	L	M	Ν	0	Р	Q	R	S	Т	U	V	W	Χ	Y	Z	Α	В	С	D	E	F	G
I	I	J	K	L	M	N	0	Р	Q	R	S	Т	U	V	W	Χ	Y	Z	А	В	C	D	Ε	F	Ŋ	Н
J	J	K	L	M	Ν	0	Р	Q	R	S	Т	U	V	W	Х	Y	Z	А	В	С	D	E	F	G	Η	Ι
K	K	L	M	N	0	Р	Q	R	S	Τ	U	V	W	Х	Y	Z	Α	В	С	D	E	F	G	Н	I	J
L	L	M	Ν	0	Р	Q	R	S	Т	U	V	W	Х	Y	Z	Α	В	\Box	D	Ε	F	G	Н	I	J	K
M	M	Ν	0	Р	Q	R	S	Т	U	V	W	Х	Y	Z	Α	В	С	D	Ε	F	G	Н	Ι	J	K	L
N	N	0	Р	Q	R	S	Т	U	V	W	Х	Y	Z	А	В	С	D	Ε	F	Ŋ	Η	I	J	K	Г	M
0	0	Р	Q	R	S	Т	U	V	W	Χ	Y	Z	А	В	С	D	Ε	F	Ŋ	Η	I	J	K	L	M	N
P	Р	Q	R	S	Т	U	V	W	Х	Y	Z	Α	В	С	D	Ε	F	G	Н	I	J	K	L	M	N	0
Q	Q	R	S	Т	U	V	W	Χ	Y	Z	Α	В	C	D	Ε	F	Ъ	Н	Ι	J	K	L	M	Ν	0	Р
R	R	S	Т	U	V	W	Х	Y	Z	А	В	С	D	E	F	G	Н	Ι	J	K	L	М	N	0	Р	Q
S	S	Т	U	V	W	Χ	Y	Z	Α	В	С	D	E	F	G	Н	Ι	J	K	L	M	N	0	Р	Q	R
T	Т	U	V	W	Х	Y	Z	А	В	С	D	Ε	F	U	Н	I	Ъ	K	L	M	Ν	0	Р	Q	R	S
U	U	V	W	Х	Y	Z	А	В	С	D	E	F	G	Н	I	J	K	L	М	N	0	Р	Q	R	S	Т
v	V	W	Х	Y	Z	Α	В	С	D	Ε	F	G	Н	I	J	K	L	M	N	0	Р	Q	R	S	Т	U
W	W	Х	Y	Z	А	В	С	D	Ε	F	G	Н	I	J	K	L	M	N	0	Р	Q	R	S	Т	U	V
Х	Х	Y	Z	А	В	С	D	Ε	F	G	Н	I	J	K	L	М	N	0	Р	Q	R	S	Т	U	V	W
Y	Y	Z	А	В	С	D	Ε	F	G	Н	Ι	J	K	L	M	N	0	Р	Q	R	S	Т	U	V	W	Х
Z	Z	Α	В	С	D	Ε	F	G	Н	Ι	J	K	L	М	N	0	Р	Q	R	S	Т	U	V	W	Х	Y

Α	В	ŋ	D	E	F	Ф	н	I	J	K	ь	M	N	0	Р	Ø	R	ន	T	ם	٧	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%	С	3.06%	G	1.96%	K	0.67%
T	9.25%	R	6.12%	U	2.71%	W	1.92%	X	0.19%
Α	8.04%	Н	5.49%	M	2.53%	Y	1.73%	J	0.16%
0	7.60%	L	4.14%	F	2.30%	В	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:

Ε	14.08%	I	5.98%	M	3.08%	Y	1.09%	Z	0.47%
Α	12.16%	L	5.24%	P	2.89%	V	1.05%	$\widetilde{\mathrm{N}}$	0.17%
0	9.20%	D	4.67%	В	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%	С	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."

School	17	TX/1	JV2	III/2
SCHOOL	V	JVI	JVZ	JVJ

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

MG YPCY KEKIOYPMQL? MY GKKHKV XMZK PK GCMV NWMYK C JMY

HRIK YPCQ YPCY.

	Α	В	C	D	E	F	Ü	H	I	J	K	L	M	N	0	P	Q	R	S	T	ט	٧	W	X	Y	Z
Freq			5		1		3	2	2	1	9	1	7	1	1	5	2	1				2	1	1	9	1

School	\mathbf{V}	IV1	JV2	IV3
SCHOOL	ν.	J V I	JVZ	J V J

1) [100 Points] Solve this Cryptogram which is a quote by Gilbert K. Chesterton where the word RAIN appears twice along with the word RAINBOW once.

GEA CQXE BJ ZGBEF NE TNKZ HGZGAX, WNND KH ZGJQXZ JQGE

ANCE. CBJQNKJ JQX ZGBE, JQXZX CNKWA OX EN ZGBEONC.

	A	В	U	D	E	F	ъ	Н	I	J	K	Ь	M	N	0	P	Q	R	ន	Т	Ū	٧	W	X	Y	Z
Freq	4	5	5	1	9	1	8	2		7	4			9	2		6			1			2	7		8

2) [140 Points] Solve this Cryptogram which is a quote by Lyndon B. Johnson.

UOYGOZTWU KY FEG EVZY GE ZOBEDOZ, IVG GENEZZEH KY EVZY

GE HKF EZ MEYO.

	A	В	U	D	E	F	ъ	Н	I	Ъ	K	L	M	N	0	P	Q	R	ន	T	ט	V	W	X	Y	Z
Freq		1		1	11	2	6	2	1		3		1	1	5					1	2	3	1		6	8

3) [250 Points] Solve this Cryptogram which is quote by Richard P. Feynman.

ACW KXIBA JIXQUXJDW XB ACSA VHZ TZBA QHA KHHD VHZIBWDK

SQR VHZ SIW ACW WSBXWBA JWIBHQ AH KHHD.

	A	В	U	D	E	F	Ъ	н	I	Ъ	K	L	M	N	0	P	Q	R	ឆ	Т	Ū	٧	W	X	Y	Z
Freq	9	7	3	4				10	5	3	4						4	1	4	1	1	3	8	5		4

4) [300 Points] Solve this Cryptogram of a quote by Mignon McLaughlin.

BUS'N CUUI GUWOXZIC NFMN VJKUONMSN NFVSHX YMS EZ KWN UCC

NVII NUJUOOUR; NFZG YMS EZ KWN UCC CUOZLZO, UO SUN MN

MII.

	Α	В	U	D	E	F	ъ	Н	I	Ъ	K	L	M	N	0	P	Q	R	ន	T	U	٧	W	X	Y	Z
Freq		1	7		2	3	2	1	6	2	3	1	6	13	7			1	6		13	3	3	2	2	6

School	V	JV1	JV2	JV3
School	•	J V I	J V Z	J V J

5) [100 Points] Encode the string **WEATHERPERMITTING** using the Affine Cipher with a=19 and b=1.

W	E	Α	T	Н	E	R	P	E	R	M	Ι	Т	Т	Ι	N	G

6) [60 Points] You know that a message has been encrypted using the Affine Cipher v	with an alphabet of 26
characters. You have discovered that the message XHGUVR decodes to say FRIEND .	What are the values of a
and b in the function $ax + b$ that were used to encode the message?	

School	V	JV1	JV2	JV3
Senioui	•	<i>J</i> 1 1	3 1 2	3 1 3

7) [160 Points] A friend passed you a note about an event you have been invited to but it has been encrypted with the Affine Cipher using an alphabet of 26 characters. They tell you that the last two characters of the message are the letters **ZA**. With that knowledge, what does this message say?

Z	Y	R	Н	N	Y	T	ש	ъ	Н	Н	В	G	F	I	X	X	E

8) [180 Points] Solve this Patristocrat which is a quote by that often quoted person Anonymous. The last word is SERIOUSLY and the first word is THE.

FYWOL SYFFX CWYWQ OEEXW JKXFL KZUAE WFYWO LSYFF XCWFQ

MWKJW OLXAJ UT

	A	В	C	D	E	F	G	н	I	J	K	L	M	N	0	P	Q	R	ន	T	Ū	٧	W	х	Y	Z
Freq	2		2		3	8				3	3	4	1		4		2		2	1	2		9	5	5	1

School	V JV1	JV2	JV3

9) [250 Points] Solve this Spanish Cryptogram about family.

HW ZWILHLW KR SAIA HW IBRLSW, WHVBJWR JAEWR WHEWR, AEOWR

MWPWR, ÑKOA RLKIÑOK KR BJW CKOIARW SWJSLAJ.

	Α	В	C	D	E	F	G	н	I	J	K	L	M	N	Ñ	0	P	Q	R	s	Т	U	V	W	х	Y	Z
Freq	7	3	1		3			5	5	5	6	5	1		2	4	1		10	4			1	16			1

10) [100 Points] You encountered this message from as you leave the building. What does it say?



School	V	JV1	JV2	JV3
Semoor	•		0 1 2	0 1 2

11) [180 Points] A sign by a garden outside the school curiously has the following written on it. What does it say?



nswer:				

12) [100 Points] Using a key of **FIND** encode the string **FREQUENCY** using the Hill Cipher with a 26 character alphabet. e.g.

F	R	E	Q	ש	E	N	U	Y	

13) [125 Points] Using a key of **THEWORDSZ** encode the string **SYNCHRONISING** using the Hill Cipher with a 26 character alphabet. e.g.

$$\begin{pmatrix} T & H & E \\ W & O & R \\ D & S & Z \end{pmatrix} \equiv \begin{pmatrix} 19 & 7 & 4 \\ 22 & 14 & 17 \\ 3 & 18 & 25 \end{pmatrix}$$

S	Y	N	C	Н	R	0	N	I	ន	I	N	G	

14) [50 Points] Using a code word of TIME, encode the following sentence using the Vigenère cipher.

L	I	F	E

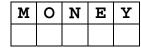
I	S

ន	Н	0	R	T

Α	N	D

S O





School	V J	$\nabla 1$	JV2	JV3

15) [100 Points] Someone is passed you a joke that has been encoded using the Vigenère cipher using the a common five letter word. You have been told that it starts out as **DEAR MATH**. What is the joke?

F	Р	Α	J	E		C	E	Н	Н	D		G	L	S	W	Y		Т	Z	W	M	Н		С	Y	D	K	G
	~	_		~	Γ	- 1	~	•	•	_	1	_	~	_	-	_	ĺ	~		-	_	_	Г		_	_	7.7	
N	G	E	Q	G	-	W	С	0	0	F		R	С	0	Т	ע		G	Х	S	Α	E	_	V	Т	R	W	V
																							<u></u>					
Q	Q	S	G	D	Γ	х	Т	N	Y	L	1	J	P	M	Х	G		Т	J	0	M							
~	×		3		-		_	7.4	_			5	-	1.1	21	5		_	-		1/1							
					L																							

16) [400 Points] Solve this Patristocrat.

IBRSE EUHCU MKBUA XJXUQ MBOCI FHDHD BCSOB HDFEP FEVIB

ACBZI DBEIB RXBSH BZHDB O

	Α	В	C	D	E	F	G	Н	I	J	K	L	M	N	0	P	Q	R	ន	T	ט	V	W	X	Y	Z
Freq	2	12	4	5	5	3		6	5	1	1		2		3	1	1	2	3		4	1		3		2

School	V	JV1	JV2	JV3
School		J V I	3 4 2	J V J

17) [250 Points] Solve this Patristocrat containing a quote by Albert Einstein. In it, you will find the word **KEEP** and the suffix **ING** at least twice each along with **YOU** twice.

KYHDY NKYCD LYQYR FBMYZ JZKDU ACDDO JAGLM BKBRZ DJAGV

GNUCD DOVAT YRF

	A	В	U	О	E	F	ብ	Н	I	J	K	L	M	N	0	P	Ø	R	ន	T	ם	V	W	X	Y	Z
Freq	4	3	3	8		2	3	1		3	4	2	2	2	2		1	3		1	2	2			7	3

18) [400 Points] My phone badly mangled this quote from Jonathan Davis. What does it say?

MSM AEYID ER BM TMQEYFM MOM EB HXPPMVMKR. MOM AEYID ER

MSM TMQEYFM MSM EVM ESA RDM FEBM.

	Α	В	U	D	E	F	ъ	H	I	Ъ	K	Ь	M	N	0	P	Q	R	ន	T	ם	٧	W	X	Y	Z
Freq	3	3		3	10	3		1	2		1		20		2	2	2	4	4	2		2		1	4	