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	М	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	Χ	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	Х	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	N	0	Р
R	R	S	Т	U	V	W	Х	Y	Z	А	В	С	D	Ε	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	А	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	Α	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	E	F	G	Н	Ι	J	K	L	M	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	Т	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	\mathbf{V}	IV1	JV2	IV3
SCHOOL	v	J V I	JVZ	J V J

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.

BQ BT O VBTQOEK QP QYBJE QYOQ VPLBJD XOTQ BT QYK

TOVK OT ORQHOZZF DPBJD TPVKIYKAK..

	Α	В	C	D	E	F	G	Н	Ι	b	K	L	M	N	0	P	Q	R	S	T	ט	٧	W	X	Y	Z
Freq	1	7		3	2	1		1	1	3	6	1			8	4	9	1		7		4		1	4	2

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

1) [100 Points] Solve this Cryptogram which is a quote by Anne Bradstreet where the words **WOULD** and **BE** appear each appear twice.

FY TB UGZ JV TFJXBI, XUB KCIFJM TVWAZ JVX RB KV

CABGKGJX: FY TB ZFZ JVX KVLBXFLBK XGKXB VY GZQBIKFXO,

CIVKCBIFXO TVWAZ JVX RB KV TBADVLB.

_		Α	В	U	D	E	F	ъ	Н	I	J	K	L	M	N	0	P	Q	R	S	T	ט	V	W	X	Y	Z
	Freq	4	14	4	1		8	5		5	7	9	3	1		2		1	2		6	2	12	2	11	3	6
																											i

2) [140 Points] Solve this Cryptogram which is a quote by Bruce Lee.

FREOKB EWME EWB AEOPPBAE EVBB OA HRAE BMAOUC KVMKJBX,

LWOUB EWB IMHIRR RV LOUURL AQVYOYBA IC IBFXOFZ LOEW EWB

LOFX.

	Α	В	ט	D	E	F	Ъ	Н	I	Ъ	K	L	M	N	0	P	Q	R	ន	Т	ם	٧	W	X	Y	Z
Freq	7	12	2		11	4		2	4	1	3	5	4		10	2	1	6			4	4	6	3	2	1

3) [250 Points] Solve this Cryptogram which is quote by Evel Kenievel.

U YIFR GWR KRRYUBL IK GWR KNRTW QUN IB PH KQOR

QBS GWR MUBS EYIMUBL GWNICLW PH WQUN.

	А	В	C	D	E	F	G	н	I	J	K	L	M	N	0	P	Q	R	ន	Т	Ū	V	W	х	Y	Z
Freq		5	1		1	1	4	2	5		4	3	2	4	1	2	4	8	2	1	6		7		3	

4) [300 Points] Solve this Cryptogram from Dante Alighieri.

ZLTN OTFFSN EL ILHTKTNLG WKSJ WMKL,

SK ELTBNA WKSJ NZL LNLKFTD.

	Α	В	C	D	E	F	G	н	I	J	K	L	M	N	0	P	Q	R	S	T	U	V	W	x	Y	Z
Freq	1	1		1	2	3	1	1	1	2	6	9	1	6	1				4	6			3			2

School	V	JV1	JV2	JV3
School	•	J V I	J V Z	3 4 3

5) [100 Points] Encode the string INVASIVESPECIES using the Affine Cipher with a=5 and b=11.

I	N	V	Α	ន	Ι	V	E	ន	P	E	C	Ι	E	S

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

a=	b=

School	V	JV1	JV2	JV3
Dellool	•	0 1 1	3 1 2	3 1 3

7) [160 Points] Another 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 **OW**. With that knowledge, what does this message say?

D	В	ש	L	U	Н	р	ტ	M	S	р	Α	E	Α	Н	Н	Α	K

8) [180 Points] Solve this Patristocrat which is a quote by Seth Godin. The first word is **LEARNING** and the last word is **DO**.

HZNQM GMPGB MJKOJ MZKJU JRGKG BBJDZ

KYGMP UJREY JJBZK JOJ

	Α	В	C	D	E	F	G	H	I	J	K	L	M	N	0	P	Q	R	ន	T	Ū	٧	W	X	Y	Z
Freq		4		1	1		5	1		10	5		5	1	2	2	1	2			2				2	4

School	V	JV1	JV2	JV3

9) [250 Points] Solve this Spanish proverb Cryptogram.

JB YL AFLGL YUXUZ UEFU GL FJU ATLGZL.

	A	В	C	D	E	F	G	н	I	J	K	ь	M	N	Ñ	0	P	Q	R	ន	Т	Ū	v	W	х	Y	Z
Freq	2	1			1	3	3			2		6									1	5			1	2	2

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



Answer:			

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?



Answer:			

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

$$\begin{pmatrix} H & E \\ L & P \end{pmatrix} \equiv \begin{pmatrix} 7 & 4 \\ 11 & 15 \end{pmatrix}$$

F	0	R	E	N	ន	I	U	ន	

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

$$\begin{pmatrix} H & E & L \\ P & F & O \\ R & U & S \end{pmatrix} \equiv \begin{pmatrix} 7 & 4 & 11 \\ 15 & 5 & 14 \\ 17 & 20 & 18 \end{pmatrix}$$

D	Y	N	Α	M	I	C	Р	L	Α	N	E	Т	

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

Н	Α	V	E

W	E

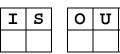
E	V	E	R

Ī	Į	Н	0	U	G	Н	T

T	Н	A	T

В	E	I	N	G

L	0	S	Т



D	E	S	Т	I	N	Α	Т	I	0	N

	School V JV1 JV2 JV3 [100 Points] Someone is trying to tell you a secret that has been encoded using the Vigenère cipher using																												
15)	[10	0 Pc	oint	s] S	Son	neor	ne is	tryi	ng t	o tel	11 y	ou a	a sec	eret 1	that	has	be	en e	nco	ded	usir	g th	e V	Vige	nère	cip	her ι	ısinş	3
the	a co	omn	non	five	let	tter	wor	d. Y	ou l	have	be	een	told	that	the	34t	h t	hrou	ıgh t	he 3	9th	lett	ers	in tl	ne co	ode	(USV	IPV'	T)
act	uall	y is 1	the	wor	d H	ID:	ING	. W	/hat	doe	th	e m	essa	ge d	leco	de to	0?												
													•			•	-					•	-						
M	0	M	E	0		T	Y	M	F	Y		F	L	В	Ŭ	S		G	N	Α	L	Y		N	Y	ט	V	X	

16) [400	Pointsl	Solve this	Patristocrat.

NWDXD HRMLN WHMKS DNNDX NWVMV ZXHDM CAMGD RRHNH

RVZXH DMCQH NWBWL BLGVN D

	Α	В	U	D	E	F	Ъ	Н	I	Ъ	K	L	M	N	0	P	Q	R	ធ	T	ש	V	W	X	Y	Z
Freq	1	2	2	8			2	7			1	3	6	8			1	4	1			4	5	4		2

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

17) [250 Points] Solve this Patristocrat containing a quote by Pablo Neruda. In it, you will find the words CAN and YOU at least twice each.

XDVQS MQVAS CCAEU PCDZU WOLVA XDVQS MMDAN UUYOY WHMBP

WDGQD GHMB

	A	В	C	D	E	F	Ъ	Н	I	J	K	L	M	N	0	P	Q	R	ន	T	Ū	٧	W	X	Y	Z
Freq	4	2	3	6	1		2	2				1	5	1	2	2	4		3		4	4	3	2	2	1

18) **[400 Points]** My phone badly mangled this great quote commonly attributed to Abraham Lincoln. What does it say?

THT BQJ NUUW QHW IDT RTURWT VAP UN IDT IDXPT, QJG VAP UN

IDT RTURWT QHW IDT IDXPT, CAI THT BQJJUI NUUW QHW IDT

RTURWT QHW IDT IDXPT.

	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	3	2	1	9			1	6	11	4				4		5	7	6		19	10	2	9	3		