North Carolina Science Olympiad — Code Busters Test 2

Names of participants: (Please print nearry)	
	
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:	(use to calculate Bonus below)

Question	Value	Incorrect letters	Deduction	Score
Timed	100	111001100010010	2000000	20010
1	140			
2	300			
3	125			
4	250			
5	75			
6	120			
7	100			
8	50			
9	350			
10	350			
11	120			
12	120			
13	75			
14	60			
15	100			
16	120			
17	300			
18	125			
19	50			
Bonus				
Final Score				

The following tables might be useful during the event.

	A	В	С	D	E	F	G	H	I	J	K	L	M	N	0	P	Q	R	S	T	Ū	٧	W	Х	Y	Z
A	Α	В	С	D	Ε	F	G	Н	Ι	J	K	L	М	N	0	Р	Q	R	S	Т	U	V	M	Χ	Y	Z
В	В	С	D	Ε	F	G	Н	Ι	J	K	L	М	N	0	Р	Q	R	S	Т	U	V	M	Χ	Y	Ζ	А
С	С	D	Ε	F	G	Н	Ι	J	K	L	М	N	0	Р	Q	R	S	Т	U	V	W	Χ	Y	Ζ	А	В
D	D	Ε	F	U	Н	Ι	J	K	L	М	Ν	0	Р	Q	R	S	Т	U	V	M	Χ	Y	Z	Α	В	С
E	Ε	F	G	Н	Ι	J	K	L	М	N	0	Р	Q	R	S	Т	U	V	M	Χ	Y	Ζ	Α	В	С	D
F	F	G	Н	Ι	J	K	L	М	N	0	Р	Q	R	S	Т	U	V	M	Χ	Y	Ζ	Α	В	С	D	E
G	G	Н	Ι	J	K	L	М	N	0	Р	Q	R	S	Т	U	V	W	Χ	Y	Ζ	А	В	С	D	Ε	F
Н	Н	Ι	J	K	L	М	N	0	Р	Q	R	S	Т	U	V	M	Χ	Y	Ζ	А	В	С	D	Ε	F	G
I	Ι	J	K	L	М	N	0	Р	Q	R	S	Т	U	V	M	Χ	Y	Z	Α	В	С	D	Ε	F	G	Н
J	J	K	L	М	Ν	0	Р	Q	R	വ	Т	IJ	V	M	Χ	Y	Ζ	А	В	С	D	Ε	F	G	Н	I
K	K	L	М	N	0	Р	Q	R	S	Т	U	V	W	Χ	Y	Ζ	Α	В	С	D	Ε	F	G	Н	Ι	J
L	L	М	N	0	Р	Q	R	S	Т	U	V	M	Χ	Y	Ζ	А	В	С	D	Ε	F	G	Н	Ι	J	K
M	М	N	0	Р	Q	R	S	Т	U	V	M	Χ	Y	Z	А	В	С	D	Ε	F	G	Н	Ι	J	K	L
N	N	0	Р	Q	R	S	Т	U	V	M	Χ	Y	Z	А	В	С	D	Ε	F	G	Н	Ι	J	K	L	М
0	0	Р	Q	R	S	Т	U	V	W	Χ	Y	Ζ	Α	В	С	D	Ε	F	U	Н	Ι	J	K	L	М	N
P	Р	Q	R	S	Т	U	V	W	Χ	Y	Z	А	В	С	D	Ε	F	G	Н	Ι	J	K	L	М	Ν	0
Q	Q	R	S	Т	U	V	M	Χ	Y	Ζ	Α	В	\cup	D	Ε	F	G	Н	Ι	J	K	L	М	N	0	Р
R	R	S	Т	IJ	V	W	Χ	Y	Ζ	А	В	\cup	О	Ε	F	G	Н	Ι	Ŋ	K	L	М	Ν	0	Р	Q
S	S	Т	U	V	W	Χ	Y	Ζ	Α	В	\cup	D	Ε	F	G	Н	Ι	J	K	L	М	N	0	Р	Q	R
T	Т	U	V	W	Χ	Y	Ζ	Α	В	\cup	О	Ε	F	G	Н	Ι	Ŋ	K	L	М	N	0	Р	Q	R	S
Ū	U	V	M	Χ	Y	Ζ	Α	В	С	D	Ε	F	G	Н	Ι	J	K	L	М	Ν	0	Р	Q	R	S	Т
V	V	W	Χ	Y	Ζ	А	В	С	D	Ε	F	G	Н	Ι	J	K	L	М	N	0	Р	Q	R	S	Т	U
W	M	Χ	Y	Z	А	В	С	D	Ε	F	G	Н	Ι	J	K	L	М	Ν	0	Р	Q	R	S	Т	U	V
X	Χ	Y	Z	А	В	С	D	Ε	F	G	Н	Ι	J	K	L	М	N	0	Р	Q	R	S	Т	U	V	M
Y	Y	Z	Α	В	С	D	Ε	F	G	Н	I	J	K	L	М	N	0	Р	Q	R	S	Т	U	V	M	Χ
Z	Z	А	В	С	D	Ε	F	G	Н	Ι	J	K	L	М	N	0	Р	Q	R	S	Т	U	V	W	Χ	Y
	_																									

AAAABA B AAABA C AAABBA E AABAAA F AABBAB G AABBBA III ABAAAA IVI ABAABAB K ABABBA L ABABBB M	AAAA	Α
AAABB D AABAA E AABAB F AABBA G AABBB H ABAAA I/J ABAAB K ABABA L	AAAAB	В
AABAA E AABAB F AABBA G AABBB H ABAAA I/J ABAAB K ABABA L	AAABA	C
AABAB F AABBA G AABBB H ABAAA I/J ABAAB K ABABA L	AAABB	D
AABBA G AABBB H ABAAA I/J ABAAB K ABABA L	AABAA	Е
AABBB H ABAAA I/J ABAAB K ABABA L	AABAB	F
ABAAA I/J ABAAB K ABABA L	AABBA	G
ABAAB K ABABA L	AABBB	Н
ABABA L	ABAAA	I/J
	ABAAB	K
ABABB M	ABABA	L
	ABABB	M

Ι

GH

5

A B

CDFF

3

4

J

K L M

ABBAA	N
ABBAB	O
ABBBA	P
ABBBB	Q
BAAAA	R
BAAAB	S
BAABA	T
BAABB	U/V
BABAA	W
BABAB	X
BABBA	Y
BABBB	Z

R S T

9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

0

N

Frequency Table of English letters:

Ε	12.51%	S	6.54%	С	3.06%	G	1.96%	K	0.67%
Т	9.25%	R	6.12%	U	2.71%	M	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:

E	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%	Ñ	0.17%
0	9.20%	D	4.67%	В	1.49%	G	1.00%	X	0.14%
S	7.20%	T	4.60%	Н	1.18%	F	0.69%	K	0.11%
N	6.83%	U	4.69%	Q	1.11%	J	0.52%	M	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."

Famous Phrases

Gettysburg address:

FOUR SCORE AND SEVEN YEARS AGO OUR FATHERS BROUGHT FORTH ON THIS CONTINENT, A NEW NATION, CONCEIVED IN LIBERTY, AND DEDICATED TO THE PROPOSITION THAT ALL MEN ARE CREATED EQUAL.

Declaration of Independence:

WHEN IN THE COURSE OF HUMAN EVENTS IT BECOMES NECESSARY FOR ONE PEOPLE TO DISSOLVE THE POLITICAL BANDS WHICH HAVE CONNECTED THEM WITH ANOTHER AND TO ASSUME AMONG THE POWERS OF THE EARTH, THE SEPARATE AND EQUAL STATION TO WHICH THE LAWS OF NATURE AND OF NATURE'S GOD ENTITLE THEM, A DECENT RESPECT TO THE OPINIONS OF MANKIND REQUIRES THAT THEY SHOULD DECLARE THE CAUSES WHICH IMPEL THEM TO THE SEPARATION.

Constitution of United States of America:

WE THE PEOPLE OF THE UNITED STATES, IN ORDER TO FORM A MORE PERFECT UNION, ESTABLISH JUSTICE, INSURE DOMESTIC TRANQUILITY, PROVIDE FOR THE COMMON DEFENSE, PROMOTE THE GENERAL WELFARE, AND SECURE THE BLESSINGS OF LIBERTY TO OURSELVES AND OUR POSTERITY, DO ORDAIN AND ESTABLISH THIS CONSTITUTION FOR THE UNITED STATES OF AMERICA.

MAGNA CARTA (In Latin):

JOHANNES DEI GRACIA REX ANGLIE, DOMINUS HIBERNIE, DUX NORMANNIE, AQUITANNIE ET COMES ANDEGAVIE, ARCHIEPISCOPIS, EPISCOPIS, ABBATIBUS, COMITIBUS, BARONIBUS, JUSTICIARIIS, FORESTARIIS, VICECOMITIBUS, PREPOSITIS, MINISTRIS ET OMNIBUS BALLIVIS ET FIDELIBUS SUIS SALUTEM.

School	V	IV1	JV2	IV3

Timed question [100 Points]: Solve this Aristocrat which is a quote from an unknown origin. When you have solved it, raise your hand so that the time can be recorded and the solution checked.

DW'NW AXHW UQWXM AWHJYXB SQTUQWOO JV MEW BXOM

UWVWQXMJTV. DEXM ROWH MT KW AWQWBI XV JMYE JO VTD XV

XBBWQUI.

	A	B	C	D	E	F	G	H	Ι	J	K	L	\mathbf{M}	N	0	P	Q	R	S	T	U	V	W	X	Y	\mathbf{Z}
Frequency	3	5		3	3			3	2	5	1		7	1	5		6	1	1	4	4	6	14	9	2	
Replacement																										

1) **[140 Points]** A message encrypted with the Affine Cipher using an alphabet of 26 characters has been intercepted. You have been told that the first two characters of the message are the letters **PU**. With that knowledge, what does this message say?

X	U	F	I	Т	U	I	U	В	F	Н	W	Т	A	W	Т	S	K	ტ	X

2) [300 Points] Solve this Xenocrypt which is a quote in Spanish.

TCKC TLQLHCT EXICT NEB YLO LE KB YXAB.

TXE LHJBQZC, TXLHWQL WCAQLHCT AXTUQNPBQ

AL KB XEHBANQLO.

	A	В	C	D	E	F	G	H	Ι	J	K	L	M	N	Ñ	0	P	Q	R	S	T	U	V	\mathbf{W}	X	Y	\mathbf{Z}
Frequency	5	7	7		5			5	1	1	3	10		3		2	1	7			8	1		2	6	2	1
Replacement																											

School	V	IV1	JV2	IV3
DCHOOL	v	., v 1	J V Z	J V .)

3) [125 Points] Solve this Aristocrat which is a quote from David Hanson.

PV'JV MVVXHL FWV NJJXINE YA UYHIVJMNFXYHNE JYCYFM

FWNF UNH PNEG XH YQJ PYJEZ. XF'M N LYEZVH NLV YA

XHIVHFXYH.

	A	В	C	D	E	F	G	H	Ι	J	K	L	M	N	0	P	Q	R	S	T	U	V	W	X	Y	Z
Frequency	2		1		5	7	1	9	3	7		3	4	9		3	1				2	9	2	7	10	2
Replacement																										

4) [250 Points] Solve this Patristocrat which is a quote by Evan Esar and ends with SIONS.

VUMUR VURWV USQJO FHVWR QOWQU SMUQO MIFQV PRKKQ

AQOUQ LDQAU VXVRO NUSQV MCQKR NXAQV UJPAM ZPRKK

QAQOU WJOWF XVRJO V

	A	В	C	D	E	F	G	H	Ι	J	K	L	M	N	0	P	Q	R	S	T	U	V	W	X	Y	Z
Frequency	5		1	1		3		1	1	4	5	1	5	2	8	3	14	8	3		11	11	5	3		1
Replacement																										

5) [75 Points] The following symbols encodes a phrase using a Baconian alphabet. What does it say?
Answer:
<u>ченениения в на применяющие на примена на примена на примена на примена на примена на примена </u>
ээссээээсгэсэсэсэссэссэссэсэээээссэээээссэсэээээсс
<u>агененинанеентениенинанининеентининанининанинин</u>
окаканананананананананананананананананан
6) [120 Points] Solve this Aristocrat which is a quote from Roy T. Bennett and starts with DON' T.

6) [120 Points] Solve this Aristocrat which is a quote from Roy T. Bennett and starts with DON'T.

IUL'C HRC CBR RVSRKCQCNULO QLI USNLNULO UT UCBRW

SRUSHR QTTRKC MUDW IRKNONULO. NC'O MUDW HNTR, LUC

CBRNWO.

	A	В	C	D	E	F	G	H	Ι	J	K	L	M	N	0	P	Q	R	S	T	U	V	W	X	Y	Z
Frequency		3	10	2				3	3		3	7	2	8	6		3	11	4	4	11	1	4			
Replacement																										

																	Scł	nool				V .	JV1	JV2 JV3
					ode	the	strin	g A S	S S!	ľRO	NG	AS	IT	S W	EAK	ESI	· L	INK	usin	g th	e Af	fine	Cipl	ner with
	a=9	and	b=8	3.																				
A	S	S	Т	R	0	N	G	A	S	Ι	Т	s	W	E	Α	K	E	S	Т	L	Ι	N	K	
8)	3) [50 Points] Using a code word of BRICK, encode the following quote from Zig Ziglar using the Vigenère cipher.																							
	cipher.																							
W	E	I	3 U	I	L	D		0 1	U I	₹	С	H	Α	R	A (C :	r F	R		F	R	0 1	M	THE
							L																	
В	R]	ГС	K	S	0	F	Н	Α	в	ГТ		W E	. [P	ΙL	E	1	U P	T:	D A	Y	E	з Ү	D A Y
													-						1 -					
							L					ı		·						ı				
		Poi se T										-			arie (Curi	e an	d is	enco	ded	usii	ng a	K1 k	tey and the

HJYRG HQGHU GPOGL YJIOP OFEON GYGLJ HUCYJ IOZHN

OELYJ JNHJK GLYRO YGVOY JZHNO ELYFH NVJEO LJYRF

YKOVF CPOFE UOLL

K 1	A	В	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	\mathbf{V}	W	X	Y	\mathbf{Z}
Frequency			2		5	5	8	8	2	10	2	8		5	13	3	1	3			3	3			11	2
Replacement																										

10) [350 Points] Solve this K1 Key encoded Patristocrat which is a quote by Arthur C. Clarke and ends with the letters IBLE.

XPFKU ECAGC KIOQW NKZFJ QULXP FEQTQ XWKIX PFHKW

WOMEF QWXKZ FUXYJ FGEQX XEFAG CHGWX XPFTQ UXKXP

FQTHK WWQME F

K1	A	В	C	D	E	F	G	H	Ι	J	K	L	M	N	O	P	Q	R	S	T	U	V	\mathbf{W}	X	Y	Z
Frequency	2		3		6	11	4	3	2	2	8	1	2	1	1	5	10			3	4		8	12	1	2
Replacement																										

11) [120 Points] The following strange headlines appeared in the newspaper but in reality, they are a Baconian encoded message where some letters encode as one character and the others as another in a pattern. You know that the message starts out as **READNO**. What does the message decode to?

Answer:			

Allow class photo today.

Small party asked noted daily local guide.

Grass upset booth clock today.

Sixth hotel added stock teeth stone.

Total peace dealt space issue.

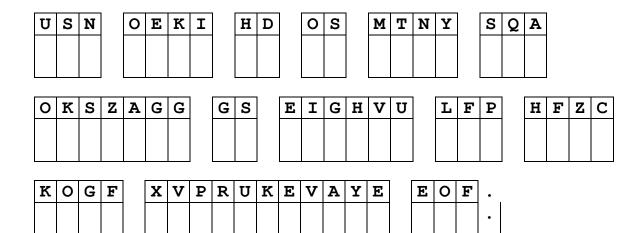
Model shell links price, allow added truly whole words.

Texas crowd could alter glass clock.

Small globe model stood lucky.

Worst horse drawn booth start block stood least along south storm.

12) [120 Points] The following quote from Abraham Lincoln has been encoded using a running key cipher against a famous document. What does it say?



13) [75 Points] Using a key of RICH encode the string **DESTINATION** using the Hill Cipher with a 26 character alphabet. e.g.

$$\begin{pmatrix} R & I \\ C & H \end{pmatrix} \equiv \begin{pmatrix} 17 & 8 \\ 2 & 7 \end{pmatrix}$$

D	E	S	T	I	N	A	T	I	0	N	

14)	cha	ırac	ters	s. Y	ou	hav	e d	isco	ove	red 1	tha	t th	e m	essa	age	FM	DD:		deco	odes	s to	say	-					-	bet the	
a=	=			b=																										
15)	cip	her	usi	ng a	a ve	ery o	con	nmo	n fi	ive l	lett	er v	vorc	l. Y	l'ou	hav	ve l		ı tol	d th	at t	he 5								nère n the
					ı						-						_													
F	В	W	Q	P		F	Y	D	T	K		S	Y	F	K	G	_	A	Z	Х	M	Y		В	Y	J	K	G		
Ū	P	W	A	Y		T	U	L	P	С		E	V	W	M	P		0	Ū	J	M	Н		G	F	D	G	J		

U X V M P

U H L P

G

D Y U M U

E

Y K W H

F B W

UK

X

School	V	JV1	JV2	JV3

16) [120 Points] Solve this Aristocrat which is a quote from Bernard Bailey which has the word CENTER in it.

AOPZ IREPZRP HEZFNNW NDRFBPI BOP RPZBPY DH BOP

LZEUPYIP, IDKP SPDSNP AENN TP ILYSYEIPG BD NPFYZ

BOPW'YP ZDB EB.

	A	В	C	D	E	F	G	H	I	J	K	L	M	N	0	P	Q	R	S	T	U	V	W	X	Y	Z
Frequency	2	8		6	6	3	1	2	6		1	2		7	4	18		4	3	1	1		2		6	7
Replacement																										

WQ KNK CMWF KJKF EHBVIAKB HVN EDWKLT, AMK QWFTA

AMWLR KNK'B ETG WT CKEAMKF AMKN IEPK QFZP E ODELKA

CKEF OKZODK EDTZ BKLN TIWKLIK

	A	B	C	D	E	F	G	H	Ι	J	K	L	M	N	0	P	Q	R	S	T	U	V	\mathbf{W}	X	Y	Z
Frequency	7	4	3	4	9	6	1	2	4	1	20	5	5	5	3	2	3	1		6		2	7			3
Replacement																										

^{17) [300} Points] Neil deGrasse Tyson's phone greatly mangled one of his tweets before encrypting it. What does it say?

18) **[125 Points]** Using a key of **MILLSTONE** encode the string **CONCENTRATING** using the Hill Cipher with a 26-character alphabet. e.g.

$$\begin{pmatrix} M & I & L \\ L & S & T \\ O & N & E \end{pmatrix} \equiv \begin{pmatrix} 12 & 8 & 11 \\ 11 & 18 & 19 \\ 14 & 13 & 4 \end{pmatrix}$$

С	0	N	С	E	N	Т	R	A	Т	I	N	G	

19) [50 Points] An anecdote has been encoded using a Caesar Cipher. What does it say?

W K H	R S W L	P L V W	V D B V	W K H	O D V V L V
K D O I	I X 0 0	, W K	H S H V	V L P L V W	V D B V W K H
J O D V	v L v	K D O I	H P S W B	, W K H	H Q J L Q H H U
V D B V	W K H	J O D V	V L V	W R R O I	О U J H .