

Science Olympiad – SSSS Codebusters

C - will0416

2019

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: _____ (use to calculate Bonus below)

Question	Value	Incorrect letters	Deduction	Score
Timed	200			
1	250			
2	150			
3	450			
4	400			
5	650			
6	500			
7	300			
8	600			
9	450			
10	100			
11	450			
12	500			
13	400			
14	500			
15	600			
16	350			
17	300			
18	700			
19	550			
20	250			
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

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	3	5	7	9	11	15	17	19	21	23	25
1	9	21	15	3	19	7	23	11	5	17	25

AAAAA	A	AABBA	G	ABBAA	N	BAABA	T
AAAAB	B	AABBB	H	ABBAB	O	BAABB	U/V
AAABA	C	ABAAA	I/J	ABBBA	P	BABAA	W
AAABB	D	ABAAB	K	ABBBE	Q	BABAB	X
AABAA	E	ABABA	L	BAAAA	R	BABBA	Y
AABAB	F	ABABB	M	BAAAB	S	BABBB	Z

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 [200 points] Solve this timed aristocrat by Albert Schweitzer. When you have solved it, raise your hand so that the time can be recorded and the solution checked.

CTFTCTHRT QVC UWQT JCWHND XD WHSV Y DOWCWSXYU

CTUYSWVH LWSP SPT LVCUG LPWRP WD WHGTOTHGTHS VQ YUU

MHVLU TGNT VQ SPT XHWFTCDT.

	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			8	5		2	4	9		1		4	1	2	2	5	4	2	7	15	7	7	11	3	4	
Replacement																										

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1) [250 points] Solve this catchy song lyric from 2012 with errors.

NFC HCH KHZO IHO CTA, FJL ONBZ BZ RUF C SHH. XA OO

NHFUZ IC JAIX XBUL, ZTFQ RFGG IH IFC XH.

	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	3	3	6			7	2	9	5	2	1	2		3	5		1	2	1	2	3			4		5
Replacement																										

2) [150 points] (Atbash) Hopefully you know what to do.

Z	I	V	B	L	F	S	Z	E	R	M	T	U	F	M	?	R	H	F	I	V	S	L	K	V	B	L	F	Z	I	V	!
																															!
M	L	D	,	T	L	T	V	G	G	S	Z	G	Y	I	V	Z	W	Z	M	W	U	R	M	R	H	S	G	S	R	H	
			,																												
G	V	H	G	H	G	I	L	M	T	!																				!	

3) [450 points] (Affine) A little bird told me that the first two letters are IK.

H	D	K	V	F	B	V	J	Y	W	H	K	D	B	V	J	J	K	E	P	C	N	Y	X	K	E	F	W	X	Y	
B	V	J	Y	W	V	J	L	W	Y	H	N	X	H	E	I	J	Y	H	Z	K	V	Y	N	J	C	P				
B	V	J	C	P	X	O	H	M	P	Y	W	X	Y	F	W	X	Y	B	V	J	W	P	X	C	E	H	N	K	V	Y
F	W	X	Y	H	Z	P	X	K	Y																					

4) [400 points] Solve this vigenère cipher with a key of GRAPES.

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

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5) [650 points] (Hill) I'm sorry little one, but some math on this test was inevitable. Encode the plaintext with the key "THANOSCAR".

$$\begin{pmatrix} T & H & A \\ N & O & S \\ C & A & R \end{pmatrix} \equiv \begin{pmatrix} 19 & 7 & 0 \\ 13 & 14 & 18 \\ 2 & 0 & 17 \end{pmatrix}$$

S	P	O	I	L	E	R	A	L	E	R	T	I	R	O	N	M	A	N	D	I	E	S	

6) [500 points] Solve this baconian cipher and try not to hate me if you figure out the pattern.

yeuhysuhkytyuhi tuhyeuskhtyuteshyktuhyiuhytesuhkyuhyu

hytuhyiuthyuhyeuhsyuhykuhtyui theyuskthyuhyuhteyushyu

kthyui theyushykuthiytesuhyukuhyuhtyiuhtyuhyuheyushykuh

yutihtyesuhkyuhtiyuthyueskhyuhyutihytuheyuskhtyuitehy

uhysuhkytuihyuhytheyuhyuskhytiuthesyuhykuhtyui

7) **[300 points]** Solve this K2 aristocrat with a keyword of "yum".

UKJQEJREQW CESAP RP OKKQP; UDJJCA CESAP RP YOZJUDAP,

HAQQEJC RP PQAQUD ZJM CKT ZJM OAZUD JAT DAECDQP.

Replacement																												
K2	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	9		6	6	6			1		8	4		2		5	9	8	4	2	2	5		1		1	5		

8) **[600 points]** Solve this patristocrat about what makes a good friend.

MHAFM SFUQM MDVFG ZVGFY GSMDG YHSVU OSFFQ ZVQUV

RQAMH AFMJA MMSUT YGSMD SUGUR QUVSF GZSFM GWV

	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	4			3		9	8	3		1			11		1		5	2	9	1	7	7	1		3	3
Replacement																										

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9) **[450 points]** Jasmine, has faithfully followed the steps of the RSA key-generation algorithm. Here are the results:

$$p = 733$$

$$q = 131$$

$$n = 96023$$

$$\phi = 95160$$

$$e = 85859$$

Unfortunately, Jasmine doesn't know how to compute the value of d and needs you to do that final step for them.

Enter the computed value of d , NOT the formula.

10) **[100 points]** Solve this Caesar cipher. And as the wise Fetty Wap once said, "1738".

Z	'	D	C	Z	B	V	Y	V	P	N	Y	R	K	'	J	L	G	Y	V	C	C	F	!
	'													'									!

11) [450 points] Solve this xenocrypt by someone, like Patrick, whose mind is an enigma.

QH VMNTVMH NR LTH NVLHVMÑT CMJNPNTVMHQ. QH PNQMYMÑT

NR LTH VÑTCMVMÑT QMIMBN.

	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
Frequency		1	2					7	1	1		3	11	8	4		2	5	2		8		7			1	
Replacement																											

12) [500 points] Solve this baconian cipher.

EARTH EATEN A WALK A WALK A BEAT EARTH EARTH A GOOD

EARTH A DEAL A GIRL A HAND A HAND A GIRL EDGAR A GOOD

A SHOT A KIND EARLY A KING A BEAT AGENT A BABY EARLY

EARLY A BEAT EMPTY A SHOT A GIRL A DEAL A HAND A GOOD

A DEAL A BEAT A GIRL A SHOT A BEAT A BEAT A SHOT

A GOOD A GIRL EAGER EARTH A SONG A GIRL EARTH EARLY

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13) [400 points] Special Agent, Emily, has the following RSA public key:

$$n = 91417 \quad e = 48557$$

Unfortunately for them, A quantum computer has successfully factored their n

$$91417 = 113 * 809$$

Compute the value of their private key:

Enter the computed private key:

14) [500 points] Don't let the test fool you, this is a running key cipher, not a vigenère. Decipher this using a key that you recite at school every day.

E	D	H	,	X	K	G	X	S	F	C	I	C	I	S	C	C	X	K	W	H	A	M	H	.	Y	O	C	Y	J	X	W
			,																					.							

K	I	V	V	Z	,	C	R	M	'	K	E	T	P	J	S	F	D	K	Q	F	Z	G	T	H	N	Q	A	O	E	M	A	R	C
					,				'																								

I	B	F	C	M	!	F	T	B	'	K	X	L	L	K	Z	K	H	M	K	A	T	H	V	,	H	U	M	F	T	X	A	H	
					!				'																,								

V	M	Z	H	E	E	Z	T	R	Z	N	W	P	M	M	W	X	F	C	W	K	V	M	L	L	U	U	S

R	M	R	E	Z	S	C	.
							.

15) [600 points] Solve this xenocrypt on liberty (hopefully a familiar topic by now).

CLHK CL ÑK VKL KÑHK LKIYWMXYK JMC UTLCT; ÑK ÑYICXHKW

Q ÑK GYWK LTO SKOKWKL LTÑT UTX JMYCOCL ÑKL

DTOJMYLHKO DKWK WYK.

	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
Frequency			7	2			1	4	2	3	19	11	4		7	5		1		1	7	2	1	6	3	7	
Replacement																											

16) [350 points] Solve this affine cipher as fast as you can (the first two letters happen to be SO).

H	F	Y	P	Z	O	I	N	I	N	G	B	N	I	F	B

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17) [300 points] Finally just a regular cipher! Solve this aristocrat by G. Campbell without any errors . . . you can take my word for it.

VQLL TCZ VTSQ ZSDOYDDSPC RSHH LELQ IL VPYCZ MUL

VSQGLDM VQSLCZ MP MQYMU.

	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			4	4	1		1	2	1			8	5		1	3	6	1	6	2	2	5			3	4
Replacement																										

18) [700 points] Solve this tough patristocrat by Andrew J. Bernstein.

IBKTO UMBOD GHKDO ZZOUP ETQGH ISFBP THZBX BFBNU

BMBOD BYIGO FBPTH ZBXXB TIOOD BYGQP DGGZB ODBY

	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		6	1	3	6	4	4		2		2	1	9	4	2		1	5	3			3	3	5
Replacement																										

