

Science Olympiad — SSSS

Written by Klebb. Maximum raw score (without time bonus) is 6000. Stats: 2 Caesar, 3+1 Aristocrat, 2 Patristocrat, 2 RSA, 2 Hill, 2 Affine, 1 Baconian, 2 Vigenere, 2 Morbit, 1 Pollux, 1 Xenocrypt

Scoring:

Time to solve first problem: _____ (use to calculate Bonus below)

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

AAAA	A	AABBA	G	ABBAA	N	BAABA	T
AAAAB	B	AABBE	H	ABBAB	O	BAABB	U/V
AAABA	C	ABAAA	I/J	ABBBA	P	BABAA	W
AAABB	D	ABAAB	K	ABBBB	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.”

Morse Code:

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	-----•

•	E
••	I
•••	S
••••	H
-•••	B
-----	0
•••••	5

-	T
•-	A
••-	U
•••-	V
-••-	X
•-•••	1
-••••	6

-•	N
•-•	R
••-•	F
-•-•	C
••-••	2
--•••	7

--	M
•--	W
•-••	L
-•-•	Y
•••-•	3
---••	8

-••	D
•-••	P
--••	Z
••••-	4
-----•	9

-•-	K
•-••	J
-•-•	Q

-••	G
-----	---

---	O
-----	---

Timed Question **[200 points]** Solve this Aristocrat about Tetris. When you finish, yell "Boom, Tetris for Jeff!" When you have solved it, raise your hand so that the time can be recorded and the solution checked.

DCF TJAafb XL DCF OMVRRJO DFDBJR TXBmi OCVGKJXARCJKR

LXB DCF KVRD DTX UFVBR TVR VA VRJVA DFFAVPFB LBxG

OVMJLXBAJV.

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

1) [100 points] Solve this Caesar about the number that is the shift.

J	X	Y	I	D	K	C	R	U	H	Y	I	J	X	U	B	Q	H	W	U	I	J	A	D	E	M	D	D	K	C	R	U	H
M	X	U	H	U	Q	T	T	Y	D	W	E	D	U	Q	V	J	U	H	H	Q	Y	I	Y	D	W	J	M	E	J	E		
J	X	U	F	E	M	U	H	E	V	J	X	Y	I	D	K	C	R	U	H	Y	I	F	H	Y	C	U						

2) [400 points] Special Agent, Grace, has the following RSA public key:

$$n = 14960779 \quad e = 3982641$$

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

$$14960779 = 2579 * 5801$$

Compute the value of their private key:

Enter the computed private key:

3) [200 points] Solve this K1 aristocrat.

EN MNNQ BX WKUN "ANDNMBNNM PXWN ACMQKG" VNAA PJNNYG.

VNB'A PSKMIN LB BX "NLISBNNM PXWN BCNAQKG." BSKB'VV

RLF LB! JLISB?

K1	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	6	11	2	1	1	1	3		3	2	5	5	6	19		4	3	1	4		1	4	3	4	1	
Replacement																										

4) [300 points] Solve this Hill using the keyword HELP.

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

M	O	A	N	X	Y	E	X	R	F	C	Z	S	A	P	R

5) [300 points] Solve this Baconian where 4 digits correspond to A and the other 4 correspond to B.

1534215321507321532153264105321532157632153241532153201

5763420715362154321057362145321053721653215321450732615

4321530215321753215326415321503215321573264105763215324

0157643201537264153210532157321645321507362415032153721

6532153215340215327641053271536214532076153241503271563

4210532715632153240715632153215430271563214075326153215

4321532015

6) [200 points] Solve this Affine where $A=7$ and $B=16$ that also gives the key for the next question. The quote is a sentence with a "random" nonsensical word thrown in, which is the key for the next question.

U	T	U	M	Q	T	K	A	G	N	B	K	X	R	Q	F	Q	L	K	V	O	F	U	T	U	D	G	Q	P	P	T	N	S	M	S	T	S	M	T	M				

7) [200 points] Solve this Vigenere where the key was given in the previous question.

L	H	P	I	V	B	Q	E	A	I	A	G	C	U	H	P	V	L	O	S	A	E	A	Z	R	R	T	A	J	C

B	S	W	V	F	H	I	J	T	K	S	O	T	A	C	P	D	F	X	S	O	O	H	H	F	B

8) [350 points] Solve this tongue-twister Aristocrat.

QH OIB IQOTVPR IBXWF ICOTV OIB ICOTVPR, IVQTV IQOTV

IBXWF ICOTV IVQTV ICOTV?

	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			2		1	12						8	2	5	2		8		10	2	2		
Replacement																										

9) [250 points] A quote has been encoded using the Morbit Cipher for you to decode. You are told that the quote ends with **NE/IT**.

9 8 4 6 7 8 3 9 8 4 9 3 3 4 9 4 2 6 9 1 8 4 8 1 2

8 8 4 1 5 3 3 9 4 9 4 1 5 2 8 9 1 5 4 6 4 8 4 3 9 9

1 6 2 8 8 4 4 9 4 1 9 5 7 5 4 6 1 6 7 9 7 9 4 9 4

4 8 4 8 4 3 8 6 4 4 9 3 9 5 1 6 9 7 5 4 5 3 7 8 3

8 2 9 8 7 8 3 6 8 4 1 6 2 6 3 6 4 5 3 4 2 9 7 8 1 6

4 6 7 7 5 7 4 6 7 3 3 4 3 2

10) [500 points] Solve this K2 Patristocrat.

TDUWY VRGIF XLWKF ZGETR UDBTD UDJKI LAYDK UJRFL

JLXXY DERVY WFAYI YTEER BFFXT KIORK OABTA YJ

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	4	3		6	4	6	2		4	4	5	4			2			6		6	4	2	3	4	7	1

11) [350 points] A quote has been encoded using the Pollux Cipher for you to decode. You are told that 1=-, 2=x, 3=x, 4=●, 5=x, 6=●

124486342694245567581624339439973374309031620269656828441

3665412418425486502641380785862948239740368726246621244

59772965846328720420665316173826843267348830803682143076

22417364685615053161439103660398202886256436842513498

38458640566261269663260508398435604826388083723692868

224927455620880245614296942883846285212090250386882835614

285403048562674

12) [150 points] Solve this Caesar.

X	U	N	D	J	P	S	S	T	X	V	W	I	I	D	I	W	T	E	G	T	K	X	D	J	H	H	W	X	U	I	,
																															,
N	D	J	V	T	I	I	W	T	H	W	X	U	I	U	D	G	I	W	X	H	F	J	T	H	I	X	D	C	!	Q	N
I	W	T	L	P	N	,	I	W	T	H	W	X	U	I	X	H	I	W	T	H	B	P	A	A	T	H	I				
						,																									
C	J	B	Q	T	G	I	W	P	I	X	H	I	W	T	E	G	D	S	J	R	I	D	U	P	E	P	X	G	D	U	
I	L	X	C	E	G	X	B	T	H	.																					
										.																					

13) [350 points] Solve this Xenocrypt.

ZY LPSOFSPY USP MG OPDRDUY SG DKNY JMS TS NMUBD, JMS

MG SVFBY SG DKNY JMS YÑFY.

	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		2		5		3	4			3	2	1	6	3	1	2	4		1	10	1	3	1			8	1
Replacement																											

14) [500 points] Solve this Patristocrat which is a question about a math concept.

YXNJE IQOPI AMEAB IQGOM VOQBI MXCIH UIVXD NIASX

CXJEI CXJOV OXMJE XJEXH XUOGH AUNIN NOAM

	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	5	2	3	1	5		2	3	9	5			5	5	7	1	3		1		3	3		10	1	
Replacement																										

15) [300 points] Hayley and Brendan are accountants for a very large bank, and have started a friendship. They communicate via email, because they live thousands of miles apart. Brendan gets curious and asks Hayley the year that they were born. Hayley doesn't mind telling Brendan, but they know that the bank monitors all employee emails, and is afraid of being the victim of age discrimination. Therefore, Brendan suggests that they use RSA, and they provides their public key: (7663, 2761). Hayley replies with the ciphertext 4026. Brendan's private key is 697. In what year was Hayley born?

Enter the answer:

16) [250 points] Solve this Vigenere which is the description of a mathematical result. The keyword is the the person it is named after. It ends with "the half of pi."

W	P	V	Q	P

A	P	K	K	D

T	W	Z	Q	T

K	I	K	R	B

F	Q	P	M	T

R	B	W	G	F

N	V	O	P	W

B	Q	M	F	N

Z	V	G	I	K

A	E	Z	B	J

Y	P	W	I	H

K	K	B	Q	E

T	W	M	K	M

Y	I	N	M	Z

J	I	L

17) [350 points] Solve this Hill.

$$\begin{pmatrix} B & R & I \\ G & H & T \\ E & S & T \end{pmatrix} \equiv \begin{pmatrix} 1 & 17 & 8 \\ 6 & 7 & 19 \\ 4 & 18 & 19 \end{pmatrix} \quad \text{Decode} \begin{pmatrix} B & R & I \\ G & H & T \\ E & S & T \end{pmatrix}^{-1} \equiv \begin{pmatrix} 15 & 7 & 25 \\ 24 & 13 & 7 \\ 22 & 4 & 21 \end{pmatrix}$$

H	Z	R	I	Z	Q	V	M	S	R	I	G	Y	D	V	H	I	Y	A	H	D	O	F	S	J	D	

X	L	I	D

18) [250 points] Solve this Affine that begins with "SO"

Z	X	R	R	F	S	D	Y	J	H	G	G	F	Y	C	P	N	Z	F	Z	J	X	S	F	M	X	X	G	G	A	D	Q	D	J	F	S	H	R	D	Q				

M	X	X	G	K	D	C	C	O	N	Z	G	Z	D	P	H	Q	T

19) [300 points] Solve this Aristocrat about a French composer.

NIBYXCZ GATPSYX LIAUS B ZAYBUB NAI ULA XPBICYSUZ ,

LRSIS AYS CZ UTYSH RBPN B ZUSG ANN AN URS AURSI. CU

CZ WTCUS XAYUSJGAIBIM BYH ZATYHZ PCDS ZAJSURCYQ ATU

AN ZUIBKCYZDM'Z PCEIBIM.

	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	11	10	2	1		3	3	11	2	1	3	3	7		5	1	5	14	5	14		1	4	11	12
Replacement																										

20) [200 points] A quote has been encoded using the Morbit Cipher for you to decode. You are told that 1=-●, 2=●●, 3=●-, 4=xx, 5=●x, 6=-x

6 2 2 7 4 8 6 1 7 1 5 1 8 4 1 1 9 8 7 3 9 5 6 3 5

1 8 4 6 2 2 7 6 6 7 2 5 3 7 2 4 5 2 3 7 7 1 4 3 2

9 8 7 2 9 4 3 4 3 6 3 7 1 4 3 6 2 9 7 2 5 7 6 9 5

8 6 1 4 2 2 7 3 9 6 3 9 5 7 6 1 7 5 8 7 6 3 2 4 2

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