Science Olympiad — CrazyScaryMangoEater's 2021 Codebusters Mini-Competition

Exam Preparation

You will need:

1. Folders for each of the teams to hold the tests
2. Sufficient copies of the test for all teams. They don't need to be stapled.
3. Multiple timers which have a lap function on them - ideally one per volunteer. The timer app on an iPhone or Android Phone that has a stopwatch function with lap function is sufficient.

Before the event begins:

1. Practice starting the timers and using the lap function to record the times. Make sure volunteers understand how to use the lap function and are not accidentally stopping the timer completely.
2. Memorize the answer to the timed question.
3. Check to make sure that this key matches the test you are proctoring.
4. Place one copy of the test for each team in the provided folders with the first page outside the folder.
5. Adjust desks and chairs – teams may have up to 3 students for this event.

Running the Event

1. When the students enter the room, instruct them to sit down, DO NOT OPEN THE FOLDER, and put their names, school name and school number on the first page.
2. Encourage them to write their team number on all the other pages AFTER they begin the test. This way if their papers gets separated from each other we can make sure to give them credit.
3. **CRITICAL:** Check to see that students have ONLY brought
    i. Something to write with (pencils, pens, erasers)
    ii. Five function calculators (addition, subtraction, multiplication, division, and usually square root). The calculator can have a simple memory store/recall function but must not have a modulus or other scientific and programmable functions. If their calculator doesn't meet these requirements, they may not use it.
    iii. If there are spare calculators in the kit, you may loan up to one per team to use for the test.
    iv. If the student has a smart watch (Apple watch, Samsung Gear, etc.) they will need to put it away.
4. Instruct the students that if they answer the timed question within 10 minutes, they can be awarded a bonus if they solve the timed question with no more than 2 letters incorrect.
    i. When they have a solution for the cryptogram they should raise their hand.
    ii. Let them know that you will announce when the 10-minute time is up. After the first 10 minutes, no additional bonus points will be awarded.
    iii. When you see a team raise their hand, hit the LAP function and head to the team.
    iv. Determine if their answer is correct (see next page for grading), If so, write the time on their score sheet.
    v. If their score is incorrect (more than 2 letters incorrect), tell the team that the answer is wrong, but DO NOT tell them what is wrong. They can continue to work on the question and raise their hand again to be checked. A team has an unlimited number of attempts during the 10-minute bonus.
5. Tell the teams that they do not have to fill in the frequency table. It is simply there as an aid to them solving the cryptogram. It will not be graded.

6. Some students may never have used a non-scientific calculator. You should have them enter a simple formula on their calculator: 1 / 26 = * 26 = .. Most will be surprised to see that the answer is not rounded to 1 as they expected but .9999999999
7. When the timers hit the 10-minute point, announce that no bonus points will be awarded and put away the timers. The students may continue to work on the question, but they may not receive any extra points.
8. A team is not restricted to only the timed question during the 10 minutes. They can move on or split up the work if they would like, but it is in their best interest to try for the bonus.
9. When time is up, have the students put writing instruments down and put their answer pages back into the folder in the correct order.

How to grade

1. Teams can have up to two incorrect letters total on their cryptogram and still be correct. The frequency of the incorrect letter is irrelevant. See the example below.
   If the cryptogram was as shown:
   KZBAOF KFXMFXYF
   SAMPLE SENTENCE

   and the students answered (underlined letters indicate mistakes)
   SAMPL<u>F</u> S<u>F</u>NT<u>F</u>NC<u>F</u>

   then it counts as four mistakes (even though the mistake was only in the letter E) and the answer DOES NOT count. However, if they put
   SAMP<u>UL</u> SENTENCE

   It is considered correct with two letter mistakes.
2. For questions which have a numeric answer (such as determining the a= and b= values), no mistakes are allowed.
3. Teams do NOT have to fill in the frequency table. It is simply there as an aid to them solving the cryptogram. It WILL NOT be graded. It is included in the answer key as an aid to the grader.
4. When scoring the Baconian ciphers (with strange text or symbols), they can write the answer under the Baconian symbols or on the line provided. Note that you will see lots of As and Bs, but they are not graded as the answer, only what they put on the answer line.
5. As you score each question, if correct, put the number of incorrect letters (0, 1, or 2) next to the question number on the scoring page. Also, put the value for the question into the score column. If they get more than 2 letters wrong, subtract 100 points from the score until it would be zero. If a question is worth 240 points and they get 4 letters wrong, you would start with 240 points (for up to 2 letters wrong) and then subtract 100 points for the next two letters wrong ending up with a final score of 40 points for that question. If they had gotten 5 or more letters wrong on a 240 point question, they would receive 0 points for that question. With a 650 point question, they could get 8 letters wrong and receive 50 points (2 free letters then 6×100=600 points off). Just put the incorrect cost deduction on the score sheet and subtract it from the value for the question. Under no circumstance should the score for any question be less than zero. Note that while the timed question must have 2 or fewer letters incorrect in order to get the timing bonus, a team solving the timed question after the 10 minutes passed would be accepted as correct with 3 incorrect letters receiving 100 points for the timed question.
6. If they correctly answered the timed question in 10-minutes or less with 2 or fewer letters incorrect, you need to compute the bonus time. Take the value for the minute from this first table below

0:xx	2,160	1:xx	1,920	2:xx	1,680	3:xx	1,440	4:xx	1,200
5:xx	960	6:xx	720	7:xx	480	8:xx	240	9:xx	0

   and then add the seconds value from this table:

X:00	240	X:01	236	X:02	232	X:03	228	X:04	224	X:05	220

X:06	216
X:12	192
X:18	168
X:24	144
X:30	120
X:36	96
X:42	72
X:48	48
X:54	24

X:07	212
X:13	188
X:19	164
X:25	140
X:31	116
X:37	92
X:43	68
X:49	44
X:55	20

X:08	208
X:14	184
X:20	160
X:26	136
X:32	112
X:38	88
X:44	64
X:50	40
X:56	16

X:09	204
X:15	180
X:21	156
X:27	132
X:33	108
X:39	84
X:45	60
X:51	36
X:57	12

X:10	200
X:16	176
X:22	152
X:28	128
X:34	104
X:40	80
X:46	56
X:52	32
X:58	8

X:11	196
X:17	172
X:23	148
X:29	124
X:35	100
X:41	76
X:47	52
X:53	28
X:59	4

For example if they solved the time question at the 6:46 mark, you would add 720 (from the 6:xx entry in the first table) to 56 (from the X:46 entry in the second table) to get a bonus of 776. If they had solved it in exactly 4:00 minutes, you would add 1200 and 240 to get a bonus of 1440.

7. Add up all the scores and put the total on the bottom of score sheet.
8. You must break all ties. Indicate the tie breaker by adding .1 to the score of the team ahead. With multiple teams tied, you will add more. I.e. if five teams all scored 200 points, the final scores that you would enter on the score sheet would be 200.4, 200.3, 200.2, 200.1 and 200.
9. To determine how to break the tie, you need to look at the correctly answered questions in the order from the table below. If both teams answered the same (i.e. they answered the question with zero mistakes) then you go on to the next question. If one team had no mistakes and the other team had one mistake, then the team with no mistakes is ahead. For example, if one team answered question #8 (which is the highest value question) and another team didn't, the first team will be ahead.

Tie Breaker Order	Question #
1	16
2	11
3	15
4	14
5	12
6	7
7	9
8	2
9	13
10	4
11	6
12	1
13	8
14	10
15	3
16	Timed
17	5
18	17
19	18

0. If there is still a tie (typically when you have teams which answered either zero, one or two questions) then you will need to look at the tie breaker questions again and count the number of correctly answered letters. The team with the most correctly matched letters is to be ahead.

Timed Question **[200 points]** Solve this aristocrat, an excerpt from a terrible essay I wrote on *To Kill a Mockingbird* last year. When you have solved it, unmute yourself and say "Time!" Then type out your answer into the Pear Deck. When you have solved it, raise your hand so that the time can be recorded and the solution checked.

OMOW GFNHAF GFO JTNROXHGUNW FCR DUGGDO OMUVOWXO GN
EVEN THOUGH THE PROSECUTION HAS LITTLE EVIDENCE TO

YCXS HJ GFOUT MOTZ ROTUNHR XDCUQR CWV GN TOPHGO GFO
BACK UP THEIR VERY SERIOUS CLAIMS AND TO REFUTE THE

JNBOTPHD GORGUQNWZ NP GFO VOPOWVCWG, GFO LHTZ
POWERFUL TESTIMONY OF THE DEFENDANT, THE JURY

WOMOTGFODORR MNGOR GN XNWMUXG GNQ TNYUWRNW NW GFO
NEVERTHELESS VOTES TO CONVICT TOM ROBINSON ON THE

XFCTAO.
CHARGE.

	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	2	1	6	5		11	21	7		3		1	6	16	27	4	3	10	1	10	9	4	12	7	2	3
Replacement	G	W	A	L	Q	H	T	U	X	P	Z	J	V	O	E	F	M	S	K	R	I	D	N	C	B	Y

1) **[250 points]** Solve this statement of life encoded with an Aristocrat.

WSRROKNBB OB S KOQN, QAIP, ZNTZNBWOKL VSKLA ISBBO AK
HAPPINESS IS A NICE, COLD, REFRESHING MANGO LASSI ON

S WAU BXVVNZ PSJ.
A HOT SUMMER DAY.

	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	7							2	1	5	2		5	5	2	2	2	6	1	1	3	3	1		3
Replacement	O	S	B	W	Q	V	X	K	L	Y	N	G	J	E	I	D	C	P	A	F	T	M	H	U	Z	R

2) **[300 points]** Solve this legendary quote from *The Mango Wars* encrypted with a hill cipher and a key of **EDDY**.

$$\begin{pmatrix} E & D \\ D & Y \end{pmatrix} \equiv \begin{pmatrix} 4 & 3 \\ 3 & 24 \end{pmatrix}$$

K	O	O	J	L	F	B	W	P	E	D	S	N	A	K	K	R	E
W	**A**	**R**	**I**	**T**	**N**	**E**	**V**	**E**	**R**	**C**	**H**	**A**	**N**	**G**	**E**	**S**	**Z**

3) **[200 points]** Solve this Aristocrat about customer service.

VKZ YZDV EGDVRJZP DZPMUEZ UD UC VKZ EGDVRJZP NRZDX'V
THE BEST CUSTOMER SERVICE IS IF THE CUSTOMER DOESN'T

XZZN VR EIQQ ORG, NRZDX'V XZZN VR VIQA VR ORG. UV
NEED TO CALL YOU, DOESN'T NEED TO TALK TO YOU. IT

TGDV FRPAD.
JUST WORKS.

	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	2		1	9	4	1	5		2	2	2		1	4	2	4	3	10		1	4	13		4	1	13
Replacement	K	X	F	S	C	W	U	Q	A	M	H	G	V	D	Y	R	L	O	Z	J	I	T	P	N	B	E

4) **[275 points]** Solve this K2 Aristocrat encoding lines from the twenty øne piløts song "Forest".

O QVAK KB WZ NOJKZAZY KB. YBZJ OK WBKLZG VATBAZ ZNJZ
I WANT TO BE LISTENED TO. DOES IT BOTHER ANYONE ELSE

KLVK JBEZBAZ ZNJZ LVJ TBMG AVEZ?
THAT SOMEONE ELSE HAS YOUR NAME?

Replacement	V	W	X	Y	Z	C	H	L	O	R	I	N	E	A	B	D	F	G	J	K	M	P	Q	S	T	U
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	6	8			2		2			6	8	3	1	3	3		1			2		5	2		2	13

5) **[175 points]** Solve this Caesar Cipher.

D	'	H		I	J	O		N	P	M	Z		D	A		5	5		Y	Z	B	M	Z	Z	N		D	N		V	X	O	P	V	G	G	T
I	**'**	**M**		**N**	**O**	**T**		**S**	**U**	**R**	**E**		**I**	**F**		5	5		**D**	**E**	**G**	**R**	**E**	**E**	**S**		**I**	**S**		**A**	**C**	**T**	**U**	**A**	**L**	**L**	**Y**

X	J	G	Y	,		J	M		D	'	Q	Z		E	P	N	O		G	D	Q	Z	Y		D	I		N	V	I		Y	D	Z	B	J
C	**O**	**L**	**D**	,		**O**	**R**		**I**	**'**	**V**	**E**		**J**	**U**	**S**	**T**		**L**	**I**	**V**	**E**	**D**		**I**	**N**		**S**	**A**	**N**		**D**	**I**	**E**	**G**	**O**

A	J	M		O	J	J		G	J	I	B	.
F	**O**	**R**		**T**	**O**	**O**		**L**	**O**	**N**	**G**	.

6) **[250 points]** The following quote from a popular Depeche Mode song needs to be encoded with the Vigenère Cipher with a keyword of **GOOGLE**.

G	O	O	G	L		E	G	O	O	G		L	E	G	O	O		G	L	E	G	O		O	G	L	E	G		O	O	G	L	E
A	L	L	I	E		V	E	R	W	A		N	T	E	D	A		L	L	I	E	V		E	R	N	E	E		D	E	D	I	S
G	**Z**	**Z**	**O**	**P**		**Z**	**K**	**F**	**K**	**G**		**Y**	**X**	**K**	**R**	**O**		**R**	**W**	**M**	**K**	**J**		**S**	**X**	**Y**	**I**	**K**		**R**	**S**	**J**	**T**	**W**

G	O	O	G	L		E	G	O	O	G		L	E	G	O	O		G	L
R	I	G	H	T		H	E	R	E	I		N	M	Y	A	R		M	S
X	**W**	**U**	**N**	**E**		**L**	**K**	**F**	**S**	**O**		**Y**	**Q**	**E**	**O**	**F**		**S**	**D**

7) **[325 points]** Solve this Baconian cipher, a quote from Harry Truman.

茶饭奶茶面饭奶茶面奶茶饭面奶茶奶饭茶面饭面饭面饭面饭奶茶面饭奶面饭茶面饭面饭面饭面饭奶面茶奶饭面饭面

BABBAABBABBAABBBABAAAAAAAABBAABAABAAAAAAAABABBAAAA

Y O U W A N T A F R

饭茶面饭面饭面奶饭面饭茶奶面饭面饭面茶奶饭茶面饭面饭奶茶面饭奶面茶饭面饭面饭面饭奶面饭面茶饭面奶茶奶

ABAAAAABAAABBAAAAABBABAAAABBAABABAAAAAAABAAABAABBB

I E N D I N W A S H

饭茶面饭面饭奶茶面饭面饭奶茶面奶饭面茶饭面奶茶饭奶面茶奶饭面饭面茶奶饭面饭茶面饭奶面饭茶面饭面饭面饭

ABAAAABBAAAABBABAABAABBABABBAAAABBAAABAABAABAAAAAA

I N G T O N G E T A

面饭面奶茶饭奶茶面奶饭面茶奶饭

AABBABBABAABBA

D O G

You want a friend in Washington? Get a dog.

8) **[215 points]** Solve this Margaret Atwood quote encoded as an Aristocrat.

T MVPNF NTXC HV QC HZC YTE HZYH TSZYQTHI JVP DVE Y

I WOULD LIKE TO BE THE AIR THAT INHABITS YOU FOR A

UVUCSH VSNJ. T MVPNF NTXC HV QC HZYH PSSVHTOCF YSF

MOMENT ONLY. I WOULD LIKE TO BE THAT UNNOTICED AND

HZYH SCOCIIYEJ.

THAT NECESSARY.

	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	1	3	4		12	3	3			2	5	2	4	3		7	8	2	9		2	8	5
Replacement	X	J	E	F	R	D	P	T	S	Y	V	Q	W	L	C	U	B	Z	N	I	M	O	G	K	A	H

9) **[300 points]** The following quote needs to be encoded with the Affine Cipher using ***a*=3** and ***b*=20**.

B	E	H	I	N	D		E	V	E	R	Y		G	R	E	A	T		M	A	N		I	S		A		W	O	M	A	N
X	**G**	**P**	**S**	**H**	**D**		**G**	**F**	**G**	**T**	**O**		**M**	**T**	**G**	**U**	**Z**		**E**	**U**	**H**		**S**	**W**		**U**		**I**	**K**	**E**	**U**	**H**

R	O	L	L	I	N	G		H	E	R		E	Y	E	S	.
T	**K**	**B**	**B**	**S**	**H**	**M**		**P**	**G**	**T**		**G**	**O**	**G**	**W**	.

10) **[200 points]** The following quote needs to be decoded with the Vigenère Cipher with a keyword of **TREES**.

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

11) **[500 points]** Solve this K1 Patristocrat.

MUVHV QMMCG VWLMK WHBVK MWFEL MIRIN PUVHR INKVW
THENE XTTIM EASTR ANGER TALKS TOYOU WHENY OUREA

FIHVD NLMFI IEWMM UVGLU ITEVZ WHZPU CLXVK RINTW
LONEJ USTLO OKATT HEMSH OCKED ANDWH ISPER YOUCA

HLVVG V
NSEEM E

The next time a stranger talks to you when you're alone, just look at them shocked, and whisper "You can see me?"

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		1	2	1	3	3	3	6	8		4	6	9	4		2	1	3		2	5	13	7	1		2
Replacement	F	G	I	J	K	L	M	N	O	Q	R	S	T	U	V	W	X	Y	Z	C	H	E	A	P	B	D

12) **[350 points]** These strange headlines actually encode a quote from *The Office* using the Baconian Cipher. The first word is **BEARS**.

WAGON MOVES SWISS LOUIS VISIT WAGON SCREW ISLAM FOODS
AAAAB AABAA AAAAA BAAAA BAAAB AAAAB AABAA AABAA BAABA
B E A R S B E E T

NAMED SQUAD MOMMA FEELS FIERY CLARE IS TOO LOYAL
BAAAB AAAAB AAAAA BAABA BAABA ABABA AABAA BAAAB
S B A T T L E S

FISTS MIAMI LOGIC MARTY MOOSE CRAZY A CASE A KING
BAABA AAAAA BAAAA AABBA AAAAA ABABA AAAAA AAABA
T A R G A L A C

BE ITS A BOOK A KING A CASE
BAABA ABAAA AAABA AAAAA
T I/J C A

Bears. Beets. Battlestar Galactica.

13) **[275 points]** The following quote needs to be decoded with the Affine Cipher where ***a***=5 and ***b***=10.

Y	J		A	C	G	'	R	E	I	Y	N	N	E	Z	,	A	C	G	'	L	E		N	C	W	B		K		L	E	R	A
I	F		Y	O	U	'	R	E	K	I	L	L	E	D	,	Y	O	U	'	V	E		L	O	S	T		A		V	E	R	Y

Y	S	H	C	R	B	K	X	B		H	K	R	B		C	J		A	C	G	R		N	Y	J	E	.
I	M	P	O	R	T	A	N	T		P	A	R	T		O	F		Y	O	U	R		L	I	F	E	.

14) **[400 points]** A sentence about the recent war between Armenia and Azerbaijan has been encoded using the Morbit Cipher for you to decode. You are told that 3=−●, 6=××, 1=×−, 2=−×, and 8=−−.

```
3 4 1 9 2 5 8 7 9 7 8 2 8 1 8 1 5 7 3 1 3 6 9 6 8
−●●●×−●−−××●−−●×●−●×−−−×−−×−−−×−×●●×−●×−−●××●−××−−
B    Y    /P    R   O   M   O   T I  N  G  / A / M

5 7 9 4 5 7 2 9 5 3 1 9 2 5 3 5 2 2 4 4 5 5 3 6 2
×●●×●−●●×●●×−×●−×●−●×−●−−×××●−●×●−×−×●●●●×●×●−●××−×
 I  L   I  T A  R   Y    /R   A  T H   E R  / T

4 4 5 2 3 6 9 6 3 7 4 5 8 7 9 4 1 8 1 2 9 1 5 7 3 3
●●●●×●−×−●××●−××−●●×●●×●−−●×●−●●×−−−×−−×●−×−×●●×−●−●
H    A  N / A / D   I  P    L    O   M  A  T I  C

6 4 7 8 2 9 4 5 9 1 5 7 8 2 3 6 2 4 2 9 7 3 2 7 3 8
××●●●×−−−×●−●●×●●−×−×●●×−−−×−●××−×●●−×●−●×−●−×●×−●−−
/ S   O   L    U   T I  O   N / T U   R   K   E Y

6 9 3 5 9 1 5 4 6 8 5 2 3 1 9 2 1 2 8 2 9 7 7 1 9 7
××●−−●×●●−×−×●●●××−−×●−×−●×−●−−××−−×−−−×●−●×●××−●−●×
/ P    U   T S  / M  A  N  Y    /M  O   R   E /C

4 5 4 2 4 5 3 7 4 5 2 3 5 4 6 4 1 7 1 5 4 7 7 5 3 7
●●×●●●−×●●×●−●●×●●×●−×−●×●●●××●●×−●××−×●●●●×●××●−●●×
I  V    I  L    I  A  N  S  / I  N  /T H    E /L

4 1 7 7 1 8 5 9 7 1 3 5 9 1 7 4 3 5 7 9 7 7
●●×−●×●××−−−×●●−●××−−●×●●−×−●×●●−●×●●×●−●×●×
I  N  E /O   F    /G   U   N  F    I  R   E
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15) **[450 points]** This twenty øne piløts line from the song "Forest" is encoded with the Pollux cipher for you to solve. You are told that 8=–, 7=–, 6=●, and 9=×.

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81197485088370530154195792221363911869884528691511094
–●●×–––×●––×–●××●●×–●××–×●●●●×●××●●–●×–––×●–●×●×●●●×–
D   O   W   N   I   N   T H     E   F     O   R   E S   T

59077923317629141235200960942548293149972729021157849281
××●––×●××●–●●×●–●●××●●●×●●×–●×––●×××●–××–●–●×●●●●×–––×●–●
  W   E   L   L     S   I   N   G     A   C     H     O   R

32283010338879409659456266368985969160730504258274982O6
×●●–×●●●××–––×–●×●××–×●●●●×●–×–××●×●●●–×●×●–●×–●––×–●●●
 U   S     O   N   E   T H     A   T   E V     E R   Y     B

58775416940745976758058779147516095201291754094103111
×–––×–●●×–●––××–●–×–●×–––×●––×●●●××●●●●×●–×–●×–●●×●●●
 O   D   Y     K   N   O   W   S     H     A   N   D   S

33121052518213861391162961974056102929240596789093682 2
××●●●●×●×●–●●×–●●××●●●●×●●×––●×●●●●×●×●–●××●––×●××●–●●
  H     E L     D     H     I   G   H     E R     W   E   L

92466958026303947494255268096650823235662306542347251 6
×●–●●××–●●●×●××–––×–●××●●–●×●●×●–●×●××●●●×●●×–●×––●×●●
 L     B     E   O   N   F     I   R   E   S   I   N   G   I

58058825962138775423870901159796116568349576984834621
×–●×––●×××●●●×–––×–●×––●×●●●××–×●●●●×●–×–××–●×–––×–●●●
 N   G     S   O   N   G   S     T H     A   T   N   O   B

57889712381785327752409444585 1
×–––×–●●×–●––××●––×●–●×–––×–×●
 O   D   Y     W   R   O   T E
```

16) **[700 points]** This special excerpt from the unreleased novel *Mango Wars 2: The New Battalion* (preorders not available yet) featuring the legendary player Wang Peng has been encoded as a K2 Patristocrat beginning with the letters **HEGA**. Solve it to avenge Gao Wenzhong.

```
IXLSR XWWDN CSJJI XGSLL XWSGB YXHJD GCZGD BNSGW
HEGAZ EDDOW NATTH ERAGG EDARM IESTO RNFRO MWARD

GDNCX WYCWX HESYG VAKJV IYCLD CJDDC XSCWD JIXGS
ROWNE DINDE SPAIR CLUTC HINGO NTOON EANDO THERA

HJIXN YCWTX LSCJD HVGXS B
STHEW INDBE GANTO SCREA M
```

He gazed down at the ragged armies, torn from war, drowned in despair, clutching onto one and other as the wind began to scream.

Replacement	S	T	V	W	X	Z	L	I	Y	O	U	A	B	C	D	E	F	G	H	J	K	M	N	P	Q	R
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	1	3	10	9	1		9	4	5	8	1	5		4				1	10	1		3	8	12	5	1

17) **[100 points]** Using a key of **BAND**, compute the decryption matrix for a 2x2 Hill Cipher in a 26-character alphabet.

$$\begin{pmatrix} B & A \\ N & D \end{pmatrix} \equiv \begin{pmatrix} 1 & 0 \\ 13 & 3 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 \\ 13 & 9 \end{pmatrix}$$

18) **[50 points]** It's an Atbash. You know what to do.

"	S	V	I	V		D	V		Z	I	V	,		W	L	M	'	G		G	F	I	M		Z	D	Z	B		M	L	D	,	"
"	**H**	**E**	**R**	**E**		**W**	**E**		**A**	**R**	**E**	,		**D**	**O**	**N**	'	**T**		**T**	**U**	**R**	**N**		**A**	**W**	**A**	**Y**		**N**	**O**	**W**	,	"

D	Z	M	T		K	V	M	T		D	S	R	H	K	V	I	V	W		U	I	L	N		Y	V	G	D	V	V	M		S	R	H
W	**A**	**N**	**G**		**P**	**E**	**N**	**G**		**W**	**H**	**I**	**S**	**P**	**E**	**R**	**E**	**D**		**F**	**R**	**O**	**M**		**B**	**E**	**T**	**W**	**E**	**E**	**N**		**H**	**I**	**S**

O	R	K	H	.
L	**I**	**P**	**S**	.