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

AAAAA	A		**ABBAA**	N
AAAAB	B		**ABBAB**	O
AAABA	C		**ABBBA**	P
AAABB	D		**ABBBB**	Q
AABAA	E		**BAAAA**	R
AABAB	F		**BAAAB**	S
AABBA	G		**BAABA**	T
AABBB	H		**BAABB**	U/V
ABAAA	I/J		**BABAA**	W
ABAAB	K		**BABAB**	X
ABABA	L		**BABBA**	Y
ABABB	M		**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 **[100 Points]**: Solve this Aristocrat which is a quote by Hellen Keller. When you have solved it, raise your hand so that the time can be recorded and the solution checked.

```
SURM BQLWVSZ IMUI G NLVHSE WSRUZS U QCVS PMGRM NSQHSE


UYISQPUQEN IL NLVHS LIMSQ BQLWVSZN.
```

	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
Freq		2	1		3		2	3	5			6	5	5		2	7	3	12		6	5	3		1	3

1) **[175 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 **DE**. With that knowledge, what does this message say?

X	C	S	P	Y	F	Z	Z	R	C	I	H	H	W	V	C	S	W	F	R	C	P

2) **[80 Points]** Encode the string **HISTORICALACCURACY** using the Affine Cipher with $a=11$ and $b=2$.

H	I	S	T	O	R	I	C	A	L	A	C	C	U	R	A	C	Y

3) **[60 Points]** You know that a message has been encrypted using the Affine Cipher with an alphabet of 26 characters. You have discovered that the message **MDCCL** decodes to say **FUNNY**. What are the values of *a* and *b* in the function *a*x + *b* that were used to encode the message?

a=_____   *b*= _____

3) **[60 Points]** Solve this Aristocrat which is a quote by William S. Burroughs which is encoded using a K1 key.

VNG JOQ DM GHWLJVODC OU VNG BCDEFGHIG,

CDV DM MJLVU, KWV DM XJFWGU

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	3	6	1	2	6	2	1	4	1	2	4	2	3		1				3	6	3	1			
Replacement																										

5) **[100 Points]** Using a key of **BFOX** 1 5 14 23 encode the string **FOURMUSICIANS** using the Hill Cipher with a 26 character alphabet. e.g.

$$\begin{pmatrix} B & F \\ O & X \end{pmatrix} \equiv \begin{pmatrix} 1 & 5 \\ 14 & 23 \end{pmatrix}$$

F	O	U	R	M	U	S	I	C	I	A	N	S	

6) **[125 Points]** Using a key of **DOWEBLINK** encode the string **STARINGCONTEST** using the Hill Cipher with a 26 character alphabet. e.g.

$$\begin{pmatrix} D & O & W \\ E & B & L \\ I & N & K \end{pmatrix} \equiv \begin{pmatrix} 3 & 14 & 22 \\ 4 & 1 & 11 \\ 8 & 13 & 10 \end{pmatrix}$$

S	T	A	R	I	N	G	C	O	N	T	E	S	T	