

Science Olympiad — SLHS Captains Tryout Exchange 2019

Names of participants: (Please print neatly)

School Name: _____

Check your team: Varsity 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	350			
1	650			
2	400			
3	450			
4	250			
5	200			
6	100			
7	400			
8	300			
9	150			
10	150			
11	250			
12	400			
13	700			
14	200			
15	450			
16	200			
17	600			
18	300			
19	300			
20	450			
21	600			

Bonus			
Final Score			

Question	Value	Incorrect letters	Deduction	Score
22	550			
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	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 •-	F ••-	K -•-	P •--•	U ••-
B -•••	G --•	L •-••	Q --•-	V •••-
C -•-•	H ••••	M --	R •-•	W •--
D -••	I ••	N -•	S •••	X -••-
E •	J •---	O ---	T -	Y -•---
				Z ---••

0 -----	2 ••---	4 ••••-	6 -••••	8 ---••
1 •-----	3 •••---	5 •••••	7 --•••	9 -----•

• E	- T	-• N	-- M	-•• D	-•- K	-•- G	--- O
•• I	•- A	•-• R	•-- W	•--• P	•--- J		
••• S	••- U	••-• F	•-•• L	--•• Z	--•- Q		
•••• H	•••- V	-•-• C	-•-- Y	••••- 4			
-••• B	-••- X	••--- 2	•••-- 3	----• 9			
----- 0	•---- 1	--••• 7	---•• 8				
••••• 5	-•••• 6						

Timed Question [350 points] Solve this aristocrat, which is a quote from Andy Dwyer from Parks and Rec. When you have solved it, raise your hand so that the time can be recorded and the solution checked.

OCJK VPNPPLPV, PGPVZ KFNP ZUC HUUS CX MK KTP NUUE, F,

KUU, AFHH LP HUUSFEW MK M NUUE. EUK KTP JMNP NUUE,

ULGFUCJHZ, KTMK'J FN XUJJFLHP.

	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		4		5	7	2	6		6	10	4	5	8	1	11			2	3	17	3	1	2		3
Replacement																										

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1) **[650 points]** Solve this Xenocrypt which is a quote from Cien años de Soledad

JHJ HYKWJC KNCJC, GNDTYU JWL DUCLVU MJ PUDVJVUDJ

QYUDBJ, S TYLUI JHJ HYKWN WJKU HYKWN, S GYUVU MNRDJD

HYKWN, S MN TYU UCÑJ WUKWN KNI JHND UCÑJ ALUI WUKWN.

	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	1	6	8			2	7	3	16	9	4	3	11	2		1	1	1	3	3	16	4	10		9	
Replacement																											

2) **[400 points]** Solve this Morbit cipher, which is a quote from Leslie Knope from Parks and Rec. Part of the key is 4=×●, 7= ×-, 8= -●, 3= -×

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

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

3) [450 points] Solve this Baconian, which is a quote from Tom Haverford from Parks and Rec.

-\\|~/-~/-_I~_I_I_I_I_I_I\\|~/-~/|~|~|~|_-_-\\/-~/

/-~/|~_I_-\\/-~/-~/|~/-\\/-\\|\\|~|-\\/|~_I~_I\\|_I_I

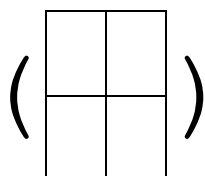
\\|\\/-_I_I\\/-\\/-_I_I_I~|_I_I\\/-_-_-_-\\/-~/

-~/|~_I\\/-\\|\\|_I_I_I_I~|~|-\\/|\\|_I~|~|-\\/|\\|_I~|~

_I~_I_I

4) [250 points] Given the Hill cipher encryption key BUST, find the decryption matrix of this 2x2 Hill

$$\begin{pmatrix} B & U \\ S & T \end{pmatrix} \equiv \begin{pmatrix} 1 & 20 \\ 18 & 19 \end{pmatrix}$$



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5) [200 points] Using the key HOUSTONTX encode LETS GO ASTROS

$$\begin{pmatrix} H & O & U \\ S & T & O \\ N & T & X \end{pmatrix} \equiv \begin{pmatrix} 7 & 14 & 20 \\ 18 & 19 & 14 \\ 13 & 19 & 23 \end{pmatrix}$$

L	E	T	S	G	O	A	S	T	R	O	S

6) [100 points] Decrypt this Caesar, which is a quote from Parks and Rec encrypted with a shift of 17

W	B	T	T	V	A	T	V	F	G	U	R	J	B	E	F	G	.	V	X	A	B	J	V	G	X	R	R	C	F
L	B	H	U	R	N	Y	G	U	L	,	O	H	G	T	B	Q	,	N	G	J	U	N	G	P	B	F	G	?	

7) [400 points] Decrypt this Baconian, which is a quote from the Office.

????!?!????????!????!????!????!?!????????!?!?!????!???

?!?????!?

?????!?!?????????!?

8) [300 points] Solve this Aristocrat, which is a quote from Dwight from the Office.

FQGEWFZ WIGBW FM ELW T RLSG RFC! CFOOFLEM LB

BTCFOFGM MXBBGH GDGHZ ZGTH!

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

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9) [150 points] Solve this Caesar Shift, which is a quote from the Office.

B	M	T	E	D	T	E	H	M	,	L	H	B	,	O	X	E	X	T	K	G	X	W	M	H	M	N	G	X

F	R	L	X	E	Y	H	N	M	.
									.

10) [150 points] Encrypt the following Brooklyn 99 quote with an affine cipher with a key of a=7, b=9.

I	T	,	S	G	I	N	A	,	S	P	H	O	N	E	,	L	E	A	V	E	M	E	A	V	O	I	C	E	M	A	I	L	.		

I	W	O	N	,	T	C	H	E	C	K	I	T	,	C	A	U	S	E	I	T	,	S	N	O	T	1	9	9	3	.				

11) [250 points] Encrypt the following Brooklyn 99 quote using a Vigenere cipher with the key BROOKLYN

A	W	,	M	A	N	.	A	L	L	T	H	E	O	R	A	N	G	E	S	O	D	A	S	P	I	L	L	E	D

O	U	T	O	F	M	Y	C	E	R	E	A	L	.	-	J	A	K	E	P	E	R	A	L	T	A

12) [400 points] Solve Aristocrat, which is a Parks and Rec quote that may contain spelling errors.

TM'L YTEN T HYZHQL LHQ. ZPNU YQWN KTXNL QII YNOIUL,

QID LNY Y LION IW QIDS KSHUBOH'L VIIYNSQ HUB KI

AYDCCTUK.

	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	2	3	1			6	10		4	8	1	8	3	1	7		3	5	5	1	2	1	8	2
Replacement																										

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13) [700 points] Solve this Patristocrat, which is a Parks and Rec quote.

GABMV TAWOV ZTGCD EYRHI AWCDW VVHVE WFEBZ BVNVW

UVEWB VZDGF BEPVX VFICIW GVBZG VNVWD EZTVF CGUUB

VNVWC EUOFA PVCGP VF

	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	6	4	7	6	7	2	2				1	3	2	3		1		3	4	19	9	1	1	5
Replacement																										

14) [200 points] Decrypt the following quote from the Office with the key SCOTT

A	C A	K N F P W G Z	S Y O R	Y J Q A	F R

J G G I H F U W U B D K H B X K	C B W	B L	H S X E K	I C H W .
				.

15) [450 points] Decrypt this Aristocrat, which is a quote from the Office that may contain spelling errors.

ULNREJNRU EOR DTLEORU VE HVW CJSU VGR EYL PTVUOF URY

J'N PLGDRS EL HL ELL EOR VNRGJDVK HJGT UELGR VKS

LGSRG DTLEORU PLAG TVGHR DLTJKJVT SLTTU.

	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		1	5	10	1	9	4		6	3	15		4	5	3		13	5	9	9	9	1		2	
Replacement																										

16) [200 points] Decrypt the following quote from Parks and Rec using an Affine cipher with the key a=19, b=17.

U	X	T	W	X	F	X	H	L	R	Z	P	R	E	F	P	A	P	E	O	D	S	R	V	V	F	X	E	R					
K	H	W	B	P	O	?	C	P	W	D	R	C	Q	P	O	.	L	F	P	E	O	N	C	P	R	Q	R	C	O	L	P	E	O
N	V	C	P	W	D	R	C	Q	P	O	.																						

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17) [600 points] Solve this Patristocrat, which is a quote from Parks and Rec that begins with the word WARNING.

JFIMC MKZCK ZBLXL BOSDO JFKKL IVSHC MKUZI SGKZ

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

18) [300 points] Solve this Aristocrat, which is a quote from the Office encrypted with a K1 key.

AEIU P AJSRIM PU XEPH TFGUPUO P HJA XEJX XEI NSJO

AJH JX EJSN-TJHX, P XEFYOEX, `JSS GPOEX, JUFXEIG

KYGIJYLGJX JXI PX!' JUM XEIU P HJA PX AJH SPS'

HIKJHXPJU. EJSN-TJHX PH XFF EPOE. HEFA HFTI MJTU

GIHVILX.

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	7				14	7	6	13	11	21	2	2	3	3	5	14		1	8	5	9	1		19	3	
Replacement																										

19) [300 points] Solve this Aristocrat, which is a Brooklyn 99 quote encrypted with a K2 key

TUEUSEZGUD, YFC KYLEXOJ SCZKU DEPEZDEZSD PCU TFU. Z

HPLE NPNUCHYCR YL POO JYFC SOYDUT SPDUD QJ EYKYCCYH.

DSFOOJ, JYF SPL BFDE HCZEU "Z TZTL'E SOYDU PLJ" YL P

NZUSU YV NPNUC.

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		1	10	10	11	6	1	4		6	3	7		5	7	10	1	1	9	5	14	1		1	13	9				

20) [450 points] Solve this quote from the Office encrypted with a Pollux cipher. Part of the key is 3=., 9=., 8=., 5=X

88451315097879065287139029621808712913920316729167988853040726

70117718346002568894981404293513573144605991709192838825117101

58032325913732967363325938785182899582798748388296719842084101

57392689595867236158389736215504101476837661

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21) **[600 points]** Solve this Patristocrat, which is a Parks and Rec quote about breakfast food where the word EGGS appears twice.

DKYAI DFIZG NFKYW FNDKY FGILR AGOID BPIJN GRIUK

NKSXI VKJIJ RGWWO XYNPF INBOI BRPIO WBZGA GIUUN

FGXIV KJIJR GWWOD KYFIZ G

	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	4		5		7	10		15	5	8	1		7	5	3		5	1		3	2	6	3	5	3
Replacement																										

22) **[550 points]** Special Agent, Gabriel, has the following RSA public key:

$$n = 944423 \quad e = 871187$$

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

$$944423 = 953 * 991$$

Compute the value of their private key:

Enter the computed private key: