

# Science Olympiad — dragonfruit35's SSSS

## Codebusters Test

### 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	150			
1	100			
2	200			
3	150			
4	450			
5	225			
6	300			
7	350			
8	650			
9	250			
10	250			
11	625			
12	125			
13	550			
14	400			
15	175			
16	325			
17	375			
18	400			
19	100			
20	275			
21	700			
<b>Bonus</b>				
<b>Final Score</b>				



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

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



Timed Question **[150 points]** Solve this aristocrat reprimanding Flash Thompson in *Spider-Man: Homecoming*. When you have solved it, raise your hand so that the time can be recorded and the solution checked.

VTT, LOPVJ, RTSHC WJT LPVWTVW SVH'W POFPNV WJT RTVW

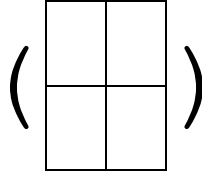
SL NEA PKT FKEHC.

	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	2		3		3	2	3		2	2	5		2	3	8		7	6			
Replacement																										

dragonfruit35's SSSS Codebusters Test

1) [100 points] Find the decryption matrix for encryption key BLIP.

$$\begin{pmatrix} B & L \\ I & P \end{pmatrix} \equiv \begin{pmatrix} 1 & 11 \\ 8 & 15 \end{pmatrix}$$



2) [200 points] Solve this aristocrat-encoded quote by Monica Rambeau in *Captain Marvel*.

LTP UJEO J NUJKNO ZT YBL ZUO NTTBOXZ VWXXWTK WK ZUO

UWXZTML TY VWXXWTKX. JKR LTP'MO QTWKQ ZT QWEO WZ PG

ZT XWZ TK ZUO NTPNU JKR SJZNU YMOXU GMWKNO SWZU VO?

	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			2		2			6	9	4	4	7	11	4	3	2	2	14	10	3	12	9	3	12
Replacement																										

3) **[150 points]** Nick and Maria want to communicate with each other using RSA for encryption. Nick generates RSA keys obtaining the following values:

$$n = 327937 \quad d = 209647$$

$$q = 929 \quad p = 353$$

$$\phi = 326656 \quad e = 282639$$

Likewise, Maria also generates RSA keys resulting in the values

$$e = 242693 \quad q = 317$$

$$n = 281179 \quad \phi = 279976$$

$$p = 887 \quad d = 68509$$

They ask each other for the public keys in order to communicate. What information do they each need to transmit in response?

You must also determine what formula Nick needs to calculate in order to decrypt the value 4566 from Maria.

Enter the minimum values that Samantha needs to transmit to Morgan:

--	--	--	--

Enter the minimum values that Morgan needs to transmit to Samantha:

--	--	--	--

Write the formula Samantha needs to calculate in order to decrypt the value 4566 from Morgan

4) **[450 points]** A quote concerning the Avengers Initiative has been translated into Spanish with a K1 key. Decode the plaintext.

**PB NKDB DGB GDWENG B WE FGWTS KD TDGHSEBH**

**DYVGBSGKNEBGNBH, TBGB CDG HN TSKNBE PPDFBG B HDG**

**BPFS QBH.**

K1	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		15	1	9	5	3	12	6			4			6			4	1		5	4		1	3		1	
Replacement																											

## dragonfruit35's SSSS Codebusters Test

5) [225 points] Solve this Vigenère-encoded quote. It appears that the key is "STARK".

Q	H	U	'	M	O	T	X	E	E	M	S	E	L	V	N	L	A	E	U	K	N	B	N	T	S	G	Y	O	L	B	

L	B	M	V	.	G	Z	T	T	U	Y	Q	H	U	J	K	Q	M	O	K	R	S	M	?	
																								?

A	S	C	G	E	U	K	O	D	R	R	Z	N	A	V	U	C	Y	M	L	.	I	U	Y	F	'	M	P	R	S	F	M	.	

6) [300 points] Decrypt this quote from *Ant-Man*. The first letter is B; the last three letters are OUT.

**ADAPT GAMMA EGYPT AT MAN DOGGY AN EGG ZAPPY ABUSE**

**SPADE SMASH GIDDY ATOMS IMAGE GASPS ANGUS HARDY MAMMA**

**BABES NAVAL AMIGO ABYSS AN EGG APPLE EDGAR METAL**

**RAVEN TASTY**



7) **[350 points]** Skye and Grant are accountants for a very large bank and have started a friendship. They communicate via email, because they live thousands of miles apart. Grant gets curious and asks Skye the year that she was born. Skye doesn't mind telling Grant, but she knows that the bank monitors all employee emails, and is afraid of being the victim of age discrimination. Therefore, Grant suggests that they use RSA, and they provides his public key: (173231, 172931). Skye replies with the ciphertext 167798. Grant's private key is 126971. In what year was Skye born?

Enter the answer:

8) **[650 points]** Solve this Patristocrat that is a quote by Stephen Strange containing "spell".

**HLOUH IKNJI EHIKG LORRH VUIKR AUOSL VBIRL JBULE**

**UIRLZ IINZL DOKVL BULEO GJPJC VBULE OGJPJ CVDIF**

**LOYBL GBULV WLRRV**

	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>Frequency</b>	1	6	2	2	4	1	4	4	9	6	4	14		2	7	2		7	1		8	7	1		1	2
<b>Replacement</b>																										

dragonfruit35's SSSS Codebusters Test

9) [250 points] Decode this emotional Affine-encrypted quote from *Avengers: Endgame* given that the first two letters are "TE".

Z	S	X	X	U	K	P	E	U	G	X	K	G	X	O	T	S	Z	J	S	U	.
																					.

10) [250 points] Solve this quote by Natasha Romanoff. It has been encrypted using the Vigenere cipher, and the first three letters are "HEY".  
(broken up into groups of 5)

U	E	R	S	E	E	Y	A	L	R	I	M	U	E	K	B	N	X	B	F	R	B	U	D	A	O	P	J	H	X

E	E	M	U	E	L	Z	I	M	U	S	H	A	I	T	A	I	L	V	M	A	R	R	X	G	O	I	V	C	D

H	P	T	S	O	L	F	I	E





15) [175 points] Encode this quote by the eponymous character of *Thor* with the Affine cipher given that  $a = 7$  and  $b = 12$ .

T	H	I	S	D	R	I	N	K	,	I	L	I	K	E	I	T	!	A	N	O	T	H	E	R	!
									,								!								!

16) [325 points] Encrypt this quote by Quentin Beck in *Spider-Man: Far From Home* using a Hill cipher with encryption key SPIDER-MAN.

$$\begin{pmatrix} S & P & I \\ D & E & R \\ M & A & N \end{pmatrix} \equiv \begin{pmatrix} 18 & 15 & 8 \\ 3 & 4 & 17 \\ 12 & 0 & 13 \end{pmatrix}$$

M	Y	S	T	E	R	I	O	I	S	T	H	E	T	R	U	T	H

## dragonfruit35's SSSS Codebusters Test

17) [375 points] Bruce tried to send an Aristocrat text message, but his thumbs are too big to type on a phone and he ended up using autocorrect to type some words, not all of which came out correctly. Can you figure out what he sent?

OAN CTT EJTAUH CT AULR OE EJXN OI, C QLAA AUN IDOCTH

OTW AUN IDOKT AKJ ROAUND OTW MTJK XJSM OA EN. INHA

JYY IJK AUN KUCDXH.

	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	12		5	4	4			4	5	7	5	2	2	8	9		1	2	1	9	7		2	3	2	
Replacement																										

18) [400 points] Agent of S.H.I.E.L.D Daisy has the following RSA public key:

$$n = 68129 \quad e = 48277$$

Unfortunately for her, a quantum computer has successfully factored her  $n$

$$68129 = 353 * 193$$

Compute the value of her private key:

Enter the computed private key:

19) [100 points] Find the name of an important location encrypted using the Caesar cipher with an unknown shift.

M	F	I	D	Z	I

20) [275 points] This quote by Korg in *Thor: Ragnarok* has been encoded against an unknown document. Figure out what it says.

E	Q	F	H	H

T	S	T	G	Z

G	Y	X	T	Z

C	I	H	K	T

R	V	W	X	B

N	X	V	W	A

H	C	H	X	K

A	O	Y	W	E

F	I	Y	W	U

E	I	I	P	T

Y	A	H	O	Q

W	B	G	R	W

X	D	U	Z	J

W	H	O	L	S

B	L	W	R	T

R	K	M	P	S

X	F	Q	Q	S

W	M	Q	Y	J

C	V	I	M	W

C	A

dragonfruit35's SSSS Codebusters Test

21) **[700 points]** Like the Avengers, travel back in time to their original movie to decode this Patristocrat quote. No further information will be provided.

**ADXMU XZPSD SAXTZ AUJDE WADXM UQGJG ZZAPT OCZSP**

**JMPGQ GJDKK ZEXZP MUTDP JUQCN UTDEG FSZGU TGGOU**

**UDSGO XZPTD EMUWD AEUWN UKKJP SUNUK KDYUE VUQG**

	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>Frequency</b>	6		2	11	6	1	10			6	6		5	3	3	8	4		6	6	16	1	3	6	1	9
<b>Replacement</b>																										