Note: Punctuation and capitalization have been added for readability.

1) Each word of the plaintext is written backwards.
The first question of a codes and ciphers test is always written backwards.

2) A Caesar shift of +2 has been applied.
"What can this strange device be? When I touch it, it gives forth a sound." – Neil Peart

3) This is a cryptogram with the enciphering key equal to the keys on a QWERTY keyboard.

```
Ciphertext:  QWERTYUIOPASDFGHJKLZXCVBNM
Plaintext:   ABCDEFGHIJKLMNOPQRSTUVWXYZ
```

"As long as you're green you can't escape! Unless you learn to face danger head-on... You won't last a second against me!" – Undyne

4) Noting the bolded and capitalized of **XFRNFT** in the previous question, create a Playfair square that as the keyword.

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

"A believing heart is your magic!" – Shiny Chariot

5) Draw lines in the directions of the arrows, with double-arrows representing lines that are twice as long. The resulting shapes look like letters if they are graphed on a digital display.
Customize

6) This is the Pigpen Cipher.
If one wishes to obtain something, something of equal value must be given.

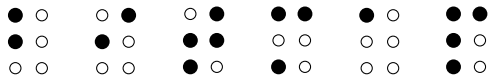
7) A binary sequence is compressed using Run-Length Encoding, where multiple instances of a character x appearing n times in a row in the sequence is represented by xxn. Single instances are simply written out. Expanded, the given sequence looks like this.

```
00000000000000000000000000000
01111000011100010000000111110
01000100100010010000000001000
01111000100010010000000001000
01000100100010010000000001000
01111000011100011111100001000
00000000000000000000000000000
```

The 1's form a word.

Bolt

8) Fill in the double-slashes as line breaks. Convert 1's to filled in circles and 0's to empty circles and translate from Braille.



Bitmap

9) Each character represents a Boolean operation that can be perfored on a pair of bits A and B. There are 4 possible input sequences to these functions, and the outputs of the functions can be represented as a four-bit binary integer. In order, the inputs are 11, 10, 01, and 00. A symbol can uniquely be assigned to each possible set of outputs, equivalent to a logical function.

Convert each logical symbol in the ciphertext to its binary equivalent. Split this binary string into groups of five bits. When converted to base 10, these sets of bits represent the indices of characters in the alphabet.

01011	00100	10111	01000	00010	01101
11	04	23	08	02	13
00110	10001	00000	01111	00111	11000
06	17	00	15	07	24

A chart representing each of the 16 possible operations is found on the next page.

Lexicography

Base 10 number	Base 2 number	11	10	01	00	Function	Definition
00	0000	0	0	0	0	0	FALSE
01	0001	0	0	0	1	$\downarrow$	NOR
02	0010	0	0	1	0	$<$	LESS THAN
03	0011	0	0	1	1	$\overline{A}$	NOT A
04	0100	0	1	0	0	$>$	GREATER THAN
05	0101	0	1	0	1	$\overline{B}$	NOT B
06	0110	0	1	1	0	$\oplus$	XOR
07	0111	0	1	1	1	$\mid$	NAND
08	1000	1	0	0	0	$\wedge$	AND
09	1001	1	0	0	1	$\leftrightarrow$	XNOR
10	1010	1	0	1	0	B	B
11	1011	1	0	1	1	$\rightarrow$	IMPLIES
12	1100	1	1	0	0	A	A
13	1101	1	1	0	1	$\leftarrow$	IMPLIED BY
14	1110	1	1	1	0	$\vee$	OR
15	1111	1	1	1	1	1	TRUE

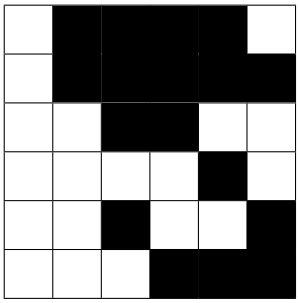
10) As the chart implies, Morse code should be investigated. Seth's exclamation (spaces and punctuation removed) can be converted to Morse code and run through Caleb's and Greg's responses (representing Keys A and B) and compared to the table to get Trevor's response. Dots are represented by 0's and dashes are represented by 1's.

Seth	10100011010101001010010110011010 0
Caleb	01100010011001100111001110011100 1
Greg	00111111000111010010111110111100 10
Trevor	10X111X0X1001X0110X0100X111X100X0

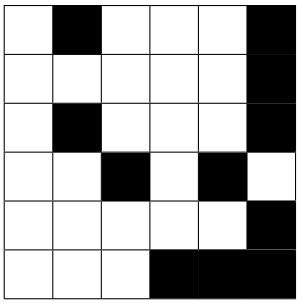
−• −−− • −••− •−−• •−•• −−− −•• • can be directly translated from Morse code.

No explode

11) B3/S23 stands for "Birth 3, Survival 2/3," which is the traditional ruleset for Conway's Game of Life (additionally, note the title of the section). The first letters of the initially black squares in the grid spell out TWO GENERATIONS; the first two generations after the given one are shown here.



Generation 1

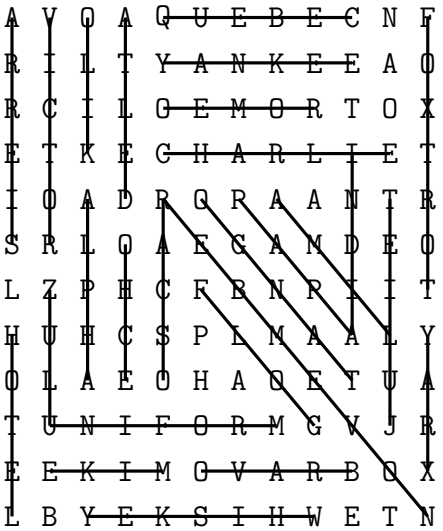


Generation 2

The second letters of the black squares in the final grid spell out a message.

Langton's Ant

12) Noting the presence of the words `QUEBEC` and `YANKEE` going forward in the first two rows and `ROMEO` going backwards in the third row, this can be inferred to be a word search, where the desired words are the words used in the phonetic alphabet.



NATO Alphabet

13) The solution to the Akari is shown, where the presence of a letter indicates a lightbulb.

	■			■		L	1		I	2		G	
H	1				■					T	■	1	■
	■			S									
■			O	2	1	1	U						
T				■	A		2	N	1	■		D	2
						A				0		2	W
0				0					A	2			
	Y		■				W		3	E			■
G	3		0						O				
■	D		1	■		■			■			A	
			V				■	■	■		I		0
		D										■	
■	1	1					C	3	R			0	
	O		■	F		■		T	■			1	💡

"Lights out, and away we go!" – David Croft

14) In the German Enigma machine, the ciphertext letter is found in the top row. The gap between the top row and the first set of letters (rotor) is crossed. The letter crossed to in the top row of the rotor must be found in the bottom row of that rotor to begin a new crossing. When the bottom set of letters (reflector) is reached, find the column that is the inverse of the column initially crossed to and begin a new set of crossings, going backwards through the rotors until the standard alphabet is reached. After each letter is decoded, shift the top rotor to the left by 1 letter, but leave all of the other rotors and the reflector alone.

This Enigma machine utilizes a plugboard, where pairs of letters in the ciphertext and plaintext are swapped for greater encryption. These pairs are given in the flavor text of this section: `SP`, `RI`, `CH`, and `DU`. Whenever one of these letters appears in the ciphertext or plaintext (but not the intermittent steps in solving a letter), it must be replaced with the other element in its pair.

The solution for the first letter is shown with highlighting. Steps going down the rotors are in red, and steps coming up the rotors are in blue.

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

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

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

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

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

The sequence for the first R is R→I-Q-P-K-Z-W-N-F-D-Z.

Zeitgeist

15) This is the German ADFGVX cipher. The keys are given in the Section information, where the short key is "Deutsch" and the long key is "Schlussfolgerungen Ziehen."

CDEHSTU	DEUTSCH
6127543	1234567
FGGADFA	GGAFDFA
ADADADG	DAGDAAD
GFXDGAA	FXAAGGD
DGFFXFA	GFAFXDF
VAAVVGV	SSVGVVV
GFVADFF	FVFFDGA

The rotated ciphertext is GG AF DF AD AG DA AD FX AA GG DG FA FX DF SS VG VV VF VF FD GA. Looking up those pairs in the following matrix gives the plaintext.

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

The clock strikes 12:00 AM.