

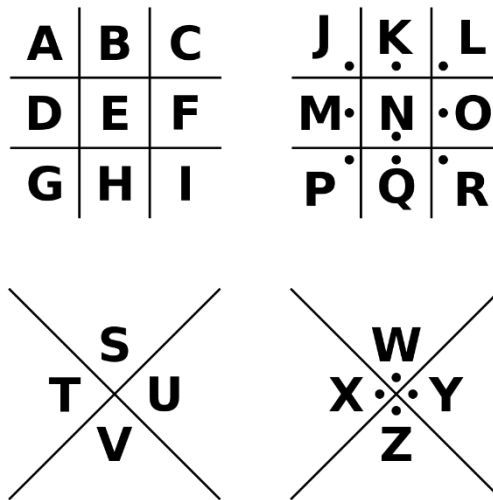


2018 Mu Alpha Theta – Codes and Ciphers (Solutions)

- 1) Take every other letter, starting with the first, and ignore the rest.
- 2) Shift each letter up by one in the alphabet. For example 'b' becomes 'a', 'c' becomes 'b', etc.
- 3) Reverse the order of letters in each three-letter chunk. "pxetce" becomes "exp" and "ect", spelling the word "expect".
- 4) The text was encoded using a pigpen cipher, where each letter is determined by its border and dot in the key ('a' is  and 'n' is ):



- 5) Take each letter that is paired with a non-prime number, and ignore the rest. Remember that 1 is not a prime number and 2 is a prime!
- 6) Shift each letter up in the alphabet by each the amount of each digit in the date 2038-01-19, repeated over the text:

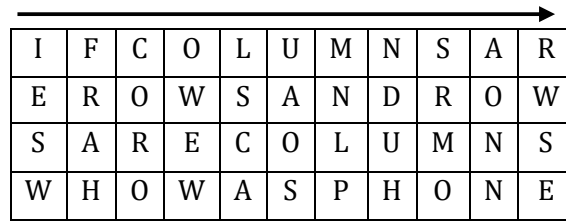
↓	V	H	H	J	U	U	U	N	T	F	O	G	C
	+2	+0	+3	+8	+0	+1	+1	+9	+2	+0	+3	+8	+0
	T	H	E	B	U	T	T	E	R	F	L	Y	C

- 7) Take the first letter of each word that is a used as a letter in the NATO phonetic alphabet, and ignore the rest. The NATO letters used are "Charlie", "India", "Oscar", "Sierra", "Tango", "Uniform", "and "Victor".
- 8) Each two-letter ciphertext pair corresponds to a single plaintext letter, following the key:

A	B	C	D	E	F	G	H	I	J	K	L	M
GS	NX	QL	FG	VT	AC	MJ	PG	CG	XN	YA	NV	IO

N	O	P	Q	R	S	T	U	V	W	X	Y	Z
PN	UN	AT	QC	RL	CB	SM	CF	LH	LW	LG	XJ	PL

9) Arrange the cipher text into a grid, then read off the rows:



A 4x10 grid of cipher text. Above the grid is a horizontal arrow pointing to the right, indicating the reading direction. The grid contains the following characters:

I	F	C	O	L	U	M	N	S	A	R
E	R	O	W	S	A	N	D	R	O	W
S	A	R	E	C	O	L	U	M	N	S
W	H	O	W	A	S	P	H	O	N	E

10) Each eight-digit binary number corresponds to the ASCII encoding for the plaintext character. Note that ASCII encodings are sequential, so since 01100001 (decimal 97) encodes "a", that means that 01100010 (decimal 98) encodes "b", and so on.

11) Starting at the character in the sixth column and twenty-fifth row, collect letters in the Golden Ratio Spiral pattern:

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

12) Each letter in the ciphertext corresponds to a single plaintext letter following the key:

Plaintext	A	B	C	D	E	F	G	H	I	J	K	L	M
Ciphertext	P	N	I	Y	L	G	Q	B	M	X	U	F	S

Plaintext	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
Ciphertext	C	O	D	Z	E	R	A	J	V	K	H	T	W

13) Each stick figure person corresponds to a plaintext character, as described in Sir Arthur Conan Doyle's Sherlock Holmes story "The Adventures of the Dancing Men". If the figure is holding a flag, that signifies the last character of a full word.

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

14) The 5x5 grid of letters is the "keysquare" for a Playfair cipher. Decrypting the cyphertext is done by applying these rules to each pair of letters in the plaintext:

- If the letters are on the same row of the table, replace them with the letters to their immediate left respectively (wrapping around to the right side of the row if a letter in the original pair was on the left side of the row).
- If the letters appear on the same column of your table, replace them with the letters immediately above respectively (wrapping around to the bottom side of the column if a letter in the original pair was on the top side of the column).
- If the letters are not on the same row or column, replace them with the letters on the same row respectively but at the other pair of corners of the rectangle defined by the original pair. The order is important – the first letter of the encrypted pair is the one that lies on the same row as the first letter of the plaintext pair.

So for our cyphertext we would start with "HL":

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

That gives us "WH" via Rule B. We move on to "XF":

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

This gives us “YD” via Rule C. We move on to “LA”:

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

This gives us “ON” via Rule A. So far we have “Why don”; continue with the rest of the cyphertext to decode the message.

- 15) The ciphertext was encoded with a Vigenère cipher, using “ROTATE” as the key. To decrypt the message, shift each letter of the ciphertext up in the alphabet by the numeric value of each letter of the key (starting with A=0) repeated across the text.

Key Letter	R	O	T	A	T	E
Shift Amount	17	14	19	0	19	4

↓	C	O	L	T	G	M	X	V	M	I	E	E	P
	+17	+14	+19	+0	+19	+4	+17	+14	+19	+0	+19	+4	+17
	L	A	S	T	N	I	G	H	T	I	L	A	Y