

## Kryptos 2022 Challenge 3 Solution

The method for solving Challenge 3 lies in the solutions to the crossword puzzle. Note the clues are given out of order and in each clue row/column one of the boxes is outlined in bold. Completing the puzzle and writing down the letters in the outlined boxes in the order of the clues gives the word "SWAGMAN".

A google search shows that Swagman is a type of transposition cipher.

The cipher works by writing the plaintext across nxn blocks (there may be some incomplete columns). The key is an nxn completed Sudoku puzzle. The plaintext is then read off vertically in the order indicated by that column of the Sudoku key.

Below is an example, encrypting the message "Swagman cipher message example" using 3x3 blocks and key

1	2	3
3	1	2
2	3	1

s	w	a
p	h	e
l	e	m

g	m	a
r	e	x
e	s	s

n	c	i
a	m	p
a	g	e

1	2	3
3	1	2
2	3	1

1	2	3
3	1	2
2	3	1

1	2	3
3	1	2
2	3	1

slphw emeag erems sxana amcge pi

For a complete description of the Swagman cipher see <http://www.cryptogram.org/downloads/aca.info/ciphers/Swagman.pdf>

The ciphertext is the handwritten letters in the bottom right corner of the puzzle page.

HETTPHUEMHEEZ F I S I A Z C L N H R N A I O S E S R L D W E S O P D E R R W W T T N O O B I R O E D N L N T

There are 60 letters in the ciphertext which would work well in any of 3x3, 4x4, 5x5, or 6x6 blocks. Let's try it with 5x5 blocks. To start we will write the ciphertext in by columns noting. The order will be wrong, but at least we'll know which letters belong in which columns.

H	H	E	S	L
E	U	E	I	N
T	E	Z	A	H
T	M	F	Z	R
P	H	I	C	N

A	S	E	E	T
I	R	S	R	T
O	L	O	R	N
S	D	P	W	O
E	W	D	W	O

B	D			
I	N			
R	L			
O	N			
E	T			

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One strategy for attacking the Swagman cipher is to use a crib (identify words from the plaintext in the ciphertext). The backstory notes the students were likely cheating and we know they like puzzles, so some possible cribs might be “answer” or “puzzle”. We note that there are z's in both column 3 and 4 so the word “puzzle” might be a good place to start.

H	H	E	S	L
E	U	E	I	N
T	E	Z	A	H
T	M	F	Z	R
P	H	I	C	N

A	S	E	E	T
I	R	S	R	T
O	L	O	R	N
S	D	P	W	O
E	W	D	W	O

B	D			
I	N			
R	L			
O	N			
E	T			

This looks promising since the P and E are in the same position in their columns and correspond to the same key in the Sudoku block.

We begin to reconstruct the plaintext while at the same time thinking about the key.

P	U	Z	Z	L

E				


				1
	1			
		1		
			1	
1				

				1
	1			
		1		
			1	
1				

	1			
1				

Since the pattern repeats in each block, we can write down more of the plaintext to see if it is making sense.

P	U	Z	Z	L

E	R	O	W	T

E	N			

This looks promising. We need to find another word that can fit in and not contradict this numbering system. Let's try to place “answer”

## Kryptos 2022 Challenge 3 Solution

H	H	E	S	L
E	U	E	I	N
T	E	Z	A	H
T	M	F	Z	R
P	H	I	C	N

A	S	E	E	T
I	R	S	R	T
O	L	O	R	N
S	D	P	W	O
E	W	D	W	O

B	D			
I	N			
R	L			
O	N			
E	T			

There are two possibilities for the N and two for the R, but since we know the key has the Sudoku properties, we need to make choices in different rows, so we'll pick the blue N and blue R. I'm not sure which rows the plaintext was in but that's ok, we can just permute them in the end. I'll fill in row 2 based on this guess to see if it makes sense.

P	U	Z	Z	L
T	H	E	A	N

E	R	O	W	T
S	W	E	R	T

E	N			
O	T			

		2		1
	1			2
		1	2	
2			1	
1	2			

		2		1
	1			2
		1	2	
2			1	
1	2			

	1			
2				
1	2			

This looks promising and we might guess that the "t" in the last column of row 2 might be the start of the word "the" which will give us the first two columns for our 3:

P	U	Z	Z	L
T	H	E	A	N
H	E			

E	R	O	W	T
S	W	E	R	T
A	L			

E	N			
O	T			
B	L			

3		2		1
	1			2
	3	1	2	
2			1	
1	2			

3		2		1
	1			2
	3	1	2	
2			1	
1	2			

3				
	1			
	3			
2				
1	2			

Continue by trying to fill in more words while keeping in mind the numbers in the key must follow a Sudoku puzzle pattern. After trial and error we find:

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P	U	Z	Z	L
T	H	E	A	N
H	E	F	I	N
E	M	I	S	H
T	H	E	C	R

E	R	O	W	T
S	W	E	R	T
A	L	P	R	O
I	D	D	E	N
O	S	S	W	O

E	N			
O	T			
B	L			
I	N			
R	D			

3	5	2	4	1
4	1	5	3	2
5	3	1	2	4
2	4	3	1	5
1	2	4	5	3

3	5	2	4	1
4	1	5	3	2
5	3	1	2	4
2	4	3	1	5
1	2	4	5	3

3	5			
4	1			
5	3			
2	4			
1	2			

The most likely ordering of the rows gives:

The answer to the final problem is hidden in the crossword puzzle row ten.