

# Cracking Ciphers using Frequency Analysis

Frequency Analysis (working out which letters appear most often in English) can be used to crack ciphers (secret messages).

Simple secret messages are created by swapping each letter for a different symbol (for example, a number or a different letter). The letter 'A' might be swapped everywhere for 5, and 'B' swapped for 22, and so on. If the message is long enough, then the new characters will still follow the pattern of frequencies of English. For example, the most common symbol will probably be E. The next most common ones will likely be A, T or O.

## Short words

At first you may have to guess which is A, which T and which O, filling them in in pencil then looking for words or non-words that appear. Short words can help a lot. If a word appears, then that will suggest you have guessed correctly. If you end up with non-words like a two letter word OA then you have guessed wrong. Perhaps it is AT instead!

## Cribs

One way to help you guess is to use 'cribs'. A crib is a word that you might expect to find in the message such as a particular person's name. Words that are commonly used to start or end a message are also words to try as cribs. Do they fit anywhere given the letters you have filled in, using frequency analysis?

## Winning World War II

The British used cribs in World War II to crack German ciphers. They correctly guessed that messages might end HEIL HITLER, for example. This helped win the war as the British could read lots of German messages so knew their plans.

## Activity

Work out what this secret message says. You saw **Rosie** pass it to **Sameena**. Each number corresponds to a letter but which is which? A dash has been used to mean a space.

3 11 17 19 - 8 17 10 11 11 25 17 -

10 11 11 4 - 10 11 - 17 4 - 4 20 11 -

8 5 11 11 4 - 8 20 9 1 -

17 4 - 4 5 9 -

7 9 14 11 - 12 19 9 10 - 19 9 8 18 11

1. Use frequency analysis to work out what the letters are: do a tally of the numbers to work out their frequency.
2. The most frequent number is likely to be E.
3. The next most frequent numbers are likely to be A, T and O. Short words (like 'a', 'at', 'and', 'the', 'to') can help you guess which letter is which.
4. Can you use a crib? Are there any names that might appear in the message? Can you see where they fit given the letters you have guessed so far.

As you work out which letter a number stands for, fill it in everywhere it appears under the secret message, as well as in the table below to keep track of what you know.

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