The word ABCDEFGHIJKLMNOPQRSTUVWXYZ is to be encrypted. Does a second dial exist that will encrypt this to a word that contains all 26 letters? Justify your answer.

Solution:

Let second dial contain symbols , where

Let be the *k-th* symbol of the word for all

And be the *k-th* symbol of the encoded word

Define to be a function that encodes a symbol with second dial symbols.

Then,

If we look at indices of our symbols and examine how then change, we can observe a pattern:

A sequence on the right is an arithmetic progression, let’s look at it closer:

but

Now we see that some of the encrypted symbols repeat, for example:

And it does not matter what kind of alphabet you have on the second dial.

So the answer is no, we can’t have a second dial that will encode ABCDEFG…XYZ to unique word.