Week 6: Ciphering a Sentence

Activity1 :

Use the rules below to create ciphers.

Create two rules for mapping the alphabet.

Sample rules:

- The characters are divided into two groups: (1) characters for which the image of their uppercase form has an enclosed area (such as P or O) and (2) characters that do not have an enclosed area in in the image of their uppercase form (such as I or Z).
- Sort the two groups alphabetically, with group 1 first and then group 2.

Apply the rules.

Applying rule 1:
Group 1: {A, B, D, O, P, Q, R} Group 2: {C, E, F, G, H, I, J, K, L, M, N, S, T, U, V, W, X, Y, Z}

Applying rule 2:
A, B, D, O, P, Q, R, C, E, F, G, H, I, J, K, L, M, N, S, T, U, V, W, X, Y, Z

Place the letter sequence that resulted from Rule 2 in the second row of the following table beneath the number 1 to 26 (example completed below).

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

This table shows a one-to-one alphabet mapping (matching one letter with one number), Alphabet Mapping #1.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
A	B	D	O	P	Q	R	C	E	F	G	H	I	J	K	L	M	N	S	T	U	V	W	X	Y	Z

Now, invent a third rule and apply it to the above mapping to come up with another one-to-one alphabet mapping table. A third rule could be to place the even-number-mapped letters in alphabetical order followed by the odd-number-mapped letters in alphabetical order. Let's call that Alphabet Mapping #2.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
B	O	Q	C	F	H	J	L	N	T	V	X	Z	A	D	P	R	E	G	I	K	M	S	U	W	Y

Activity 2: Encode Sentences

Encode sentences using the mapping they developed in Activity 1.

1. **Think of a simple message you would like to send to your partner.**
2. **Encode it three times: first use just Alphabet Mapping #1, then use just Alphabet Mapping #2, and then use both mappings from the previous activity.**
3. **If you have done a mapping on your own, use that for encoding.**

> For example, if the sentence is:
> We drove to the gym.
> Using the Alphabet Mapping #1, we find each letter of the sentence in the second row of the table created in Activity 1. We replace the letter with the corresponding number in the first row.
>
> Please note that one must place letter breaks (the character "_") and separate each word by a blank space. In this example, the encoded sentence is:
> 23_9 3_7_4_22_9 20_4 20_12_9 11_25_17

Activity 3: Answer the following questions

1. Which mapping is easier to use to encode a message?
2. Write an algorithm that describes the process of encoding.
3. How would implement your cipher in a computer program? Write C code for the cipher.
4. Imagine that another person gives you an encoded message and you do not know the mapping tables. How would you go about deciphering or decoding the sentences? What patterns would you look for to help you discover the one-to-one mapping?
5. If someone wants to come up with a cipher that is very difficult to for others to decode, what are some of the strategies that he or she should consider to break down the problem?

Words to understand from the internet:

Cipher, Encryption, Decryption, Encoding, Decoding, Ciphertext, Plaintext