Exercises 11

Conversion of types

Exercise 11.1 - `String` to `int` conversion

Write a method called `stringToInt` () which converts a string in the same way as the predefined method Integer.`parseInt` (), that is to say, which returns the numeric value of the string if it is an integer and causes an error in other cases (eg. if the string contains letters). You will ensure that the method also works for negative numbers.
You can use both methods `Character.isDigit`() that determines whether a character is a digit and `Character.getNumericValue()` which returns the numeric value of a number to do this program. Both methods take a character parameter.

Exercise 11.2 - Extracting words

We will consider a word is a string of characters that includes only letters. All other characters are treated as delimiters used to separate the different words.
To determine whether a character is a letter, use the method `Character.isLetter()`.
Write a method that converts a `String` into an array of strings that contains the words in the same order.
For example, the string "hello my friend" will be converted into the array of strings {"hello", "my", "friend"}. To do this, you should browse the string to convert and store at any time the beginning of the already read current word. One must also distinguish if one is reading a **word** or a **word separator** between two words. Do not overlook the fact that there may be several successive separator characters such as multiple spaces between words.

Exercise 11.3 - Roman numerals conversion

Roman numerals are numbers written in letters that can be considered as the figures of this type of notation. Each letter is associated with a number that is added or subtracted depending on the position of the digit in the number.
Here is the correspondence between the letters and numerical values:

letter:	I	V	X	L	C	D	M
value:	1	5	10	50	100	500	1000

Question 11.3.1 - Letter conversion

Write a method that converts a Roman numeral given by a character of type char corresponding to the value (type `int`). In cases where the character is not one of the seven letters used by Roman numerals, the method should cause an error.

11.3.2 - Number conversion

To determine the value of a number written in Roman numerals, the number must be read from right to left, just add the digit value, except if it is less than the previous one, in this case, subtract its digit value:
- XVI = 1 + 5 + 10 = 16;
- XIV = 5 - 1 + 10 = 14, because I is less than V
- DIX = 10 - 1 + 500 = 509, because I is less than X;
- MMMCMXCIX = 10 - 1 + 100 - 10 + 1000 - 100 + 1000 * 3 = 3999;

Write a method that converts a Roman numeral written in a `String` to a numeric value of type `int`. It will be useful to call the method written in the previous question.

Exercise 4.11 - Basic cryptography

The encoding and decoding operations are symmetrical. They permit to transform a certain message to maintain its confidentiality (encryption) or to conform to technical constraints. For example, computers use binary encodings to handle all data: text, numbers, images, sounds, etc..

Question 11.4.1 - Code of Julius Caesar

To encrypt his messages, Julius Caesar used a code where each letter was replaced by the letter on three notches further into the alphabet. For example, **a** is encoded by **d** , **b** by **e,** etc.. The last three letters of the alphabet are encoded respectively by **a**, **b** and **c**.
Write the functions of encoding and decoding for this code. These functions will be defined as letters, other characters remain unchanged. These functions allow you to encode and decode strings.
Note that in Java, the `char` is **numeric**: we can apply the arithmetic operations including addition and subtraction useful in this exercise.

11.4.2 - A code with a key

We want to keep the principle of replacing a letter by another characterized by its offset in the alphabet. But now we want the shift that varies from one letter to another in a digital key.
Each number key gives the offset of a letter.
Take for example the key 23781. This key will be applied successively to several pieces of string length 5. The first letter is replaced by the second letter following in the alphabet because 2 is the first digit of the key. The second letter will be replaced by the following third, the third by following the seventh, etc..
For example, the message: hello, how are you? (in french) will be coded as follows:

```
b o n j o u r c o m m e n t v a
2 3 7 8 1 2 3 7 8 1 2 3 7 8 1 2
d r u r p w u j w n o h u b w c
```

Write functions of encoding and decoding for this encoding method. The key parameter is given in the form that you find most convenient.