Poof of programs using Frama-C

I) Syntax

Syntax of the annotations :

```
formula ::= expr
          | expr rel expr
          | formule ==> formule
          | formule <==> formule
          | formule && formule
          | formule || formule
          | \forall type ident ; formule
          | \exists type ident ; formule
rel ::=  == | != | < | <= | > | >=
```

Syntax to define pre and post conditions :

```
/*@ requires ...;
    ensures ...; */
```

Loop annotations :

```
/*@
   loop invariant ...;
   loop variant ...;
*/
```

The predicate `\valid(x)` means that `x` is a valid memory zone.

The predicate `\valid(t+(0..n-1))` specifies that the memory zones `t[i]` forall `i` in `[0... n-1]` are valid.

The result of the function is designated by `\result`.
The value of a variable`x` before function call is designated by `\old(x)`.

The command `assigns` specifies what are the variables which are modified by the function. For example `assings t[0..n-1]` specifies that the array t is modified. The command `assigns \nothing` allow to specify that the function produces no side-effects.

To run frama-c with the jessie plugin :
`frama-c -jessie mycode.c`
Warning ! Do not create a `main` function, we will just write the function to be proved without any `#include`.

II) Exercises

Program in C, specify and prove using Frama-C the following functions :

1. Compute the minimum between two integers.
2. Test is all elements of a given array are zero :

```
/*@
   requires ...;
   ensures ...;
*/
int all_zeros(int t[], int n) {
    /*@
       loop invariant ...;
       loop variant   ...;
    */
     ...
}
```

3. Copy the content of one array into another (the two array have the same size, the size is given as an argument, jessie plugin assumes that there is no alias between the two arrays).

```
 void copy1(int s[], int t[], int n) {
  ...
}
```

4. Fill an array with a given value.
5. Compare two arrays.
6. Test is a given array is a palindrome.
7. Search the index of the minimum of a given array.
8. Returns the index of an element in a given array.
9. Swap two pointers.