

Prove that $I(n)$ is a loop invariant for bbb. (14 points.)

$$I(n) = \text{ after } n \text{ iterations, } x = 50 + i$$

```
fun bbb(m) =  
  let  
    val x = ref 50;  
    val y = ref 50;  
    val i = ref 0;  
  in  
    (while !i < m do  
      (x := !x + 1;  
       y := !y - 1;  
       i := !i + 1);  
      !x + !y)  
    end;
```

Write a function `findExtreme` that takes a function (with type `int × int → bool`) and a list of integers and uses the function to select the extreme element (least, greatest, etc) of the list. Specifically, the function that `findExtreme` takes as a parameter defines a way to order `int`, that is, it compares two ints (say a and b) and returns `true` if a comes before b and `false` otherwise (mathematically, this function is a *total order*). Thus `findExtreme` is a generalization of `findGreatest`. For example, `findExtreme(fn (a, b) => a > b, [6, 4, 18, 9, 2])` would return 18. (This problem is *not* naturally solved using `map` or `filter`.)