Esempio di prova di esame - Matematica AA 2015

Esercizio1.
Soluzione
(a)
```
module type MULTIS =
 sig type  'a multis
     val empty: unit -> 'a multis
     val mul: 'a multis -> 'a -> int
     val add: 'a multis -> 'a -> 'a multis
     val rem: 'a multis -> 'a -> 'a multis
end;;
```
(b)
```
module Multis =
(struct
 type  'a multis = fun 'a -> int
     let empty ...
     let mul ...
     val add m x = fun y -> if (y=x) then (m x)+1 else m x
     val rem ...
end::MULTIS);;
```
(c)
```
let M = add(add(add (empty()) 2) 4) 2
```

Esercizio2.
Soluzione
(a)
```
interface MULTIS<A>{
    public int mul (A x);
    public void add (A x);
    public void rem (A x) throws NotFoundException;
}
```
(b)
```
class ImmMultiS<A> implements MULTIS<A>{...}
class ImmMultiSE<A> extends ImmMultiS<A>{
    private int size;
    public ImmMultiSE(){
        super(); size = 0;
    }
    public void add (A x){
        if (mul(x)==0) size++;
        super.add(x);
    }
    public void rem (A x){
        if (mul(x)==0) size--;
        super.rem(x);
    }
    public void size (){
        return size;
    }
}
```

Esercizio3 (Laboratorio)
Soluzione
```
let csem c ev st =
    match c with
    ...
    | CCondAssign(i,cond,e1,e2)->
        let condVal = esem cond ev st and
            iLoc = apply_env ev i
```

```
      in (match (condVal,iLoc) with
        | (Bool b, L l) -> (let eiVal = if (b = True)
                                        then esem e1 ev st
                                        else esem e2 ev st
                            in let st1 = update st l eiVal
                                in (ev,st1))
        | (Bool b, _) -> not_a_location iloc
        | _ -> type-error()
        )
```