

I2I-2 Functional Verification Example Exercises

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July 2, 2023

1 Dacentrili

The followign OCaml functions are given:

```
1 let rec damcentravi a lst = match lst with
2   | [] -> a
3   | h::t -> damcentravi (h::(List.rev a)) t
4
5 let rec get_nth n lst = match lst with
6   | [] -> 0
7   | h::t -> if n = 0 then h else get_nth (n-1) t
8
9 let pick_middle lst = get_nth ((List.length lst) / 2) lst;;
```

Prove that the equality

```
1 a = pick_middle (damcentravi [] (a::b))
```

holds.

2 Even list

The followign OCaml functions are given:

```
1 let rec el a lst = match lst with
2   | h::_::t -> el (h::a) t
3   | [h] -> el (h::a) []
4   | _ -> a
5
6 let rec de i a lst = match lst with
7   | h::t -> de (i+1) (if i mod 2 = 0 then h::a else a) t
8   | _ -> a
```

Prove that the equality

```
1 de 0 [] 1 = el [] 1
```

holds.

3 Bigotree

The following OCaml functions are given:

```
1 type node = Empty | Inner of node * int * node
2
3 let rec insert_in_tree v t = match t with
4   | Empty -> Inner (Empty, v, Empty)
5   | Inner (l, u, r) -> if v > u then
```

```

6      Inner (l, u, insert_in_tree v r)
7  else
8      Inner (insert_in_tree v l, u, r)
9
10 let rec to_tree a lst = match lst with
11 | [] -> a
12 | h::t -> insert_in_tree h (to_tree a t)
13
14 let rec to_list t = match t with
15 | Empty -> []
16 | Inner (l, v, r) -> to_list l @ [v] @ to_list r
17
18 let rec insert n lst = match lst with
19 | [] -> [n]
20 | h::t -> if n > h then
21     h::(insert n t)
22     else
23     n::h::t
24
25 let rec sort lst = match lst with
26 | [] -> []
27 | h::t -> insert h (sort t)

```

Prove that the equality

```

1 to_list (to_tree Empty a) = sort a

```

holds.