

# CSE210a: Homework 6 (Dafny)

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### HW6:

```
1 datatype Tree<T> = Leaf | Node(Tree<T>, Tree<T>, T)
2 datatype List<T> = Nil | Cons(T, List<T>)
3
4 0 references
5 function flatten<T>(tree:Tree<T>):List<T>
6 decreases tree
7 ensures tree==Leaf ==> flatten(tree)==Nil
8 {
9   match tree
10   case Leaf ==> Nil
11   case Node (left, right, m) => append(Cons(m, flatten(left)), flatten(right))
12 }
13
14 0 references
15 function append<T>(xs:List<T>, ys:List<T>):List<T>
16 decreases xs, ys
17 ensures xs==Nil ==> append(xs, ys)==ys
18 ensures ys == Nil ==> append(xs, ys)==xs
19 {
20   match xs
21   case Nil => ys
22   case Cons(x, xs') => Cons(x, append(xs', ys))
23 }
24
25 0 references
26 function treeContains<T>(tree:Tree<T>, element:T):bool
27 decreases tree
28 {
29   match tree
30   case Leaf => false
31   case Node (left, right, m) => m==element || treeContains(left, element) || treeContains(right, element)
32 }
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

No problems have been detected in the workspace so far.

Filter. E.g.: text, \*\*/\*.ts, !\*\*/node\_modules/\*\*

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## Extra Credit:

```
1  datatype Exp = Const(val:int) | Var(string) | Plus(Exp, Exp) | Mult(Exp, Exp)
2
3  0 references
4  function eval(e:Exp, store:map<string, int>):int
5  decreases e, store
6  {
7      match(e)
8      case Const(n) => n
9      case Var(s) => if(s in store) then store[s] else -1
10     case Plus(e1, e2) => eval(e1, store) + eval(e2, store)
11     case Mult(e1, e2) => eval(e1, store) * eval(e2, store)
12 }
13
14 0 references
15 function optimize(e:Exp):Exp
16 decreases e
17 {
18     match(e)
19     case Mult(e1, e2) => if e1==Const(0) then Const(0)
20                         else if e1==Const(1) then e2
21                         else if e2==Const(0) then Const(0)
22                         else if e2==Const(1) then e1
23                         else if e1.Const? && e2.Const? then Const(e1.val*e2.val)
24                         else Mult(e1, e2)
25     case Plus(e1, e2) => if e1==Const(0) then e2
26                         else if e2==Const(0) then e1
27                         else if e1.Const? && e2.Const? then Const(e1.val+e2.val)
28                         else Plus(e1, e2)
29     case Const(n) => Const(n)
30     case Var(s) => Var(s)
31 }
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

Filter: E.g.: text, \*\*/\*.ts, !\*\*/\*node\_modules/\*\*

No problems have been detected in the workspace so far.

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