1993 Paper 1 Question 6

The structure of a binary tree containing integers at some of its leaves is given by the ML datatype `T` defined as follows:

```
datatype T = X | N of int | D of T*T;
```

Define a function `filter` of type `(int -> bool) -> (T -> T)` with the property that the call `filter p t` will yield a simplified copy of `t` by repeated application of tree rewrite rules:

```
D(X,a) -> a     D(a,X) -> a
```

on the tree obtained from `t` by replacing all leaf nodes of the form `N k` for which `p k` yields `true` by `x`. Thus, for example:

```
filter (fn n => n=0)
```

should yield a function that converts `D(D(N0,N0), D(D(N2,N0), N3))` to `D(N2,N3)`.