Задание

```
type Set = Int -> Bool
contains :: Set -> Int -> Bool
singletonSet :: Int -> Set
union :: Set -> Set -> Set
intersect :: Set -> Set -> Set
diff :: Set -> Set -> Set
filter' :: Set -> (Int -> Bool) -> Set
bounds = [-1000,1000]
forAll :: Set -> (Int -> Bool) -> Bool
exists :: Set -> (Int -> Bool) -> Bool
```

Решение

```
type Set = Int -> Bool
a = (\a -> True)::Set

contains :: Set -> Int -> Bool
contains s a = s a

singletonSet :: Int -> Set
singletonSet = \b -> (\a -> a == b)
singletonSet b = \a -> a == b
singletonSet b = let
  answer a = a==b
  in answer
```

замыкание, closure

Решение

```
union :: Set -> Set -> Set
union a b = \c -> (contains b c) || (contains a c)

intersect :: Set -> Set -> Set
intersect a b = \c -> (contains b c) && (contains a c)

diff :: Set -> Set -> Set
diff a b = \c -> (contains a c) && (not (contains b c))

filter' :: Set -> (Int -> Bool) -> Set
filter' a f = \c -> (contains a c) && (f c)
```

Решение

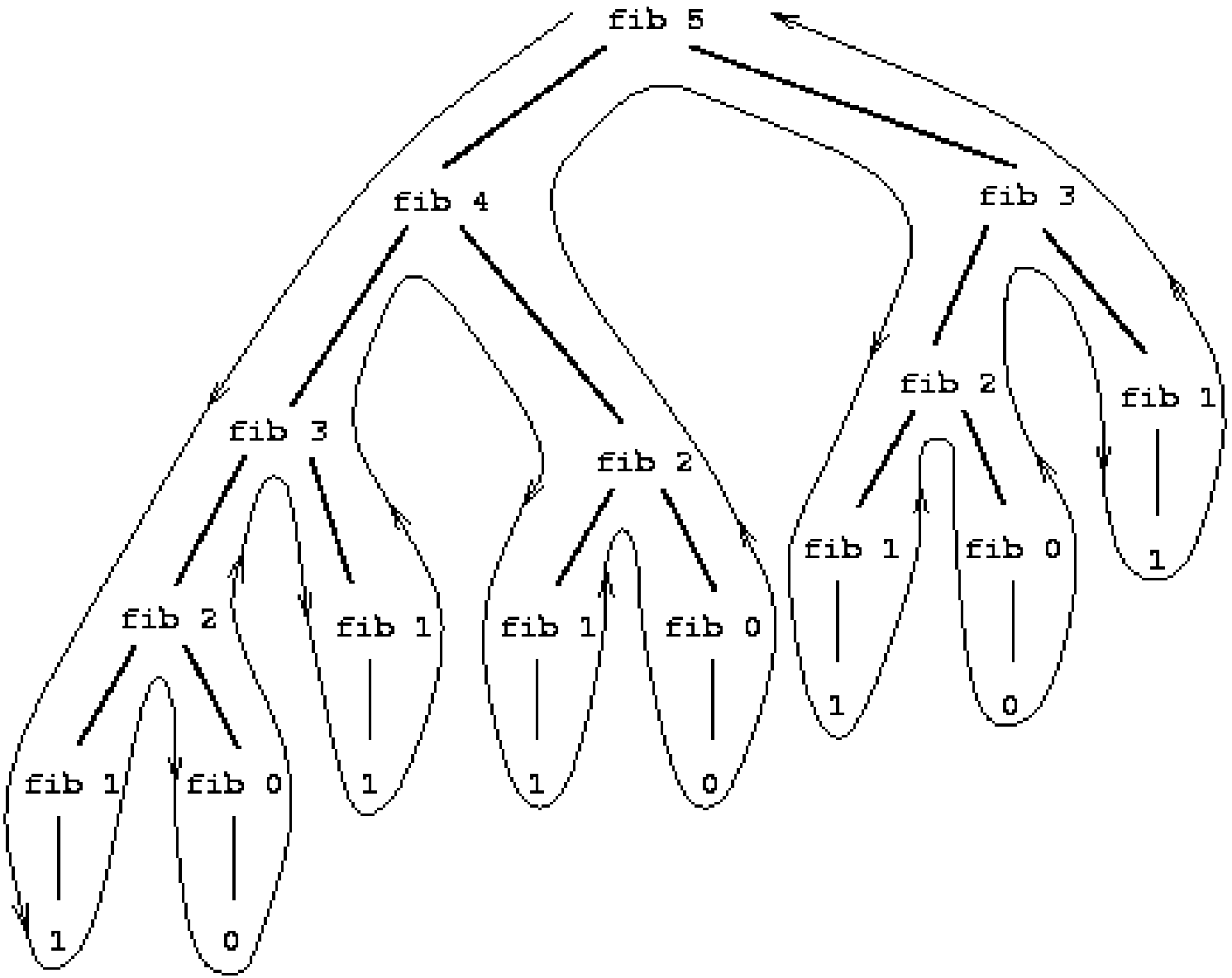
```
forAll :: Set -> (Int -> Bool) -> Bool
forAll a f =
  let
    forAll' 1000 = True
    forAll' acc =
      if (contains a acc) && not (f acc)
        then False
        else forAll' (acc+1)
  in forAll' (-1000)

exists :: Set -> (Int -> Bool) -> Bool
exists a f = not $ forAll a (not . f)
```

Ещё немного о fib

```
fib1 0 = 1
fib1 1 = 1
fib1 n = fib1 (n-1) + fib1 (n-2)
fi1 = map fib1 [1..]
```

Безумно медленно

Ещё немного о fib



Ещё немного о fib

```
fib2' (a, b) 0 = a
fib2' (a, b) n = fib2' (b, a+b) (n-1)
fib2 = fib2' (1, 1)
fi2 = map fib2 [1..]
```

Нипанятна!

Мемоизация

```
fi4 =
  let fib 0 = 0
      fib 1 = 1
      fib n = fib4' (n-2) + fib4' (n-1)
      fib4' n = fi4 !! n
  in  (map fib [0 ..])
```

Profit! (см. Data.Map, Data.Set)

Задание

Функция permute, генерация списка всех перестановок списка

permute [1;2;3] = [[1;2;3];[1;3;2];...;[3;2;1]]

Задание

appendL = foldr (++) [] - конкатенация списка списков

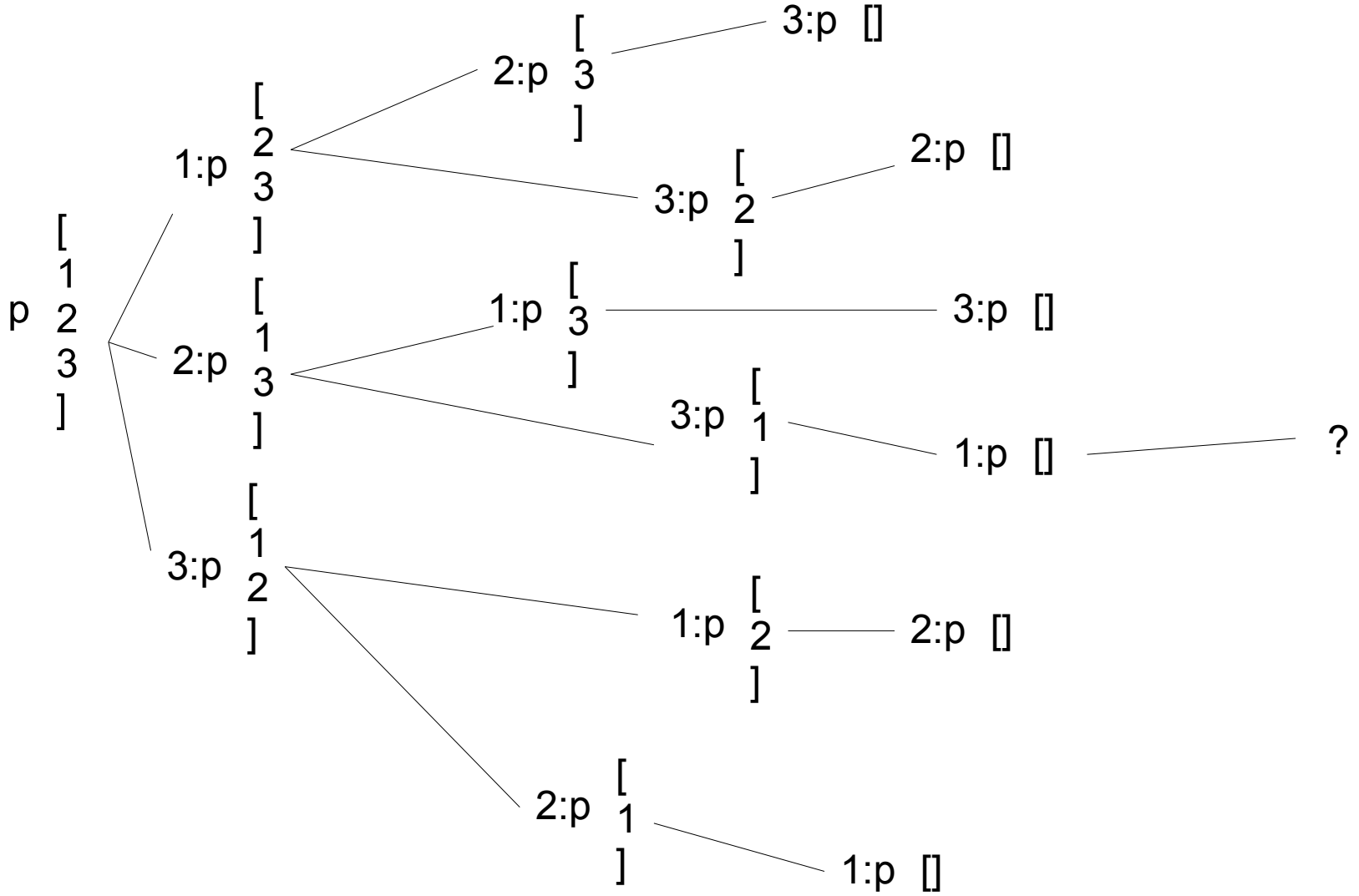
appendL [[1,2],[3,4,5],[6]] = [1,2,3,4,5,6]

deepMap :: (a -> b) -> [[a]] -> [[b]]

deepMap (+1) [[1,2],[3,4,5],[6]] = [[2,3],[4,5,6],[7]]

foldr – функция свёртки, следующая лекция

Задание



Решение

```
permute' [] = [[]]

permute' list = let

  listOfListsWith a = map (\e -> a : e) (permute'
(filter (\x -> x /= a) list))

  in appendL $ map listOfListsWith list
```

Решение

> permute' [1,2,3]

[[1,2,3],[1,3,2],[2,1,3],[2,3,1],[3,1,2],[3,2,1]]

Клёви!

> permute' [1,2,1]

[[1,2],[2,1],[2,1],[1,2]]

Печалька

Решение

```
permute list =
  let
    xs = permute' [0.. length list - 1]
    deepMap = map . map
  in deepMap (\x -> list !! x) xs
```

Размен монет

Write a recursive function that counts how many different ways you can make change for an amount, given a list of coin denominations. For example, there are 3 ways to give change for 4 if you have coins with denomiation 1 and 2: 1+1+1+1, 1+1+2, 2+2.

Do this exercise by implementing the countChange function in Haskell, yopt! This function takes an amount to change, and a list of unique denominations for the coins. Its signature is as follows:

```
CountChange Int -> [Int] -> Int
```

Once again, you can make use pattern matching and other things which you know in Haskell.

Размен монет

```
countChange 0 _ = 0

countChange _ [] = 0

countChange money (coin : coins)

  | coin > money = countChange money coins

  | coin < money = countChange (money-coin)
(coin:coins) + countChange money coins

  | coin == money = 1
```