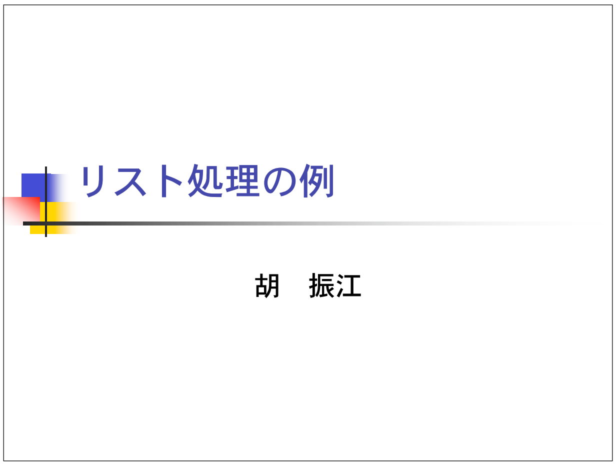
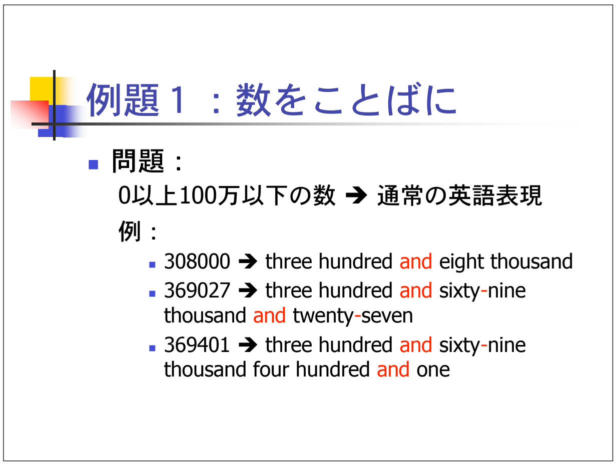


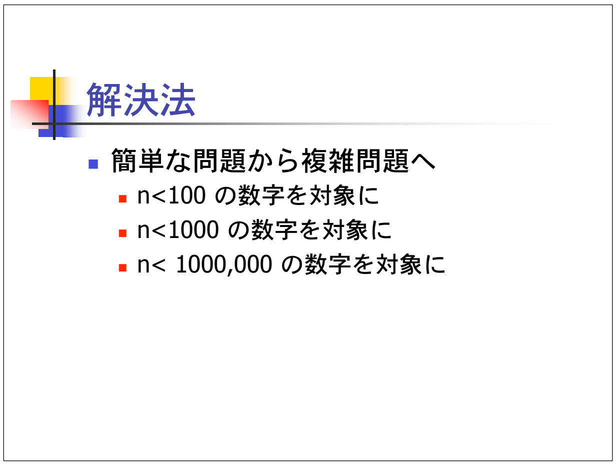
リスト処理の例

胡　振江



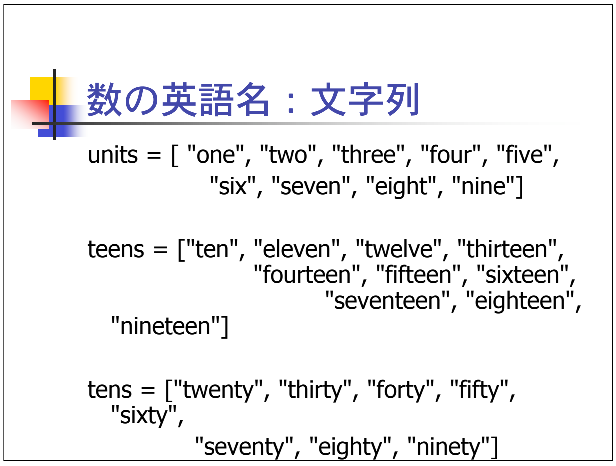
例題１：数をことばに

- 問題：
  0以上100万以下の数 ➔ 通常の英語表現
  例：
  - 308000 ➔ three hundred and eight thousand
  - 369027 ➔ three hundred and sixty-nine thousand and twenty-seven
  - 369401 ➔ three hundred and sixty-nine thousand four hundred and one



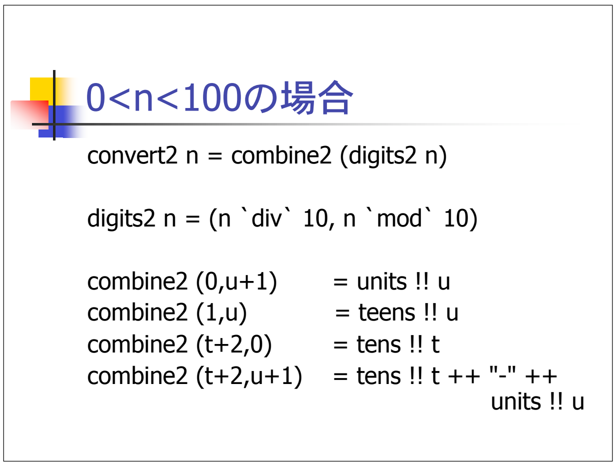
解決法

- 簡単な問題から複雑問題へ
  - n<100 の数字を対象に
  - n<1000 の数字を対象に
  - n< 1000,000 の数字を対象に



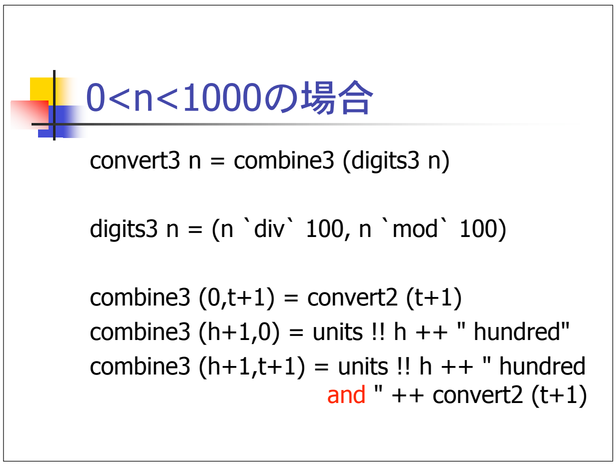
数の英語名：文字列

```
units = [ "one", "two", "three", "four", "five",
             "six", "seven", "eight", "nine"]

teens = ["ten", "eleven", "twelve", "thirteen",
                 "fourteen", "fifteen", "sixteen",
                        "seventeen", "eighteen",
  "nineteen"]

tens = ["twenty", "thirty", "forty", "fifty",
  "sixty",
          "seventy", "eighty", "ninety"]
```



0<n<100の場合

```
convert2 n = combine2 (digits2 n)

digits2 n = (n `div` 10, n `mod` 10)

combine2 (0,u+1)      = units !! u
combine2 (1,u)        = teens !! u
combine2 (t+2,0)      = tens !! t
combine2 (t+2,u+1)    = tens !! t ++ "-" ++
                                    units !! u
```



0<n<1000の場合

```
convert3 n = combine3 (digits3 n)

digits3 n = (n `div` 100, n `mod` 100)

combine3 (0,t+1) = convert2 (t+1)
combine3 (h+1,0) = units !! h ++ " hundred"
combine3 (h+1,t+1) = units !! h ++ " hundred
                        and " ++ convert2 (t+1)
```

0<n<1000,000の場合

```
convert6 n = combine6 (digits6 n)
digits6 n = (n `div` 1000, n `mod` 1000)

combine6 (0,h+1) = convert3 (h+1)
combine6 (m+1,0) = convert3 (m+1) ++ " thousand"
combine6 (m+1,h+1) = convert3 (m+1) ++
                     " thousand“ ++
                     link (h+1) ++
                      convert3 (h+1)

link h | h < 100 = " and "
       | otherwise = " "
```

実行例

```
Convert> convert6 308000
"three hundred and eight thousand"
(985 reductions, 1350 cells)

Convert> convert6 369027
"three hundred and sixty-nine thousand and twenty-seven"
(1837 reductions, 2547 cells)

Convert> convert6 369401
"three hundred and sixty-nine thousand four hundred and one"
(1851 reductions, 2548 cells)
```

例題２：カレンダーの印刷

- 問題：calendar 2002 ➔

```
JANUARY 2002          FEBRUARY 2002         MARCH 2002

Sun     6 13 20 27    Sun     3 10 17 24    Sun     3 10 17 24 31
Mon     7 14 21 28    Mon     4 11 18 25    Mon     4 11 18 25
Tue  1  8 15 22 29    Tue     5 12 19 26    Tue     5 12 19 26
Wed  2  9 16 23 30    Wed     6 13 20 27    Wed     6 13 20 27
Thu  3 10 17 24 31    Thu     7 14 21 28    Thu     7 14 21 28
Fri  4 11 18 25       Fri  1  8 15 22       Fri  1  8 15 22 29
Sat  5 12 19 26       Sat  2  9 16 23       Sat  2  9 16 23 30

APRIL 2002            MAY 2002              JUNE 2002

Sun     7 14 21 28    Sun     5 12 19 26    Sun     2  9 16 23 30
Mon  1  8 15 22 29    Mon     6 13 20 27    Mon     3 10 17 24
…….
```

抽象的なカレンダーの構成

カレンダーの印刷

図形の表示

```
type Picture = [[Char]]

height,width :: Picture -> Int
height p = length p
width p = length (head p)
```

1 2 3 4
5 6 7 8

[[‘1’,‘2’,‘3’,‘4’],
[‘5’,‘6’,‘7’,‘8’]]

図形の構成

図形qの上に図形pを置く

```
p `above` q | width p == width q = p++q
```

図形pを図形qの左に置く

```
p `beside` q | height p == height q = zipWith (++) p q
```

図形のリストを縦に積む

```
stack = foldr1 above
```

図形リストを横に並べる

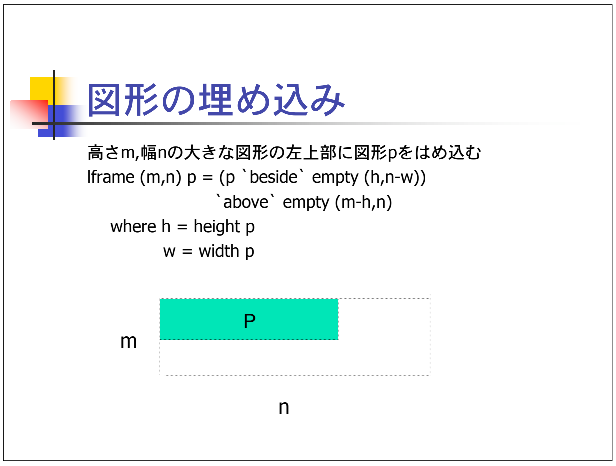
```
spread = foldr1 beside
```

特定の高さと幅をもつ空の図形の生成

```
empty (h,w) = copy (copy ' ' w) h
```

図形のgrouping

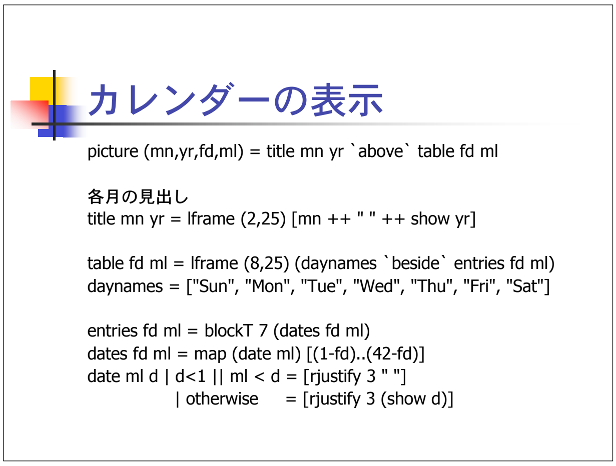
```
block :: Int -> [Picture] -> Picture
block n = stack . map spread . group n
group n xs = [take n (drop j xs) | j <- [0,n..(length xs-n)]]

[G1,G2,G3,G4,G5,G6,G7,G8]  ➔     G12
                           n=2   G34
                                 G56
                                 G78

blockT :: Int -> [Picture] -> Picture
blockT n = spread . map stack . group n
```



図形の埋め込み

高さm,幅nの大きな図形の左上部に図形pをはめ込む

```
lframe (m,n) p = (p `beside` empty (h,n-w))
                  `above` empty (m-h,n)
    where h = height p
          w = width p
```

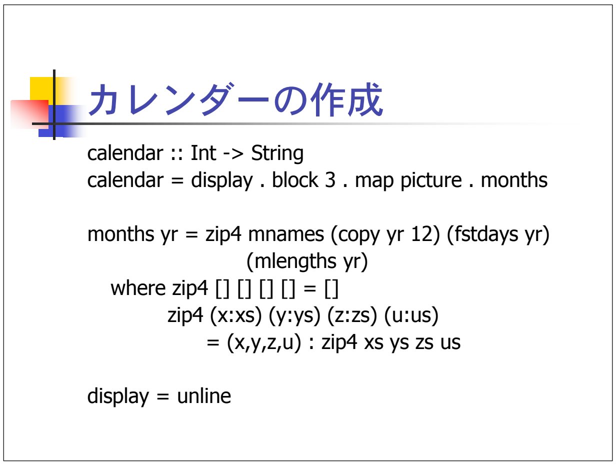


カレンダーの表示

```
picture (mn,yr,fd,ml) = title mn yr `above` table fd ml
```

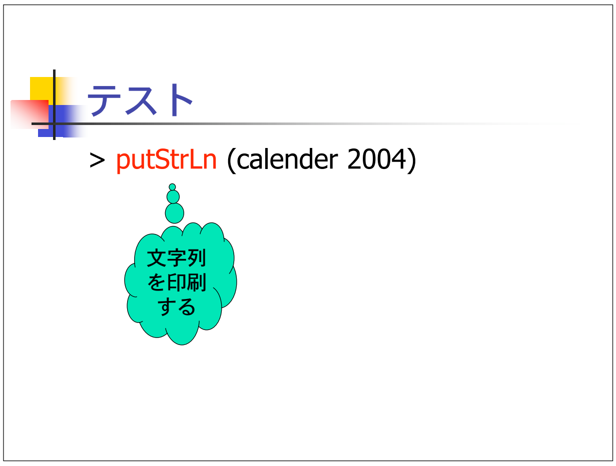
各月の見出し

```
title mn yr = lframe (2,25) [mn ++ " " ++ show yr]

table fd ml = lframe (8,25) (daynames `beside` entries fd ml)
daynames = ["Sun", "Mon", "Tue", "Wed", "Thu", "Fri", "Sat"]

entries fd ml = blockT 7 (dates fd ml)
dates fd ml = map (date ml) [(1-fd)..(42-fd)]
date ml d | d<1 || ml < d = [rjustify 3 " "]
          | otherwise     = [rjustify 3 (show d)]
```



カレンダーの作成

```
calendar :: Int -> String
calendar = display . block 3 . map picture . months

months yr = zip4 mnames (copy yr 12) (fstdays yr)
                 (mlengths yr)
    where zip4 [] [] [] [] = []
          zip4 (x:xs) (y:ys) (z:zs) (u:us)
              = (x,y,z,u) : zip4 xs ys zs us

display = unline
```



テスト

```
> putStrLn (calender 2004)
```