Forritunarmál Hópverkefni 5

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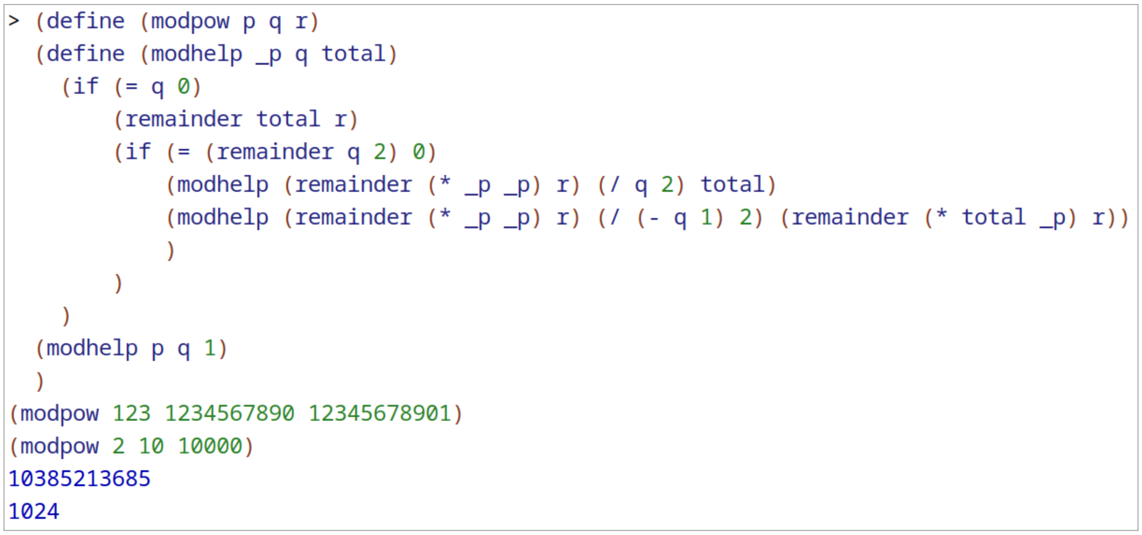
1

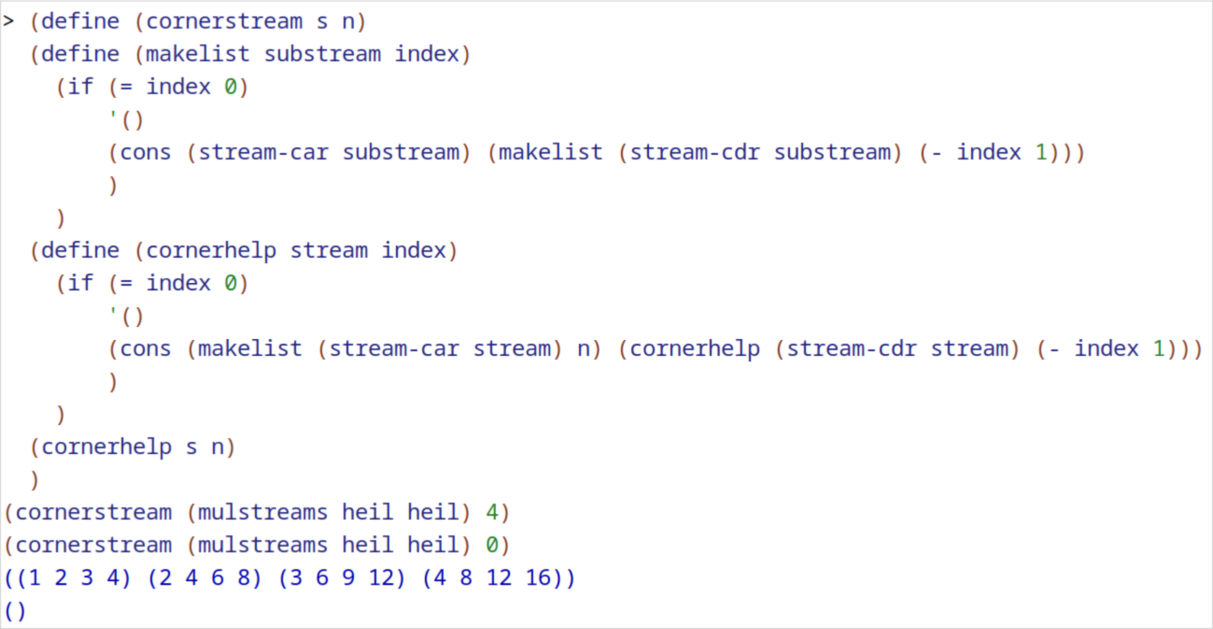
```
;; Notkun: (modpow p q r)
;; Fyrir: p, q og r eru heiltölur og q >= 0, 0 <= p < r
;;        og r > 1.
;; Gildi: p^q mod r, semsagt afgangur p^q þegar deilt
;;        með r.
(define (modpow p q r)
  ;; Notkun: (modhelp _p q total)
  ;; Fyrir: _p, q og total eru heiltölur,
  ;;        0 <= _p < r, q >= 0, 0 <= total < r
  ;; Gildi: (total * (_p^q mod r)) mod r
  (define (modhelp _p q total)
    (if (= q 0)
        (remainder total r)
        (if (= (remainder q 2) 0)
            (modhelp (remainder (* _p _p) r) (/ q 2) total)
            (modhelp (remainder (* _p _p) r) (/ (- q 1) 2) (remainder (* total _p) r))
            )
        )
    )
  (modhelp p q 1)
  )
```



```
> (define (modpow p q r)
  (define (modhelp _p q total)
    (if (= q 0)
        (remainder total r)
        (if (= (remainder q 2) 0)
            (modhelp (remainder (* _p _p) r) (/ q 2) total)
            (modhelp (remainder (* _p _p) r) (/ (- q 1) 2) (remainder (* total _p) r))
            )
        )
    )
  (modhelp p q 1)
  )
(modpow 123 1234567890 12345678901)
(modpow 2 10 10000)
10385213685
1024
```

2

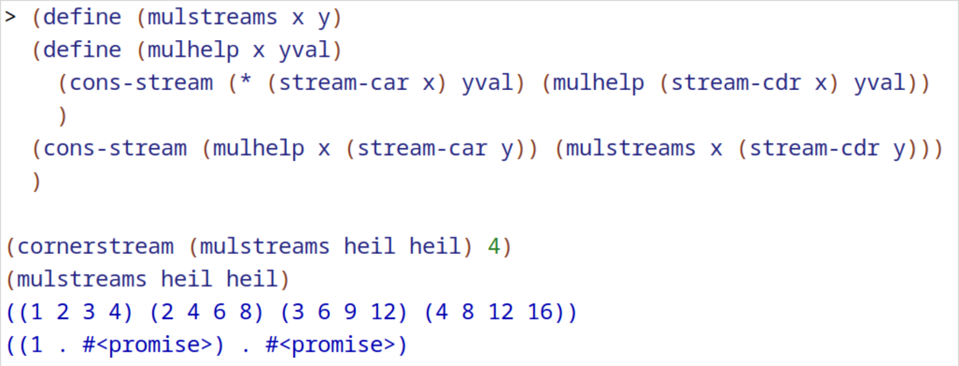
```
;; Notkun: (cornerstream s n)
;; Fyrir: s er óendanlegur straumur óendanlegra
;;        strauma,
;;        s=[[x11 x12 ...],[x21 x22 ...] ...].
;;        n er heiltala, n>=0.
;; Gildi: Listinn
;;        ((x11 x12 ... x1n)
;;        (x21 x22 ... x2n)
;;        ...
;;        (xn1 xn2 ... xnn)
;;        )
(define (cornerstream s n)
  ;; Notkun: (makelist substream index)
  ;; Fyrir: substream er óendanlegur straumur, [x1, x2, ...],
  ;;        index er heiltala, 0 <= index <= n
  ;; Gildi: Listinn (x1, x2, ... , x_index)
  (define (makelist substream index)
    (if (= index 0)
        '()
        (cons (stream-car substream) (makelist (stream-cdr substream) (- index 1)))
        )
    )
  ;; Notkun: (cornerhelp stream index)
  ;; Fyrir: stream er óendanlegur straumur óendanlegra
  ;;        strauma [[x11, x12, ...], [x21, x22, ...], ...],
  ;;        index er heiltala, 0 <= index <= n
  ;; Gildi: Listinn ((x11, x12, ..., x1n),
  ;;                 (x21, x22, ..., x2n),
  ;;                 ...
  ;;                 (x_index1, x_index2, ..., x_indexn))
  (define (cornerhelp stream index)
    (if (= index 0)
        '()
        (cons (makelist (stream-car stream) n) (cornerhelp (stream-cdr stream) (- index 1)))
        )
    )
  (cornerhelp s n)
  )
```



```
> (define (cornerstream s n)
  (define (makelist substream index)
    (if (= index 0)
        '()
        (cons (stream-car substream) (makelist (stream-cdr substream) (- index 1)))
        )
    )
  (define (cornerhelp stream index)
    (if (= index 0)
        '()
        (cons (makelist (stream-car stream) n) (cornerhelp (stream-cdr stream) (- index 1)))
        )
    )
  (cornerhelp s n)
  )
(cornerstream (mulstreams heil heil) 4)
(cornerstream (mulstreams heil heil) 0)
((1 2 3 4) (2 4 6 8) (3 6 9 12) (4 8 12 16))
()
```

3

```
;; Notkun: (mulstreams x y)
;; Fyrir: x og y eru óendanlegir straumar talna,
;; x=[x1 x2 x3 ...].
;; y=[y1 y2 y3 ...].
;; Gildi: Óendanlegur straumur óendanlegra strauma
;; talna sem er
;; [[x1*y1 x2*y1 x3*y1 ...]
;; [x1*y2 x2*y2 x3*y2 ...]
;; [x1*y3 x2*y3 x3*y3 ...]
;; ...
;; ]
(define (mulstreams x y)
  ;; Notkun: (mulhelp x yval)
  ;; Fyrir: x er óendanlegur straumur talna, [x1 x2 x3 ...],
  ;;        yval er tala
  ;; Gildi: óendanlegi straumurinn [x1*yval x2*yval ...]
  (define (mulhelp x yval)
    (cons-stream (* (stream-car x) yval) (mulhelp (stream-cdr x) yval))
    )
  (cons-stream (mulhelp x (stream-car y)) (mulstreams x (stream-cdr y)))
  )
```

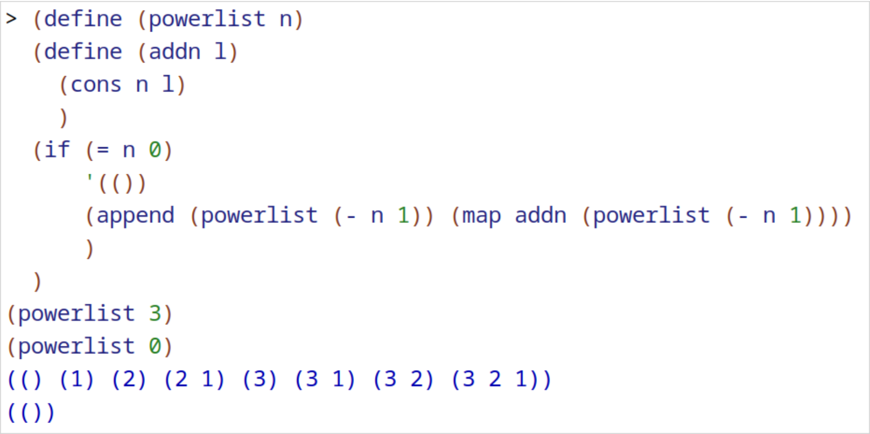


```
> (define (mulstreams x y)
  (define (mulhelp x yval)
    (cons-stream (* (stream-car x) yval) (mulhelp (stream-cdr x) yval))
    )
  (cons-stream (mulhelp x (stream-car y)) (mulstreams x (stream-cdr y)))
  )

(cornerstream (mulstreams heil heil) 4)
(mulstreams heil heil)
((1 2 3 4) (2 4 6 8) (3 6 9 12) (4 8 12 16))
((1 . #<promise>) . #<promise>)
```

4

```
;; Notkun: (powerlist n)
;; Fyrir: n er heiltala, n>=0.
;; Gildi: Listinn (y1 y2 y3 ...)
;;        sem inniheldur alla lista sem
;;        hægt er að smíða með því að taka
;;        núll eða fleiri gildi úr {1,...,n}
;;        og skeyta þeim saman í lista í
;;        minnkandi röð.
(define (powerlist n)
  ;; Notkun: (addn l)
  ;; Fyrir: l er listi, l = (l1 l2 ... lm)
  ;; Gildi: Listinn (n l1 l2 ... lm)
  (define (addn l)
    (cons n l)
    )
  (if (= n 0)
      '(())
      (append (powerlist (- n 1)) (map addn (powerlist (- n 1))))
      )
  )
```



```
> (define (powerlist n)
  (define (addn l)
    (cons n l)
    )
  (if (= n 0)
      '(())
      (append (powerlist (- n 1)) (map addn (powerlist (- n 1))))
      )
  )
(powerlist 3)
(powerlist 0)
(() (1) (2) (2 1) (3) (3 1) (3 2) (3 2 1))
(())
```