

Problem Set 8: Streams

Out: Tuesday, 4 May 2004

Due: Tuesday, 11 May 2004

Compatibility: For this problem set, you'll need to use the `stream.ss` file (available on the web site) if you are using DrScheme. No files are necessary to complete this assignment in MIT Scheme.

Problem 1: Use `stream-map` (p. 320 of textbook) to define a procedure called `convert-temp-stream` that takes a stream of temperatures in Fahrenheit and returns a stream of corresponding temperatures in Celsius, using the formula: $C = 5/9 * (F - 32)$. Process the stream in two stages: First subtract 32 from each temperature, then multiply the results by 5/9.

Problem 2: Use `stream-filter` (p. 322 of textbook) to define the stream of all integers that are not divisible by either 2, 3, or 5.

Problem 3: Complete the following alternative definition of the integers stream:

```
(define integers (cons-stream 1 (stream-map <??> integers)))
```

Problem 4: The procedure `reorder` rearranges the items in one stream (the data stream) into the order specified by another stream (the order stream), which consists of item numbers specifying the desired order.

For example, if the data stream starts with 4, 13, 2, 8 and the order stream starts with 3, 1, 4, 2 then the result stream will start with 2, 4, 8, 13. (The first item of the result is the third item of the data, the second item of the result is the first item of the data, and so on.)

a) Complete the following definition of `reorder`:

```
(define (reorder order-stream data-stream)
  (cond ((stream-null? order-stream) the-empty-stream)
        ((stream-null? data-stream) the-empty-stream)
        (else (cons-stream <??> <??>))))
```

Hint: Use the procedure `stream-ref` (p. 319 of the textbook).

b) Describe the values returned by `(reorder integers data-stream)` and by `(reorder data-stream integers)`, where `integers` is the stream of positive integers (defined in class several ways, as well as in the textbook and above in problem 3) and `data-stream` is any stream containing only positive integers.

c) What are the first seven numbers in the stream returned by

```
(reorder (stream-cdr fibs) (stream-cdr fibs))
```

where `fibs` is the stream of Fibonacci numbers (defined on p. 329 of the textbook)?