

OLLSCOIL NA hÉIREANN, CORCAIGH
THE NATIONAL UNIVERSITY OF IRELAND, CORK
COLÁISTE NA hOLLSCOILE, CORCAIGH
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SUMMER EXAMINATIONS 2014

CS 4620 : Functional Programming I

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Dr Joseph Manning

Answer all questions

1½ Hours
(allow about 1 minute for each 1%)

Please ensure that you have the correct exam paper

DO NOT TURN THE PAGE UNTIL INSTRUCTED TO DO SO

Every definition should be accompanied by the *type* of the item being defined

(25%) 1. Give definitions for each of the following standard Haskell functions; for each function, also include a *comment* (in the format used in this module) to clearly and concisely describe its purpose:

- a) `take` (5%)
- b) `drop` (5%)
- c) `takeWhile` (5%)
- d) `dropWhile` (5%)
- e) `zipWith` (5%)

(35%) 2. A *stairs* is a finite list of two or more integers such that the difference between every pair of adjacent items is a non-zero constant. For example, each of these lists is a stairs:

[5, 8] [1, 3, 5, 7, 9] [3, 2, 1, 0, -1, -2]

whereas none of these lists is a stairs:

[] [4] [1, 3, 5, 8, 9] [1, 2, 3, 2, 1] [7, 7, 7] .

Write a Haskell function `isStairs` to test if a given finite list of integers is a stairs.

(40%) 3. a) Give a Haskell definition for the function `iterate`, which takes a function `f :: a -> a` and an item `x :: a` as parameters, and returns the infinite list:

[x, f x, f (f x), f (f (f x)), ...] . (10%)

b) Give a Haskell definition for the infinite list `reps`, which has, as its n^{th} item, a list composed of n copies of the integer n , for $n = 1, 2, 3, \dots$; thus, `reps` is the list:

[[1], [2, 2], [3, 3, 3], [4, 4, 4, 4], ...] .

(as preparation for part (c), consider using `iterate` to solve this problem). (15%)

c) *Pascal's Triangle* is an infinite triangular pattern of integers, in which each number on the boundary is 1 and each number in the interior is the sum of the two numbers diagonally above it:

```
      1
     1 1
    1 2 1
   1 3 3 1
  1 4 6 4 1
 . . . . .
```

Give a Haskell definition for the infinite list `pascal`, which has, as its n^{th} item, a list of the numbers in the n^{th} row of Pascal's Triangle, for $n = 1, 2, 3, \dots$; thus, `pascal` is the list:

[[1], [1, 1], [1, 2, 1], [1, 3, 3, 1], ...] . (15%)