

Programming Language Concepts, CS2104
Tutorial 8 (22 October 2011)
(All students must prepare/attempt in advance.)

Exercise 1

Infinite power series can represent a variety of transcendental numbers and functions. They have the general expression:

$$P(x) = a_0 + a_1 \cdot x + a_2 \cdot x^2 + \dots$$

Such power series can be represented in Haskell as infinite streams. For instance, the following power series evaluates to the number e .

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$$

This power series would be represented by the Haskell stream:

`[1 , 1 , 1 / 2 , 1 / 6 , ...]`

Write a Haskell expression that evaluates to the stream above.

Exercise 2

Write a Haskell function that takes in an infinite stream that represents a power series, and a value for variable x , and computes an infinite stream of approximations to the value of the series for the given argument. Test your function on the stream defined in your solution to Exercise 1.

Exercise 3

Write a Haskell function that computes the integral of a power series. The result should be a power series as well.

Exercise 4

Write a Haskell function that computes the derivative of a power series. The result should also be a power series.

Exercise 5

Solve the differential equation:

$$f'(x) = f(x), f(0) = 1$$

Print out values of the solution and try to identify the solution function.