CO225 Lab 8

Ziyan Maraikar

August 22, 2014

1. Define a higher order function to compute the numerical derivative of a function f at point x

$$f'(x) = \frac{f(x + dx) - f(x)}{dx}$$

2. The Trapezoid rule is a numerical method for calculating definite integrals.

$$\int_a^b f(x)\,\mathrm{d}x = \frac{b - a}{N} \sum_{k=1}^{N} f(x_{k+1}) + f(x_k)$$

   Write a higher order function to calculate $\int_a^b f(x)\,\mathrm{d}x$ using this formula (Hint: you may use `series_sum`.)

3. Write a higher order function that uses Newton's method to numerically approximate the (real) roots of a function. Given a function f and its derivative f', begin with an initial guess of x_0. Then successively refine the approximation using the formula

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

   The process stops when $f(x) < \epsilon$ for some small tolerance ϵ.