Numerical Computing
Homework 2

1. **Programming Assignment (due next class):** Consider the infinite series

$$\sum_{N=1}^{\infty} \frac{1}{N(N+1)},$$

which converges mathematically. (Note however that in floating point arithmetic it is no longer an infinite series.)

This assignment is to compute the above sum going forwards starting at $N = 1$, and going backwards, ending at $N = 1$. When you go forwards, stop summing when the next term doesn't change the answer, or when you hit the largest integer. When you go backwards, start from that large value and sum down to $N = 1$. Comment on the difference in the two sums.

Next, repeat the experiment above summing forward and backwards, but only sum to $N = 10^3$. Comment on the magnitude of the difference between the two sums. Which do you think is more accurate?

Hand in your program and its output. You might experiment with using both single and double precision, if your language/compiler lets you do that. Most important is your analysis of the output. Note that even though this program is very short, it may take a long time to run. pay attention to the type of your variables, and make explicit casts if necessary. Try using the optimize flag on your compiler to make it run faster.

Written homework (due in 1 week):

1. In the Overton text (new edition), answer questions 5.7,5.8,6.5,7.1,7.6,10.14(guess)

2. Finish the problem started in class, namely, find the optimal value of h that minimizes the error in computing the approximation to the derivative based on the formula

$$f\prime(x) = \frac{f(x+h) - f(x-h)}{2h} + Mh^2/6$$

where M is an upper bound on the third derivative of the function f, assuming it exists. (Also from chapter 11 of the Overton text).