Assignment 1

1. Calculate 1.00000 - 0.99999. Why is it different from 0.00001?

2. Calculate $a = (2^N - 1)/(1.0 * 2^N)$ and $b = 1.0 - a$ (so that b should be $1.0/2^N$). Now calculate $b * (2^N)$. Do this for various values of N and look for the first N where you get something different from 1.0. Explain the answer.

3. Calculate the alternating sum of the integer part of $1000/n$ for n in the range 1 to 1000. This *should* be approximately 1000 times the value of log(2). Is it? What place of decimal is is correct for?

4. Does the value improve if we take more values for n? Why not?

5. Repeat the above calculation with 1000 replaced by 8388608 ($= 2^{23}$). What happens now?

6. (a) $\pi^2/6$ is roughly 1.6449. Find the smallest N so that sum of $1/n^2$ for n going from 1 to N is at least 1.644.

   (b) e is roughly 2.71828. Find the smallest N so that the sum of $1/n!$ for n going from 1 to N is at least 2.718.

   Explain the discrepancy between the values of N needed. In both cases try to also estimate the required N "by hand".

7. (Starred) Find out about Euler's summation technique which speeds up the covergence for 6(a) and log(2) as well.