Math 114 – Computer Assignment 3 – due Tuesday, July 26

Directions: Complete the following assignment using Maple software. Maple may be used either in a campus PC lab (Johnson Center 342 or Innovation 301) or on osf1.

This assignment examines series using Maple’s algebraic capability via the sum command. Your work should be clear, concise, and complete. Make sure you indicate how answers were obtained by including sufficient Maple input/output and commentary.

Use the sum command to understand how comparison really works by considering the three sums:

\[
\sum_{n=1}^{\infty} \frac{1}{n}, \quad \sum_{n=1}^{\infty} \frac{1}{n^2}, \quad \sum_{n=1}^{\infty} \frac{1}{n^2 + 1}.
\]

**Part 1:** According to our theory, the sum \(\sum_{n=1}^{\infty} \frac{1}{n}\) is divergent, comparable to an integral that yields the ln function as \(\int_{1}^{\infty} \frac{1}{x} \, dx\). Make the comparison concrete by using Maple to compute the following discrete sums as floating point numbers and compare them to each other and to \(\ln(10)\): (a) sum of the first terms 1 to 10; (b) sum of terms 11 to 100; (c) sum of terms 101 to 1000. Each of these last two is a right sum, so it is smaller than the integral. Since the integral is clear, you should compare with the value of the integral, \(\ln(10)\). You expect, from the integral test, that these are closer together as we look for larger values.

**Part 2:** According to our theory, the second and third sums are comparable to integrals and to each other in the limit. Use Maple to confirm this by computing the sum from \(k = 101\) to 1000 and also \(k = 1001\) to 2000 for both series and also compute corresponding integrals. Compare all the pieces with each other as floating point numbers.