Assignment 5

Out: Tuesday, 24 October 2006
Due: Thursday, 2 November 2006

Total: 100 points

Exercise 1 (20 points) The following is a well-known series:

\[ \ln 2 = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \cdots \]

Please implement a stream consisting of all the partial sums of this series.

Exercise 2 (30 points) For each \( i \geq 1 \), we use \( P_i \) for the \( i^{th} \) prime number. For instance, \( P_1 = 2 \), \( P_2 = 3 \) and \( P_3 = 5 \). Please implement a stream consisting of all the sums of the form \( \sum_{i=1}^{n} \frac{1}{P_i} \) for \( n \geq 1 \).

Exercise 3 (50 points) A natural number \( n \) is a Ramanujan number if there exist two distinct pairs of natural numbers \((i_1, j_1)\) and \((i_2, j_2)\) such that \( n = i_1^3 + j_1^3 = i_2^3 + j_2^3 \). For instance, 1729 is a Ramanujan number as \( 1729 = 1^3 + 12^3 = 9^3 + 10^3 \). Please construct a stream of all Ramanujan numbers and then use it to find the first twenty Ramanujan numbers.