

MATH 5370: Homework -III

1. **(Hilbert Matrix)** Write a program that introduces a class of Hilbert Matrix. For the exact form, please click on the link:
https://en.wikipedia.org/wiki/Hilbert_matrix.

This class should be able to calculate:

- a. Based on a user input N fill the entries of a NxN Hilbert Matrix. N should be atmost $1e+3$. Your program should prompt the user of the range for N. [**10 points**]
- b. The inverse of this matrix. [**5 points**]
- c. The determinant of the matrix and its inverse. [**5 points**]
- d. The 1 norm and the maximum norm. [**5 points**]
- e. The condition number. [**5 points**]

For the above exercise, please keep in mind that you are required to pass arguments by reference.

Also, you have the freedom to organize the class member functions as public or private members.

2. **(Polynomial Class)** Based on the code (c++ and header file) skeleton shared in class, please perform the following tasks:
 - a. Convert the member functions to pass by reference rather than value. [**5 points**]
 - b. Compute not just the first three derivatives, but also determine if the user defined evaluation point is a root and whether it is a root of multiplicity 1 (simple root), 2 or 3. [**15 points**]