

Preconditioned Conjugate Gradient (pcg) Iterations

Let the matrix $A \in R^{n \times n}$ be large, $n = 20,000$ and sparse whose entries are zero everywhere *except* the primes $2, 3, 5, 7, \dots, 224737 = p(n)$ in all the positions on the main diagonal *and* the number 1 along the diagonals A_{ij} with $|i - j| = 1, 2, 4, 8, \dots, 16384 = 2^{\text{int}(\log_2(n))}$.

What is the $(1, 1)$ entry of the inverse A^{-1} ? Compute it with 10 decimals of accuracy.

Record the number of pcg iterations and the number of nonzero entries in A .

Note: Choose a proper preconditioner and first test your code for problems with smaller values of n .