

229A: Numerical Methods in Linear Algebra

Homework 3: due 2/25/02

Problem 1: Solve Exercise 9.1

Problem 2: Solve Exercise 9.2

Problem 3: Solve Exercise 10.1

Problem 4: Solve Exercise 10.2

Problem 5: Solve Exercise 10.3

Problem 6: Solve Exercise 11.3

Problem 7: Consider a function $\chi_{[0,1]}(x)$, which is the characteristic function of the interval $[0, 1]$, and its expansion into the Legendre polynomials $\{P_n\}_{n=0}^{\infty}$.

(a) Show that

$$\chi_{[0,1]}(x) \sim \frac{1}{2} + \sum_{k=0}^{\infty} \frac{(-1)^k (4k+3)(2k)!}{4^{k+1} k! (k+1)!} P_{2k+1}(x).$$

(b) Using the matlab program you created in Problem 1 (or its modified version), plot the $\chi_{[0,1]}(x)$ and its N -term approximation:

$$S_N(x) = \frac{1}{2} + \sum_{k=0}^N \frac{(-1)^k (4k+3)(2k)!}{4^{k+1} k! (k+1)!} P_{2k+1}(x),$$

for $N = 1, 2, \dots, 10$ and $-1 \leq x \leq 1$.