Lab Work - Week 5

Math 105B Lab

Summer Session II - 2022

Approximation Theory

CODING ASSIGNMENT 13 - Least Squares Regression

Produce a function with the following specifications:

NAME:	leastSqrs_########
INPUT:	x,y
OUTPUT:	a
DESCRIPTION:	The vector a contains the coefficients of the least squares regression line of the data x,y.
PSEUDOCODE:	See pg. 508, eqns. 8.1 and 8.2.

EXERCISES

1. **(Participation assessment)** The following list contains homework grades and the final-examination grades for 30 numerical analysis students. Find the equation of the least squares line for these data and use this line to determine the homework grade required to predict minimal A (90%) and D (60%) grades on the final. Plot the least squares line and the data on the same figure.

Homework	Final	Homework	Final
302	45	323	83
325	72	337	99
285	54	337	70
304	62	339	54
334	79	319	66
322	65	234	51
331	99	337	53
279	63	351	100
316	65	339	67
347	99	343	83
343	83	314	42
290	74	344	79
326	76	185	59
233	57	340	75
254	45	316	45

CODING ASSIGNMENT 14 - Chebyshev Polynomial Approximation

Produce a function with the following specifications:

NAME:	chebyPolyAppx_########
INPUT:	f, N, TOL, intTOL, depth
OUTPUT:	A
DESCRIPTION:	The vector A contains the $N+1$ Chebyshev coefficients for f, found using the your adaptSimpsonInt numerical integration algorithm with tolerance intTOL and adaptive depth 'depth' to approximate the coefficients on the interval (-1+TOL,1-TOL).
PSUEDOCODE:	See pg. 522 Theorem 8.6 for a description of the orthogonal polynomials w.r.t. a weight function, and section 8.3 on the Chebychev polynomials.

EXERCISES

1. Compute a Chebyshev polynomial approximation of exp(x) over the interval with N large enough so that the error is less than 1e-6 over the interval.

2. Consider the function

$$f(x) = \begin{cases} -1 & \text{if } x < 0 \\ 0 & \text{if } x = 0 \\ 1 & \text{if } x > 0 \end{cases}.$$

   Compute the Chebyshev approximations for increasing $N = 2, 3, 4, 5$ and observe the behavior of the error function. Describe the result. Can one make the error as small as one likes by increasing N?