Name: ____

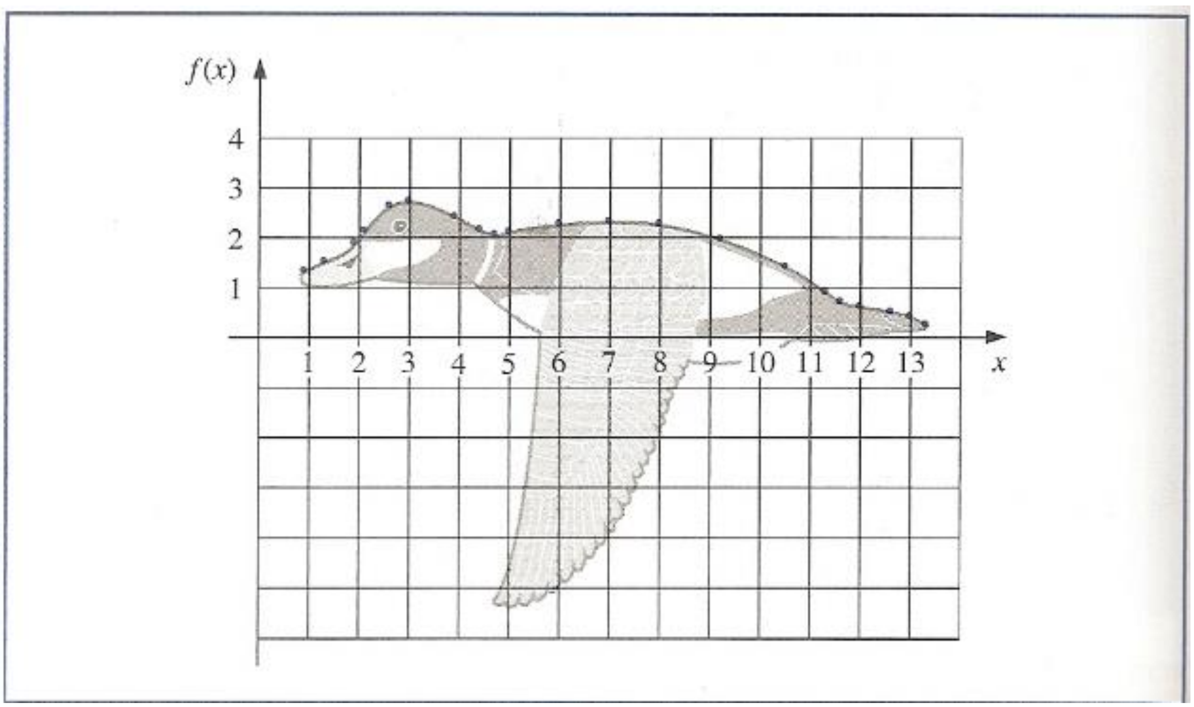
CECS 271 Numerical Methods using Matlab

TASK 5.2 Addendum Approximating Functions Due: 28 OCT 2020

1. Here is a picture of a ruddy duck in flight. To approximate the profile of the top part of the duck data has been take of the curve through which the approximating curve should pass. A coordinate system has been superimposed over the profile for clarity. Generate a cubic spline for this data and plot each point and the spline curve and display the coefficients of the 20 cubic splines for the 20 intervals in a Matlab output data table with column headings: # x f(x) a b c d.

Table of Data Points from Diagram

x	0.9	1.3	1.9	2.1	2.6	3.0	3.9	4.4	4.7	5.0	6.0	7.0	8.0	9.2	10.5	11.3	11.6	12.0	12.6	13.0	13.3
$f(x)$	1.3	1.5	1.85	2.1	2.6	2.7	2.4	2.15	2.05	2.1	2.25	2.3	2.25	1.95	1.4	0.9	0.7	0.6	0.5	0.4	0.25



2. Approximate the curve of Problem 1 using a Lagrange Polynomial fit to the points and find the polynomial coefficients. Plot this curve on the same plot as that of Problem 1. Which process produces the better fitting curve?

3. Fit a least-squares quadratic of the form $y=ax^2 + bx + c$ to the data generated from the function f(x)= exp(-2exp(-x)). Plot the data points and the approximating quadratic using 100 points on the interval x=[0,6]. Compute the error between each data points and the quadratic and compute the total squared error: $TSE = \sum_{k=0}^{k=6} \left(f(x_k) - y_k\right)^2$. Display the coefficients a, b and c, and the TSE.

Table for Problem 3		
#	x	f(x)
1	0	0.135
2	1	0.479
3	2	0.763
4	3	0.905
5	4	0.964
6	5	0.987
7	6	0.995

4. Find the results of these matrix operations. Use the help command in Matlab for unrecognized commands. Do not use any loops, just a series of Matlab commands. For example, if A=[1,3;2,4] then the sum of the elements on the main diagonal is s=sum(diag(A))=5.

(a) A=[1,3,-4;2,-2,1]; B=[3,-2; -1,4;-2,5]; Find the sum of the elements of the product C=AB. (ans= -3)

(b) A=[2,3,5;4,-2,-1;0,4,2]; B=[1,2,4;-3,2,0;5,4,5;1,5,-2]; Find the sum of the 2nd column of C=BA. (ans= 14)

(c) v=1:2:5; w=3:-2:-1; A=[v-w; w.^2-v.^-1; w.^v-v.^w]; Find the vector of the 2nd row of A. (ans= [8,2/3,4/5])

(d) A=[1,2,3;4,5,6;7,8,9]; v=diag(A,0); What is v? (ans: v= [1;5;9])

(e) k=1:3; A=[k;k.^2;k.^3]; B=A.^-1/A; Find the sum of the main diagonal elements of B. (ans= 0.7492)

(f) B=[1,2,3;5,4,1;-3,6,2]; s=sum(diag(B(1:3,3:-1:1))); What is s? (sum of anti-diagonal elements of B: ans= 4)

(g) k=1:16; A=k'*k; B=A.^(3/2)./(A.^2-99); Find the sum of the elements of both diagonals of B. (ans= 3.0056)

(h) A=[1,2,3;4,6,5;3,-1,2]; B=[3,2;2,1;1,-1]; C= 2B'*A + 2(A*B)' - 3(A'*B)'; What is C? ans: C=[6 ,41,-3; -1,7,-3]

(i) A=[r^2, -1, 1; 3,-2r,-5; 4, 2,-3]; What is r if sum(A(:))= 0? (ans: r=1)

(j) A=[1,-2,3; 3,-4,1;6,-2,3]; If a_{ij} for i,j=1,2,3… for the elements of a matrix, find the sum of all the elements of A whose i and j indices add to an odd number. (ans= 0)

(k) Repeat (j) but using k=1:10; A=k'*((k-pi)./(k+pi)). (ans=45.7521)