Problem 4:

There are three different code file for this program. I have divided the files between Simpson Method, Gauss Method, and script file.

**The separate code is given below:**

**scriptProblem04.m**

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%18 April 2023

%Fall2023

%Homework07

%Problem04

clear all;

format long;

prompt = "Choose the value of N for Gauss Quadrature:";

N = input(prompt);

prompt = "Choose the even number of patches for Simpson's rule(K):";

K = input(prompt);

fprintf('The approximation using N = %d and K = %d: ', N,K);

Integral = gaussMethod(N,K) ;

display(Integral);

**simpsonMethod.m**

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%Problem04

function[gx] = simpsonMethod(xi,n)

a = xi^2-1;

b = 1-xi^2;

h = (b-a)/n;

xvalues = a:h:b;

x = xi;

f = @(y) x\*x - 2\*x\*y + y\*y;

s1 = f(a)+f(b);

s2 =0;

s4= 0;

for j = 2:2:length(xvalues)-1

s4 = s4+ f(xvalues(j));

end

for j = 3:2:length(xvalues)-2

s2 = s2+ f(xvalues(j));

end

gx = h/3\*(s1+ 4\*s4+ 2\*s2);

**gaussMethod.m**

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%Problem04

function[Approx] = gaussMethod(N,K)

Approx = 0;

if(N==1)

Approx = 2\*simpsonMethod(0,K);

end

if(N==2)

xi= [0.57735027,-0.57735027];

wi=[1.0,1.0];

for j = 1:N

Approx = Approx + wi(j)\*simpsonMethod(xi(j), K);

end

end

if(N==3)

xi= [0.77459667, 0, -0.77459667];

wi= [0.55555556,0.88888889,0.55555556];

for j = 1:N

Approx = Approx + wi(j)\*simpsonMethod(xi(j), K);

end

end

if(N==4)

xi =[0.33998104,0.86113631,-0.33998104,-0.86113631];

wi = [0.65214515,0.34785485,0.65214515,0.3478548];

for j = 1:N

Approx = Approx + wi(j)\*simpsonMethod(xi(j), K);

end

end

end

The output:

**For N = 3 and K = 8:**

>> scriptProblem04

Choose the value of N for Gauss Quadrature:3

Choose the even number of patches for Simpson's rule(K):8

The approximation using N = 3 and K = 8:

Integral =

1.173333337779929

**For N= 4 and K = 10**

>> scriptProblem04

Choose the value of N for Gauss Quadrature:4

Choose the even number of patches for Simpson's rule(K):10

The approximation using N = 4 and K = 10:

Integral =

1.142857122668414