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

```
%Author: Kamal Giri
%Scientific Computing
%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

```
%Author: Kamal Giri
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%Homework07
%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

```
%Author: Kamal Giri
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%18 April 2023
%Fall2023
%Homework07
%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
```