%KamalGiri

Problem 1:

**Code for Gauss Quadrature:**

**internalGx.m**

function [gx] = internalGx(curr, xi, wi, N, f)

a = -sqrt(1-curr^2);

b = sqrt(1-curr^2);

sum = 0;

for k = 1:N

x = 0.5\*(b-a)\*xi(k) + 0.5\*(b+a);

sum = sum + wi(k) \* f(x, curr);

end

%I was getting wrong value because I was mutliplying 0.5\*(b-a) inside the

%loop

gx = 0.5\*(b-a) \* sum;

end

**scriptProblem01**

clear all;

f = @(x,y) 0.5\*(exp(-x.^2) + exp(-y.^2));

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

N = input(prompt);

if(N==3)

xi= [0.77459667, 0, -0.77459667];

wi= [0.55555556,0.88888889,0.55555556];

end

if(N==4)

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

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

end

if(N==5)

xi = [0.90617985, 0.53846931, 0.00000000,-0.53846931, -0.90617985];

wi = [0.23692689, 0.47862867, 0.56888889, 0.47862867, 0.23692689];

end

Approx = 0;

for j = 1:N

Approx = Approx + wi(j)\*internalGx(xi(j), xi, wi, N, f);

end

Approx

**Code for Monte-Carlo**

**MC2D.m**

function[integralMC2D] = MC2D(M)

f = @(x,y) 0.5\*(exp(-x.^2) + exp(-y.^2));

a = -1;

b = 1;

c= -1;

d = 1;

sum = 0;

%Randomizing

x = a+ (b-a)\*rand(1,M);

y = c+ (d-a)\*rand(1,M);

for i = 1:M

sum = sum + fExt(x(i), y(i), f);

end

fbar = sum/M;

integralMC2D = pi \*fbar;

end

**fExt.m**

function [val] = fExt(x,y, f)

val = 0;

if x^2 + y^2 <=1

val= f(x, y);

end

end

**scriptM2CD.m**

clear all;

format long;

M = 10^6;

IntregalV= 0;

for i = 1: 10

IntregalV = IntregalV + MC2D(M);

end

IntregalV = IntregalV/10

**Calculating the difference:**

|  |  |  |  |
| --- | --- | --- | --- |
| **N** | **Value Using Monte-Carlo** | **Value Using Gauss**  **Quadrature** | **Absolute Value** |
| **3** | 2.517621439781281 | 2.560061128586483 | 0.042439688805202 |
| **4** | **2.517495391527651** | **2.530258937959873** | **0.012763546432222** |
| **5** | **2.518361697830591** | **2.524923343620527** | **0.006561645789936** |

**Problem02:**

**Solving Analytically:**

**Text, letter

Description automatically generated**

**A picture containing letter

Description automatically generated**

**MathLab Implementation using Monte Carlo:**

**MC3D.m**

function[integralMC3D] = MC3D(M)

fx = @(x,y,z) 0.7 \* (x.^2 + y.^2 + z.^2);

sum = 0;

x = -1+ 2\*rand(1,M);

y = -1+ 2\*rand(1,M);

z = -1+ 2\*rand(1,M);

for i = 1:M

sum = sum + (fExt3D(x(i), y(i),z(i), fx));

end

fbar = sum/M;

Volume = (4\*pi)/3;

integralMC3D = Volume\*(fbar);

**fExt3D.m**

function [val] = fExt3D(x,y, z,fx)

val = 0;

if (x^2 + y^2 + z^2) <=1

val= feval(fx,x, y,z);

end

end

**scriptMonteCarlo.m**

clear all;

format long;

M = 10^6;

IntregalV= 0;

for i = 1: 10

IntregalV = IntregalV + MC3D(M);

end

IntregalV = IntregalV/10

Exact Answer solving Analytically : 1.759291886

From MonteCarlo: 0.920943486960326

Absolute Difference: 0.838348399039674