LAB 9

MA202 Numerical Techniques

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Exercise 1

```
a=-10;
b=10;
n=90;
lambda = [0.01,0.1,1,10,100];
for i=1:1:length(lambda)
f=@(x) sin(lambda(i)*x)/x;
Trapezoidal_Rule(a,b,n,f);
end
```

```
result = 0.1977
result = 1.8699
result = 3.0938
result = 0.9100
result = -0.2298
```

```
a=0;
b=5*pi;
n=90;
lambda = [0.01,0.1,1,10,100];
for i=1:1:length(lambda)
g=@(x) exp(sin(lambda(i)*x));
Trapezoidal_Rule(a,b,n,g);
end
```

```
result = 17.0060
result = 31.0435
result = 22.1135
result = 19.8873
result = 19.8873
```

Exercise 2

```
lower=-10;
upper=10;
f=@(x1,x2,x3,x4,x5,x6,x7,x8) exp(-1/2*(x1.^2 + x2.^2 + x3.^2 + x4.^2 ...
    + x5.^2 + x6.^2 + x7.^2 + x8.^2));

N = 1000;

x1 = lower + (upper - lower)*rand(1,N)
```

```
x1 = 1×1000
```

```
    3.9328   -6.6731    5.4700   -1.7360    4.1723   -3.3573    1.0212    9.9294···
```

```
x2 = lower + (upper - lower)*rand(1,N);
x3 = lower + (upper - lower)*rand(1,N);
x4 = lower + (upper - lower)*rand(1,N);
x5 = lower + (upper - lower)*rand(1,N);
x6 = lower + (upper - lower)*rand(1,N);
x7 = lower + (upper - lower)*rand(1,N);
x8 = lower + (upper - lower)*rand(1,N);

% since lower - upper = 20
value = (20*8)/N *sum(f(x1,x2,x3,x4,x5,x6,x7,x8))
```

```
value = 1.4007e-12
```

```
fprintf("The value of integral : %0.5f",value);     %Upto 5th significant digit.
```

```
The value of integral : 0.00000
```

```
Exercise 3
% interval
a = -10;
b = 10;
% numebr of samples
N=1000;
lambda = [0.01,0.1,1,10,100];
for i=1:1:length(lambda)
f=@(x) sin(lambda(i)*x)/x;

% integral value


    % samples
    xS = a+(b-a)*rand(1,N);
   % sum(f(xS))
    % Monte Carlo integration
    intMC = (b-a)*sum(f(xS))/N;


stderr= std(sin(xS)/xS)/sqrt(1000);
fprintf("integration value %5f and standard error %5f\n",intMC,stderr)
end
```

```
integration value 0.000200 and standard error 0.000000
integration value 0.001806 and standard error 0.000000
integration value 0.000385 and standard error 0.000000
integration value -0.000044 and standard error 0.000000
integration value -0.000011 and standard error 0.000000
```

```
a = 0;
b = 5*pi;
```

```
% numebr of samples
N=1000;
lambda = [0.01,0.1,1,10,100];
for i=1:1:length(lambda)
f=@(x) sin(lambda(i)*x)/x;

% integral value


    % samples
    xS = a+(b-a)*rand(1,N);
   % sum(f(xS))
    % Monte Carlo integration
    intMC = (b-a)*sum(f(xS))/N;


stderr= std(sin(xS)/xS)/sqrt(1000);
fprintf("integration value %5f and standard error %5f \n",intMC,stderr)
end
```

```
integration value 0.000157 and standard error 0.000000
integration value 0.001217 and standard error 0.000000
integration value 0.000214 and standard error 0.000000
integration value -0.000004 and standard error 0.000000
integration value 0.000048 and standard error 0.000000
```

```
function Trapezoidal_Rule(a,b,n,f)
h=(b-a)/n;
sum=0;
for i=1:1:n-1
if a+i*h ~= 0
sum = sum + f(a+i*h);
end
end
result = h/2*(f(a)+f(b)+2*sum)
end
```