**Lab (6):** **Numerical Integration#2: Implementing Simpson Rule in Matlab**

* **The Simpson rule as discussed in class is given as**

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* **The following file simpson.m implements the Simpson’s rule in Matlab**

**function [integral]=simpson(index\_f,a,b,n)**

**%**

**% function [integral]=simpson(a,b,n0,index\_f)**

**%**

**% function to calculate the integral using Simpson rule**

**% input parameters:**

**% index\_f: parameter for the integrand**

**% a: lower limit**

**% b: upper limit**

**% n: Number of intervals must be positive even integer greater than or %**

**%equal to 2**

**%**

**% output parameter:integral**

**% Initialize for Simpson integration.**

**sumend = f(a,index\_f) + f(b,index\_f);**

**sumodd = 0;**

**sumeven = 0;**

**% For case of n=2**

**if(n == 2)**

**h = (b-a)/n;**

**k=1;**

**sumodd1 = f(a+k\*h,index\_f);**

**integral= h\*(sumend + 4\*sumodd1)/3; %%%% this will calculate the integeral**

**end**

**%% For case of n > 2.**

**if(n > 2)**

**h = (b-a)/n;**

**for i=2:2:n-2**

**sumeven = sumeven + f(a+i\*h,index\_f);**

**end**

**for k=1:2:n-1**

**sumodd = sumodd + f(a+k\*h,index\_f);**

**end**

**integral= h\*(sumend + 4\*sumodd + 2\*sumeven)/3; %%%% this will caluclate the integeral**

**end**

**%**

**% This defines the integrand.**

**function f\_value = f(x,index)**

**switch index**

**case 1**

**f\_value = exp(-x.^2);**

**case 2**

**f\_value = 1 ./(1+x.^2);**

**case 3**

**f\_value = 1 ./(2+sin(x));**

**case 4**

**f\_value = exp(cos(x));**

**end**

* **Read the m file carefully and make sure you understand all the Matlab commands**
* **Run this function by writing a script file (e.g. main.m). A sample script file is as follows:**

**clear all**

**a = 0;**

**b = 1;**

**n = 2;**

**index\_f = 1**

**integral = simpson(index\_f,a,b,n)**

* Run this script file to calculate the integral of , as given on page 198 of your textbook and fill in the following table



* Modify your script file to generate the table 5.2, page 198 of your textbook. A sample script file is as follows.

clear all

a = 0;

b = 1;

n = 1;

index\_f = 1

n1 = [ 2 4 8 16 32 64 128];

for q = 1:length(n1)

n = n1(q);

integral(q) = simpson(index\_f,a,b,n);

end

trueval = 0.746824132812427;

err = trueval - integral

y = [n1; err];

fprintf(1,'%6.2f %12.8f\n',y);

* Plot the error versus n, i.e., plot(n1,err,’-o’)
* Repeat the above exercises for the integrals given on page 198 of your textbook. Note you will have to change the simpson.m file to add the new integrand.