General Sir John Kotelawala Defence University
Faculty of Engineering
Department of Mathematics
Mathematical Software - MA 1232

Learning Outcomes Covered: LO3, LO4, LO5
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Intake 39 - Semester 2 | Tutorial 07 | 10.10.2022

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1. Write MATLAB function files for the following Numerical Integration Methods.

   (a) Simpson's Rule

```
function I = simpsons_onethird(f,a,b)
% uses Simpson's 1/3 rule to calculate the integral
% of a function in a given interval
% inputs : f,a,b
% f= anonymous function (e.g. f=@(x) sin(x))
% a= Initial point of interval
% b= Last point of interval
% outputs : I
% I= integral value
_________-
_________-
_________-
end
```

   (b) Composite Simpson's Rule

```
function I = simpsons_composite(f,a,b,n)
% uses Composite Simpson's rule to calculate the integral
% of a function in a given interval
% inputs : f,a,b,n
% f= anonymous function (e.g. f=@(x) sin(x))
% a= Initial point of interval
% b= Last point of interval
% n= number of equal subintervals
% outputs : I
% I= integral value
_________-
_________-
_________-
end
```

   (c) Composite Trapezoidal Rule

```
function I = trapiz_composite(f,a,b,n)
% uses Composite Trapezoidal rule to calculate the integral
% of a function in a given interval
% inputs : f,a,b,n
% f= anonymous function (e.g. f=@(x) sin(x))
% a= Initial point of interval
% b= Last point of interval
% n= number of equal subintervals
% outputs : I
% I= integral value
_________-
_________-
_________-
end
```

2. Find the integral of the following using :

   - integral, in-built function
   - trapz, in-built function
   - trapiz_composite, the function you created in 01.c
   - simpsons_onethird, the function you created in 01.a
   - simpsons_composite, the function you created in 01.b

   and compare your answers.

   (a) $\int_0^1 x\sqrt{1+x}\, dx$

   (b) $\int_1^5 \frac{x}{x+1}\, dx$

   (c) $\int_1^4 \sqrt{x+\frac{1}{x}}\, dx$

3. Numerically approximate the solution of $\int_2^8 3\ ln(x)\ dx$, using the Composite Trapezoidal Rule for n=1,2,3,4,5,6,7,8,9,10. Also find the exact integral.
   Plot the absolute errors against n and observe the variation of error with the increase of number of sub-intervals.