```
function [I] = Simpson(x,y)
%
% Harvinder Singh Virk, MECH-105, Last Edited - 8-APR-2018, Time:
 09:50 PM.
%
 ************************************************************************
% { Simpson's 1/3 rule is an extension of Trapezoidal rule where the
% integrand is approximated by a second order polynomial. The
 trapezoidal rule was based on approximating the integrand by a first
 order polynomial, and then integrating the polynomial over interval
 of integration.}
% Numerically evaluates the integral of the vector of function values
 y
% with respect to x.
%
 ************************************************************************
% Input:
% x - Values of x-dimension.
% y - The function which is being evaluated.
%
 ------------------------------------------------------------------------
% Output:
% I - Integral of the function over the x and y limit.
%
 ------------------------------------------------------------------------
tic
% Lenghts shouldn't be equal for x and y.
if length(x) ~= length(y)
    error('Lengths are not equal')
end
% Checking for the equal spacing for an array using diff function.It
 calculates differences between adjacent elements of X along
.... the first array dimension whose size does not equal 1.

diffev  = diff(x);
 if min(diffev)- max(diffev)>= 10^(-15)
     error('The values should be evenly spaced in order to make
 Simpsons 1/3 rule work')
 elseif min(diffev) <= 0
     error('The values are not in order/sequence. The difference
 between them is negative.')
 end
 % Creating the Largest array dimension in X.
 k = length(x); % creating the array
 % checking for the even and odd number
 odd = round(k/2);
 % Initializing the value.
 I = 0;
 if  (k/2) == odd
     disp('Trapezoid rule is used to evaluate the last interval') %
 Displaying the warning that trapezoid rule is used to calculate last
 interval.
```

```
% Integrating using Simposn's 1/3 rule. The numbers are odd then
 adding the trapezoid rule for the last interval.
     for numb = 1:2:(k-3)
         onethirdrule = (x(numb+2)-x(numb))*(y(numb)+4*y(numb
+1)+y(numb+2))/6; % Simpson's 1/3 rule for integration.
         I = onethirdrule + I; % Adding previous answer eveytime the
 loop will run.
     end
     I = I+(x(k)-x(k-1))*(y(k)+y(k-1))/2; % Adding the trapezoid rule
 for the last interval.
 else
% Intergrating even numbers using Simpson's 1/3 rule.
     for numb = 1:2:(k-2)
        onethirdrule = (x(numb+2)-x(numb))*(y(numb)+4*y(numb+1)+y(numb
+2))/6; % Simpson's 1/3 rule for integration.
         I = onethirdrule + I; % Adding previous answer eveytime the
 loop will run.
     end
 end
 toc
end
```

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