Bahria University,

Karachi Campus



LAB EXPERIMENT NO.

**08**

LIST OF TASKS

|  |  |
| --- | --- |
| TASK NO | OBJECTIVE |
| 1 | **Write a Python program to determine the area enclosed by the function f(x) = e x over the interval from x=0 to x=2 using the Trapezoidal Rule with two intervals.** |
| 2 | **Write a Python program utilizing Simpson's 1/3 Rule to compute the definite integral ∫ 𝒍𝒏𝒙 𝒅𝒙 𝟐𝒆 𝟐 𝒆 𝟐 where n = 4 represents the number of intervals used in the approximation.** |
| 3 | **Determine the approximation of the area beneath the curve represented by y = f(x) over the interval from x=−4 to x=2 using the Trapezoidal Rule with n=6 subintervals. The values of the function f(x) are provided within following table.** |

Submitted On

\_\_\_\_\_\_\_\_\_\_\_\_

**Task 1: Write a Python program to determine the area enclosed by the function f(x) = e x over the interval from x=0 to x=2 using the Trapezoidal Rule with two intervals.**

**Solution**

import math

def function(x):

  return math.exp(x)

def trapeziodal\_rule(a,b,n):

  h=(b-a)/n

  result= function(a)+function(b)

  i=1

  while i<n:

    result+=2\*function(a+i\*h)

    i+=1

  return result\*(h/2)

a=0

b=2

n=2

print('Area Under Curve : ' , trapeziodal\_rule(a,b,n))

**Output**

****

**Task 2: Write a Python program utilizing Simpson's 1/3 Rule to compute the definite integral ∫ 𝒍𝒏𝒙 𝒅𝒙 𝟐𝒆 𝟐 𝒆 𝟐 where n = 4 represents the number of intervals used in the approximation.**

**Solution**

def function(x):

  return math.log(x)

def simpson\_rule(a,b,n):

  h=(b-a)/n

  x\_values=[]

  f\_x\_values=[]

  i=0

  while i<n:

    x\_values.append(a+i\*h)

    f\_x\_values.append(function(x\_values[i]))

    i+=1

  result=0

  i=0

  while i<n:

    if i==a or i==b:

      result+=f\_x\_values[i]

    elif i%2==0:

      result+=2\*f\_x\_values[i]

    else:

      result+=4\*f\_x\_values[i]

    i+=1

  return result\*(h/3)

a=math.exp(2)

b=2\*math.exp(2)

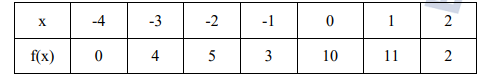
n=4

print('Area Under Curve: ' , simpson\_rule(a,b,n))

**Output**

****

**Task 3: Determine the approximation of the area beneath the curve represented by y = f(x) over the interval from x=−4 to x=2 using the Trapezoidal Rule with n=6 subintervals. The values of the function f(x) are provided within following table.**

****

**Solution**

def trapezoidal\_rule\_from\_points(points):

    n = len(points)

    integral = points[0][1] + points[-1][1]

    for i in range(1, n - 1):

        integral += 2 \* points[i][1]

    h = points[1][0] - points[0][0]

    integral \*= h / 2

    return integral

given\_points = [(-4, 0), (-3, 4), (-2, 5), (-1, 3), (0, 10),(1,11),(2,2)]

result = trapezoidal\_rule\_from\_points(given\_points)

print("Approximated Integral Value Using Given Data: " , result)

**Output**

****