Project 7 : Numerical Integration

(1)

```
In[506]:= Clear[f, x, y]

In[507]:= LeftEPRule[a_, b_, n_] := Module[{},
        int = (b - a) / n;
        N[Sum[f[a + i * int] * int, {i, 0, n - 1}]]];

     RightEPRule[a_, b_, n_] := Module[{},
        int = (b - a) / n;
        N[int * Sum[f[a + (i * int)], {i, 0, n - 1}]]];

     TrapezoidRule[a_, b_, n_] := Module[{},
        int = (b - a) / n;
        N[int * Sum[1 / 2 (f[a + (i * int)] + f[a + ((i + 1) * int)]), {i, 0, n - 1}]]];

     SimpsonsRule[ a_, b_, n_] := Module[{},
        int = (b - a) / n;
        coef[i_ ? EvenQ] = 2;
        coef[i_ ? OddQ] = 4;
     N[int / 3 * (f[a] + f[b] + Sum[coef[i] * f[a + i * int], {i, 1, n - 1}])]];
```

(2)

```
In[511]:= N[Integrate[x + Sin[x], {x, 0, 10}]]

Out[511]= 51.8391
```

(3)

```
In[512]:= f[x_] = x + Sin[x];
     LeftEPRule[ 0, 10, 10]

Out[513]= 46.9552
```

(4)

In[514]:= **RightEPRule[0, 10, 10]**

Out[514]= 46.9552

(5)

In[515]:= **TrapezoidRule[0, 10, 10]**

Out[515]= 51.6832

(6)

In[516]:= **SimpsonsRule[0, 10, TrapezoidRule[0, 10, 10] 10]**

Out[516]= 51.6869

(7)

In[517]:= **method = {"Integrate", "LeftEDRule", "RightEDRule", "Trapezoid Rule", "Simpson's Rule"};**
values = {51.8391, 46.9552, 46.9552, 51.6832, 51.6869};
Grid[Transpose @ {method, values}]

Out[519]=
```
    Integrate      51.8391
    LeftEDRule     46.9552
   RightEDRule     46.9552
 Trapezoid Rule   51.6832
 Simpson's Rule   51.6869
```

(8)

In[520]:= **LeftEPRule[0, 10, 1000]**
RightEPRule[0, 10, 1000]
TrapezoidRule[0, 10, 1000]
SimpsonsRule[0, 10, 1000]

Out[520]= 51.7918

Out[521]= 51.7918

Out[522]= 51.8391

Out[523]= 51.8391

In[524]:= **Clear[values];**
values = {51.8391, 51.7918, 51.7918, 51.8391, 51.8391};
Grid[Transpose @ {method, values}]

Out[526]=
```
    Integrate     51.8391
    LeftEDRule    51.7918
   RightEDRule    51.7918
  Trapezoid Rule  51.8391
  Simpson's Rule  51.8391
```