ASSIGNMENT #1

SUBJECT & BASIC INFORMATION

➡ Write down a C++ program which calculates the integral of $\boldsymbol{f(x) = x^3 + 4x}$ using the "Reiman Sums" formula below.

- Values of ***a***,***b***, and ***n*** will be entered from the keyboard

- Let $f(x)$ be defined on the closed interval $[a, b]$ and n be the number of intervals
- Let $P = \{x_1, x_2 \dots, x_n, x_{n+1}\}$ be a partition of $[a, b]$with $a = x_1 < x_2 < \cdots x_{n+1} = b$.
  - x_i is the ith term of the partition

    $$x_i = a + (i - 1) * \Delta x$$
  - Δx is the interval step value between $[a, b]$

    $$\Delta x = \frac{b-a}{n}$$
- Let $\varepsilon = \{\varepsilon_1, \varepsilon_2, \dots, \varepsilon_n, \}$ be the midpoints of two interval steps

  $$\varepsilon_i = x_i + \frac{\Delta x}{2}$$

"Reiman Sums" Formula of Interval Calculation between the interval $[a, b]$:

Left Hand Rule : $\int_a^b f(x) \cong \Delta x * \sum_{i=1}^{n} f(x_i)$

Right Hand Rule : $\int_a^b f(x) \cong \Delta x * \sum_{i=1}^{n} f(x_{i+1})$

Midpoint Rule : $\int_a^b f(x) \cong \Delta x * \sum_{i=1}^{n} f(\varepsilon_i)$

TWO SAMPLE SCREEN OUTPUT FOR THE REQUESTED PROGRAM

```
a  : 0
b  : 10
n  : 10
-----------------------------------------------------------------
    i        x[i]     epsilon[i]       LHF       RHF       MF
-----------------------------------------------------------------
    1         0         0.5           0          5       2.125
    2         1         1.5           5         16       9.375
    3         2         2.5          16         39      25.625
    4         3         3.5          39         80      56.875
    5         4         4.5          80        145     109.125
    6         5         5.5         145        240     188.375
    7         6         6.5         240        371     300.625
    8         7         7.5         371        544     451.875
    9         8         8.5         544        765     648.125
   10         9         9.5         765       1040     895.375
--------------------------------------
--------- INTEGRAL RESULTS -----------
f(x)=x^3 + 4x from [0,10] with 10 intervals
--------------------------------------
MIDPOINT RULE           : 2687.5
LEFT HAND RULE          : 2205
RIGHT HAND RULE         : 3245
--------------------------------------
```

```
a  : 0
b  : 10
n  : 20
-----------------------------------------------------------------
    i        x[i]     epsilon[i]       LHF       RHF       MF
-----------------------------------------------------------------
    1         0         0.25          0       1.0625    0.507812
    2       0.5         0.75     1.0625          2.5     1.71094
    3         1         1.25        2.5       4.6875     3.47656
    4       1.5         1.75     4.6875            8     6.17969
    5         2         2.25          8      12.8125     10.1953
    6       2.5         2.75    12.8125         19.5     15.8984
    7         3         3.25       19.5      28.4375     23.6641
    8       3.5         3.75    28.4375           40     33.8672
    9         4         4.25         40      54.5625     46.8828
   10       4.5         4.75    54.5625         72.5     63.0859
   11         5         5.25       72.5      94.1875     82.8516
   12       5.5         5.75    94.1875          120     106.555
   13         6         6.25        120      150.312      134.57
   14       6.5         6.75    150.312         185.5     167.273
   15         7         7.25      185.5      225.938     205.039
   16       7.5         7.75    225.938          272     248.242
   17         8         8.25        272      324.062     297.258
   18       8.5         8.75    324.062         382.5     352.461
   19         9         9.25      382.5      447.688     414.227
   20       9.5         9.75    447.688          520      482.93
--------------------------------------
--------- INTEGRAL RESULTS -----------
f(x)=x^3 + 4x from [0,10] with 20 intervals
--------------------------------------
MIDPOINT RULE           : 2696.88
LEFT HAND RULE          : 2446.25
RIGHT HAND RULE         : 2966.25
--------------------------------------
```

RULES & EVALUATION

- Using a **goto** statement is strictly prohibited.
- Each C++ file should include the comment lines below at the beginning of the C++ file

```
// ********************************************************************************
// ******              STUDENT NAME :                                        *****
// *****             STUDENT NUMBER :                                       *****
// *****               ASSIGNMENT # :                                       *****
// *****                   - HONOR CODE -                                   *****
// ********************************************************************************
```

- You should compile your codes with **Microsoft Visual Studio 2022**. (NOTE: If you use another compiler, please test your codes with this compiler before uploading your homework on the system)
- **Deadline:** Control the SABIS system
- You should upload only your C++ file (.cpp file) together before the deadline.
- Evaluation Criteria
  - Comment lines (student information, explaining operations like variable names, if statements, loops, etc.)
  - Obeying the variable declaration rules
  - Being readable (intendation, comments, etc.)
  - Correct compilation of the code
  - …