In this lab, we used the Fourier series approximation to approximate different functions. Firstly, a numerical integration method was implemented and then used to calculate the coefficients of Fourier series. The coefficients were then used to plot the figure.

The folder contains:
fs1.cpp: the code for the first function.
fs2.cpp: the code for the second function.
fs3.cpp: the code for the third function.
Makefile: the code helps the compiling of the code
Report: which is the report of this lab
README: which is the documentation

To compile the code:
In linux terminal, type make to compile.
To run the code:
Type ./fs1.x ./fs2.x ./fs3.x separately, one for the generation of each functions

Output:

Function 1:

The fourier coefficients for n= 2 are(in order of a0 a1-an b1-bn):
6.57974 -4 1 2 -1

The fourier coefficients for n= 4 are(in order of a0 a1-an b1-bn):
6.57974 -4 1 -0.444444 0.25 2 -1 0.666667 -0.5

The fourier coefficients for n= 8 are(in order of a0 a1-an b1-bn):
6.57974 -4 1 -0.444444 0.25 -0.16 0.111112 -0.0816383 0.0625089 2 -1 0.666667 -0.5 0.4 -0.333333 0.285713 -0.250004

The fourier coefficients for n= 16 are(in order of a0 a1-an b1-bn):
6.57974 -4 1 -0.444444 0.25 -0.16 0.111112 -0.0816383 0.0625089 -0.0493827 0.0399866 -0.0330281 0.027714 -0.0235213 0.0199976 -0.0158638 0.0124293 2 -1 0.666667 -0.5 0.4 -0.333333 0.285713 -0.250004 0.222233 -0.200015 0.181843 -0.166714 0.153943 -0.143079 0.13401 -0.124587

Function 2:

The fourier coefficients for n= 2 are(in order of a0 a1-an b1-bn):
7.63436e-16 1.3553e-15 3.14313e-16 7.73921 -8.3696

The fourier coefficients for n= 4 are(in order of a0 a1-an b1-bn):
7.63436e-16 1.3553e-15 3.14313e-16 4.87698e-16 -7.22201e-16 7.73921 -8.3696 6.13529 -4.7473

The fourier coefficients for n= 8 are(in order of a0 a1-an b1-bn):
7.63436e-16 1.3553e-15 3.14313e-16 4.87698e-16 -7.22201e-16 7.59518e-16 7.59246e-16 1.2486e-15 -1.57601e-15 7.73921 -8.3696 6.13529 -4.7473 3.85184 -3.23431 2.78491 -2.444

The fourier coefficients for n= 16 are(in order of a0 a1-an b1-bn):
7.63436e-16 1.3553e-15 3.14313e-16 4.87698e-16 -7.22201e-16 7.59518e-16 7.59246e-16 1.2486e-15 -1.57601e-15 9.00183e-16 -2.0305e-15 1.51394e-15 6.4132e-15 1.23442e-15 -5.72139e-15 6.4549e-15 -8.88671e-15 7.73921 -8.3696 6.13529 -4.7473 3.85184 -3.23431 2.78491 -2.444 2.17686 -1.96205 1.78567 -1.63838 1.51369 -1.40703 1.31299 -1.22675

Function 3:

The fourier coefficients for term= 5 are(in order of a0 a1-an b1-bn):
0 1.1616e-15 -1.32887e-15 -7.64296e-16 -5.30449e-16 12.7324 -2.00337e-15 4.24413 -5.59085e-16

The fourier coefficients for term= 10 are(in order of a0 a1-an b1-bn):
0 1.1616e-15 -1.32887e-15 -7.64296e-16 -5.30449e-16 5.88179e-16 1.03413e-15 1.2621e-15 -2.20858e-15 6.24359e-16 12.7324 -2.00337e-15 4.24413 -5.59085e-16 2.54648 1.67361e-15 1.81891 5.07463e-17 1.41478

The fourier coefficients for term= 15 are(in order of a0 a1-an b1-bn):
0 1.1616e-15 -1.32887e-15 -7.64296e-16 -5.30449e-16 5.88179e-16 1.03413e-15 1.2621e-15 -2.20858e-15 6.24359e-16 6.33243e-17 8.34597e-16 5.18581e-15 6.87072e-16 -3.36529e-15 12.7324 -2.00337e-15 4.24413 -5.59085e-16 2.54648 1.67361e-15 1.81891 5.07463e-17 1.41478 9.74078e-16 1.15765 -1.05838e-15 0.980031 -3.95423e-15

The fourier coefficients for term= 20 are(in order of a0 a1-an b1-bn):
0 1.1616e-15 -1.32887e-15 -7.64296e-16 -5.30449e-16 5.88179e-16 1.03413e-15 1.2621e-15 -2.20858e-15 6.24359e-16 6.33243e-17 8.34597e-16 5.18581e-15 6.87072e-16 -3.36529e-15 1.6038e-15 -7.06231e-15 4.18405e-15 1.3438e-15 4.89789e-15 12.7324 -2.00337e-15 4.24413 -5.59085e-16 2.54648 1.67361e-15 1.81891 5.07463e-17 1.41478 9.74078e-16 1.15765 -1.05838e-15 0.980031 -3.95423e-15 0.853132 8.57572e-17 0.739279 3.46511e-15 0.663118