EECE.5200 - Homework 4

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Accessing Source Code

Source code is available at: https://github.com/tjkessler/eece5200/tree/main/hw4

To run the code, first run ***make*** in the *hw4* directory. This will produce 2 files: *q1.o* and *q2.o* corresponding to question 1 and question 2 respectively. Running each will produce **1.** output statements for $\frac{du}{dx}$ at each point x_i and the evaluation of $u(x_i + \frac{dx}{2})$ where $dx = \frac{2\pi)}{N}$ for $N = 16$, and **2.** output statements for each x_i and $w(n)$ given a highest frequency index of $14 \rightarrow N = 30$.

Question 1

The following output is the result of running *q1.o*:

```
(base) tjkessler@Traviss-MacBook-Air hw4 % ./q1.o
du/dx for x_i, i = (0, N)
N =             16
0    0.00000000
1    9.09494702E-13
2   -2.27373675E-12
3   -9.53674316E-06
4   -2.84217094E-13
5   -9.09494702E-12
6    2.04636308E-12
7   -5.91171556E-12
8    1.45519152E-11
9    4.32009983E-11
10    4.54747351E-12
11   -3.09228199E-11
12   -1.36878953E-10
13    1.54495239E-04
14    5.72981662E-11
15    4.77484718E-12

u(x + dx/2) where dx/2 = 2 * pi / N
N =             16
0   0.382683426
1  -0.707106769
2  -0.923879504
3    1.19248806E-08
4   0.923879683
5   0.707106769
6  -0.382683009
7   -1.00000000
8  -0.382683843
9   0.707106829
10   0.923879325
11   -1.94312338E-06
12  -0.923879743
13  -0.707106054
14   0.382683933
15    1.00000000
```

Question 2

The following output is the result of running *q2.o*:

```
(base) tjkessler@Traviss-MacBook-Air hw4 % ./q2.o
x                w(n)
0.00000000       224.998138
0.209439516       1.14440918E-05
0.418879032       1.43051147E-05
0.628318548       2.38418579E-05
0.837758064      -2.86102295E-06
1.04719758        4.48226929E-05
1.25663710       -3.57627869E-05
1.46607661       -1.27553940E-05
1.67551613       -8.18967819E-05
1.88495564       -1.81198120E-05
2.09439516       -1.43051147E-06
2.30383468       -1.81198120E-05
2.51327419       -5.24520874E-06
2.72271371       -8.24928284E-05
2.93215322       -6.67572021E-06
3.14159274        0.00000000
3.35103226        1.04904175E-05
3.56047177       -2.47955322E-05
3.76991129       -1.38282776E-05
3.97935081       -2.00271606E-05
4.18879032       -3.33786011E-06
4.39822960        1.19209290E-06
4.60766935        4.38094139E-06
4.81710911       -2.47955322E-05
5.02654839        4.00543213E-05
5.23598766        1.18017197E-05
5.44542742       -1.07288361E-06
5.65486717       -2.22921371E-05
5.86430645       -2.62260437E-06
6.07374573        5.18560410E-06
```

When looking for $w(n) = \frac{1}{2}$, it is apparent that $0.00 < x < 0.2094$.

Bibliography

[1] Thompson, C. *University of Massachusetts Lowell Department of Electrical and Computer Engineering 16.520 Computer Aided Engineering Analysis Problem Set 4*. Retrieved March 16, 2021, from http://morse.uml.edu/Activities.d/16.520/S2021.d/HW4.pdf