The Report for Programming Assignments in Chapter Four

Wenchong Huang

Date: November 24, 2022

1 How to Test

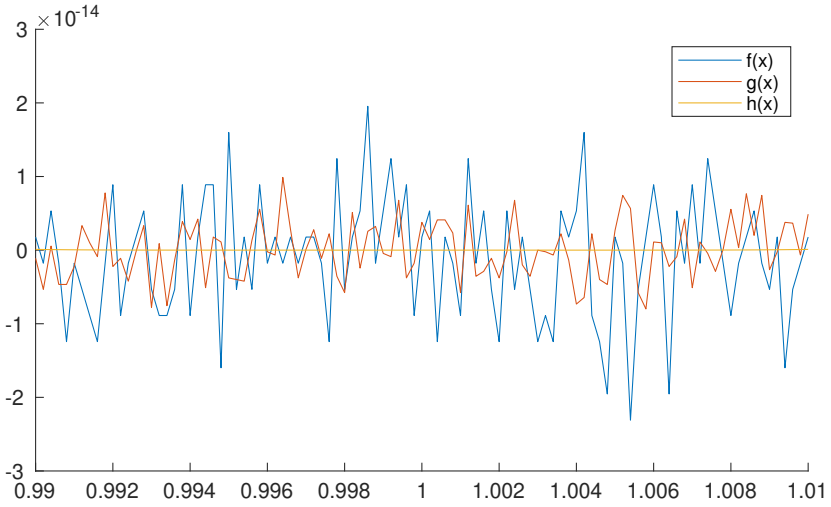
Enter the folder `Programming-Chapter4/src` with terminal, `make` here, you will see some executable files whose names are corresponding assignments. Run them directly and you will see the results.

To get the figures in this report, run `drawA.m` and `drawB.m` with **matlab**.

2 Results

2.1 Assignment A

Please see the numerical result in `Programming-Chapter4/src/A.txt`. We plot it here.



We could see that $f(x)$ and $g(x)$ have strong oscillation. And $h(x)$ is the most accurate, $f(x)$ is the least accurate.

The reason is that we did lots of additions and subtractions of numbers which are very close in $f(x)$ and $g(x)$. And that caused catastrophic cancellations. However $h(x)$ only did subtraction once when calculate $x - 1$. So $h(x)$ is much more accurate.

2.2 Assignment B

We consider the normalized FPN system $\mathbb{F}$ with $\beta = 2, p = 3, L = -1, U = 1$.

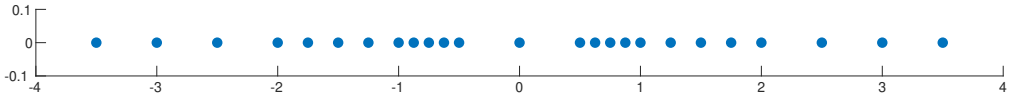
(i) $\text{UFL}(\mathbb{F}) = 0.5,\ \text{OFL}(\mathbb{F}) = 3.75$.

(ii) The numbers in $\mathbb{F}$ are listed here.

```
-3.5 -3 -2.5 -2 -1.75 -1.5 -1.25 -1 -0.875 -0.75 -0.625 -0.5
0 0.5 0.625 0.75 0.875 1 1.25 1.5 1.75 2 2.5 3 3.5
```

There are 33 numbers, which supported the corollary on the cardinality.

(iii) See the numbers in $\mathbb{F}$ in the following figure.



(iv) The subnormal numbers of $\mathbb{F}$ are listed here.

```
-0.375 -0.25 -0.125 0 0.125 0.25 0.375
```

(v) See the numbers of extended $\mathbb{F}$ in the following figure, where blue points are normal numbers and red points are subnormal numbers.