Numerical Analysis

Homework 9. Polynomial Interpolations

Due: May 5, 2015

In this home work, you will find the functions that approximate the simulated waveform shown below.

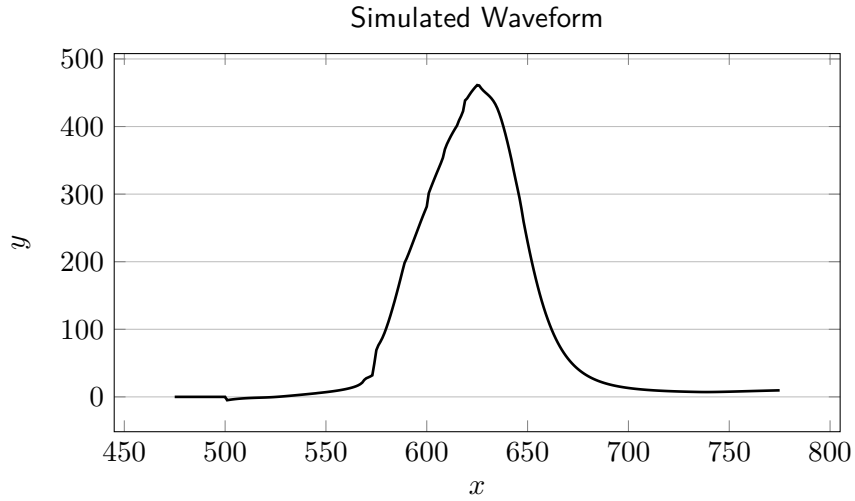

Figure 1. A simulated waveform

The data for this waveform are also given in the file `f301.dat`. Please implement the following function for Lagrange Interpolation.

```
double Lagrange(double x,VEC &XDATA,VEC &YDATA);
```

This function interpolate the function of the given support points `(XDATA[i],YDATA[i])` and find the value at x.

1. Suppose the support points are given by the file `f3.dat`, please find the interpolated values for `x=475, 476, ..., 775`. Plot the interpolated values against the data given by `f301.dat`. What is the maximum error of the interpolated values? What is the maximum error in the range $550 \leq x \leq 700$?
2. Suppose the support points are given by the file `f5.dat`, please find the interpolated values for `x=475, 476, ..., 775`. Plot the interpolated values against the data given by `f301.dat`. What is the maximum error of the interpolated values? What is the maximum error in the range $550 \leq x \leq 700$?
3. Suppose the support points are given by the file `f7.dat`, please find the interpolated values for `x=475, 476, ..., 775`. Plot the interpolated values against the data given by `f301.dat`. What is the maximum error of the interpolated values? What is the maximum error in the range $550 \leq x \leq 700$?
4. Suppose the support points are given by the file `f13.dat`, please find the interpolated values for `x=475, 476, ..., 775`. Plot the interpolated values against the data given by `f301.dat`. What is the maximum error of the interpolated values? What is the maximum error in the range $550 \leq x \leq 700$?

5. Suppose the support points are given by the file `f21.dat`, please find the interpolated values for `x=475, 476, ..., 775`. Plot the interpolated values against the data given by `f301.dat`. What is the maximum error of the interpolated values? What is the maximum error in the range $550 \leq x \leq 700$?

6. Please state your observations.

Notes.

1. For this homework you need to turn in a set of C++ source codes. That includes `hw09.cpp`, which solves question 5 above, `MAT.h`, the new header file, `MAT.cpp`, which includes the `Lagrange` functions, `VEC.h` and `VEC.cpp` files.

2. A `pdf` file is also needed. Please name this file `hw09a.pdf`.

3. Submit your files on EE workstations. Please use the following command to submit your homework 9.

   ```
   $ ~ee407002/bin/submit hw09 hw09a.pdf hw09.cpp MAT.h MAT.cpp VEC.h VEC.cpp
   ```

   where `hw09` indicates homework 9.

4. Your report should be clearly written such that I can understand it. The writing, including English grammar, is part of the grading criteria.