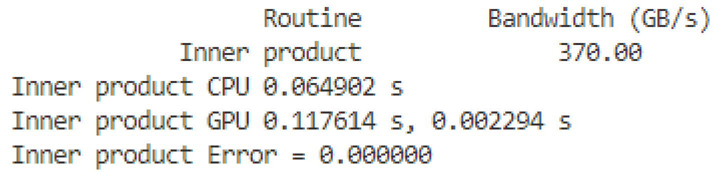
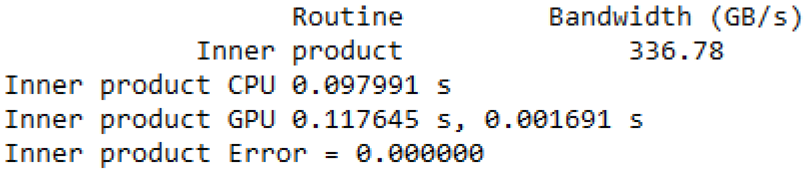
Shengyi Liang
HPC
Prof. Peherstorfer
Homework 4
Here is my github address for homework: https://github.com/TonyLiang0518/Shengyi_Liang_HPC.git

1.
Inner product($N = 2^{25}$): "innerprod.cu" and "innerprod.exe"
RTX 3070 Ti(personal computer):



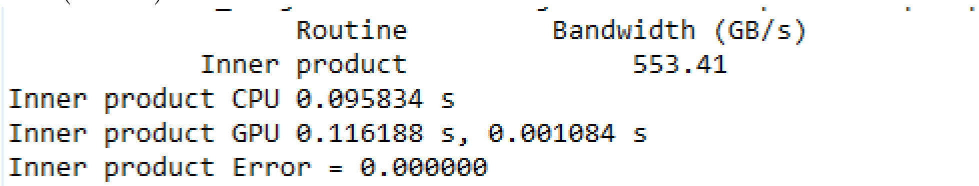
```
                 Routine         Bandwidth (GB/s)
           Inner product              370.00
 Inner product CPU 0.064902 s
 Inner product GPU 0.117614 s, 0.002294 s
 Inner product Error = 0.000000
```

RTX8000(Greene):



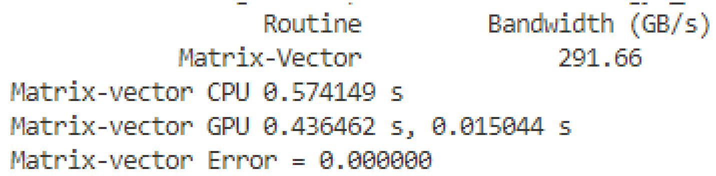
```
                  Routine         Bandwidth (GB/s)
            Inner product              336.78
Inner product CPU 0.097991 s
Inner product GPU 0.117645 s, 0.001691 s
Inner product Error = 0.000000
```

V100(Greene):



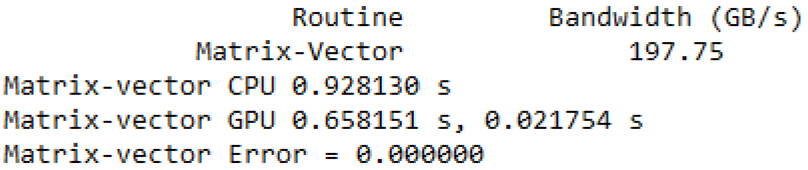
```
                  Routine         Bandwidth (GB/s)
            Inner product              553.41
Inner product CPU 0.095834 s
Inner product GPU 0.116188 s, 0.001084 s
Inner product Error = 0.000000
```

Matrix-vector multiplication($N = 100$): "mvmult.cu" and "mvmult.exe"
RTX 3070 Ti(personal computer):



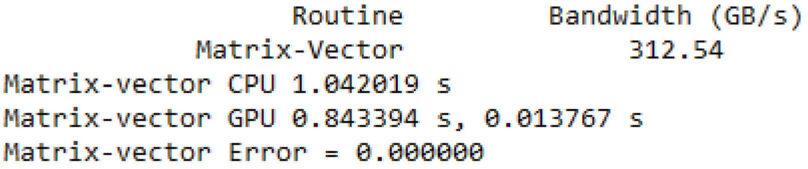
```
                 Routine         Bandwidth (GB/s)
           Matrix-Vector              291.66
 Matrix-vector CPU 0.574149 s
 Matrix-vector GPU 0.436462 s, 0.015044 s
 Matrix-vector Error = 0.000000
```

RTX8000(Greene):



```
                  Routine         Bandwidth (GB/s)
            Matrix-Vector              197.75
Matrix-vector CPU 0.928130 s
Matrix-vector GPU 0.658151 s, 0.021754 s
Matrix-vector Error = 0.000000
```

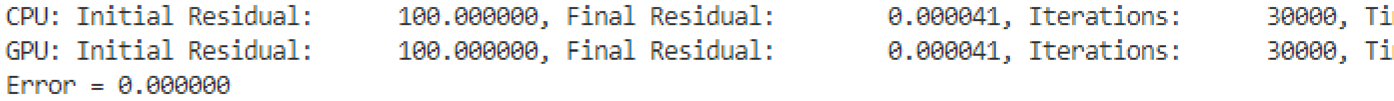
V100(Greene):



```
                  Routine         Bandwidth (GB/s)
            Matrix-Vector              312.54
Matrix-vector CPU 1.042019 s
Matrix-vector GPU 0.843394 s, 0.013767 s
Matrix-vector Error = 0.000000
```

2.

The code is in file “jacobi2d.cu” and executable file is “jacobi2d.exe”.



```
CPU: Initial Residual:      100.000000, Final Residual:        0.000041, Iterations:      30000, Ti
GPU: Initial Residual:      100.000000, Final Residual:        0.000041, Iterations:      30000, Ti
Error = 0.000000
```

Results is based on my personal computer with $N = 100$:
CPU: Intel i9-9900K 3.6GHz (16CPUs)
Memory: 32GBs
GPU: Nvidia GeForce RTX 3070 Ti 8041MB VRAM and 16341MB shared RAM

3.

We have completed function for FFT and IFFT (step 1); they work well as expected. One unforeseen issue is that there are different formulations of FFT and IFFT; they need to be paired up correctly.