*Report of Home Work 10:*

PART I:

1. I have installed the PETSc 3.2.P7 using following commands:

setenv PETSC\_DIR /home/asaadat/workspace/HW10/petsc-3.2-p7

setenv PETSC\_ARCH linux-gnu-c-debug

export PETSC\_DIR=/home/asaadat/workspace/HW10/petsc-3.2-p7

export PETSC\_ARCH=linux-gnu-c-debug

./configure PETSC\_DIR=/home/asaadat/workspace/HW10/petsc-3.2-p7 PETSC\_ARCH=linux-gnu-c-debug

make PETSC\_DIR=/home/balay/petsc-3.2-p0 PETSC\_ARCH=linux-gnu-c-debug all

make PETSC\_DIR=/home/balay/petsc-3.2-p0 PETSC\_ARCH=linux-gnu-c-debug test

2. Done.

3.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 Processor | | | 2 Processor | | | 4 Processor | | |
| Size | Max runtime (sec) | No. Iterations | Norm of errors | Max runtime (sec) | No. Iterations | Norm of errors | Max runtime (sec) | No. Iterations | Norm of errors |
| 200x200 | 9.610e-01 | 121 | 0.000513148 | 6.395e-01 | 138 | 0.00101063 | 3.618e-01 | 140 | 0.000992427 |
| 400x400 | 7.836e+00 | 244 | 0.00162086 | 5.001e+00 | 272 | 0.000747222 | 3.391e+00 | 273 | 0.00107876 |
| 800x800 | 6.265e+01 | 468 | 0.00252132 | 4.480e+01 | 547 | 0.00116594 | 3.114e+01 | 520 | 0.0028784 |

**For solver cg:** (Note: max runtime is maximum time over all processors which is also used in calculating Flops/s)

Table 1. Data of runtime, iteration number and norm of errors for solver "cg"

**For solver gmres:**

Table 2. Data of runtime, iteration number and norm of errors for solver "gmres"

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 Processor | | | 2 Processor | | | 4 Processor | | |
| Size | Max runtime (sec) | No. Iterations | Norm of errors | Max runtime (sec) | No. Iterations | Norm of errors | Max runtime (sec) | No. Iterations | Norm of errors |
| 200x200 | 3.703e+00 | 294 | 0.0140103 | 3.053e+00 | 311 | 0.0156403 | 2.8144e+01 | 318 | 0.014939 |
| 400x400 | 4.635e+01 | 922 | 0.0329293 | 4.259e+01 | 1007 | 0.0334713 | 5.518e+01 | 1006 | 0.0343009 |
| 800x800 | 7.234e+02 | 3330 | 0.0662957 | 2.482e+02 | 1830 | 0.0465856 | 2.285e+02 | 2075 | 0.0629053 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 Processor | | | 2 Processor | | | 4 Processor | | |
| Size | Max runtime (sec) | No. Iterations | Norm of errors | Max runtime (sec) | No. Iterations | Norm of errors | Max runtime (sec) | No. Iterations | Norm of errors |
| 200x200 | 1.914e+00 | 73 | 0.0199002 | 3.876e+00 | 82 | 0.0181413 | 4.832e-01 | 84 | 0.0240403 |
| 400x400 | 1.497e+01 | 139 | 0.0217363 | 1.806e+01 | 156 | 0.0299198 | 4.461e+00 | 157 | 0.0201647 |
| 800x800 | 9.686e+01 | 272 | 0.0477211 | 5.350e+01 | 302 | 0.0447282 | 4.132e+01 | 304 | 0.0459145 |

**For solver tfqmr:**

**Table 3. Data of runtime, iteration number and norm of errors for solver "tfqmr"**

PART II:

The code and the corresponding Makefile are attached.

|  |  |  |  |
| --- | --- | --- | --- |
| CPU | | | |
| Size | ||I-Q'Q||\_F | ||I-Q'Q||\_max | ||A-QR||\_F |
| 2048 x 128 | 9.742039e-05 | 3.635883e-06 | 3.107160e-05 |
| 4096 x 128 | 1.302806e-04 | 5.245209e-06 | 4.377960e-05 |
| 8192 x 128 | 1.788470e-04 | 7.390976e-06 | 6.243036e-05 |
| 16384 x 128 | 2.535919e-04 | 1.335144e-05 | 8.785037e-05 |
| 32768 x 128 | 1.763952e-04 | 6.973743e-06 | 1.249809e-04 |
| 65536 x 128 | 2.443146e-04 | 8.642673e-06 | 1.756730e-04 |
| 131072 x 128 | 3.448527e-04 | 1.215935e-05 | 2.501218e-04 |

|  |  |  |  |
| --- | --- | --- | --- |
| CPU+GPU | | | |
| Size | ||I-Q'Q||\_F | ||I-Q'Q||\_max | ||A-QR||\_F |
| 2048 x 128 | 2.484795e-04 | 9.059906e-06 | 4.620940e-05 |
| 4096 x 128 | 3.380318e-04 | 1.061015e-05 | 6.503784e-05 |
| 8192 x 128 | 4.660951e-04 | 1.525879e-05 | 9.215384e-05 |
| 16384 x 128 | 6.435950e-04 | 2.574921e-05 | 1.299727e-04 |
| 32768 x 128 | 9.181247e-04 | 3.457069e-05 | 1.846759e-04 |
| 65536 x 128 | 1.314791e-03 | 5.316734e-05 | 2.601447e-04 |
| 131072 x 128 | 1.964596e-03 | 1.180172e-04 | 3.696572e-04 |



