

## 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.

**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"**

	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 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

**For solver tfqmr:**

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

	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

## PART II:

The code and the corresponding Makefile are attached.

Size	CPU		
	$\ I-Q'Q\ _F$	$\ I-Q'Q\ _{\max}$	$\ A-QR\ _F$
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

Size	CPU+GPU		
	$\ I-Q'Q\ _F$	$\ I-Q'Q\ _{\max}$	$\ A-QR\ _F$
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

