

# Assignment 4

CPSC424

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## 1 Software and Development Environment

All the programming for this assignment was done in vim. This document was made using emacs. The only modules used in this assignment were Langs/Intel/15 and MPI/OpenMPI/1.8.6-intel15.

### 1.1 How to run the code

To compile the code and load the appropriate modules do the following:

```
cd jnb37_ps4_cpsc424
sh setup.sh
```

In order to run code, run

```
qsub run.sh
```

## 2 Data

### 2.1 Serial

$K$	128	256	384	512	640	768	896	1024
Data 1	0.774	1.554	2.287	2.963	3.590	4.189	4.773	5.349
Data 2	3.094	6.205	9.195	11.968	14.578	17.103	19.61	22.178
Data 3	12.394	24.882	36.975	48.382	59.291	69.975	80.708	91.706
Data 4	49.498	99.247	146.893	191.670	234.006	274.683	314.476	353.857

## 2.2 Parallel

$K$	128	256	384	512	640	768	896	1024
Data 1	.786	1.543	2.145	2.566	2.90	3.170	3.376	3.549
Data 2	3.052	6.045	8.435	10.187	11.698	13.096	14.470	15.834
Data 3	12.315	29.748	39.284	44.656	50.402	55.465	62.576	66.764
Data 4	54.323	100.875	135.794	165.012	190.092	213.097	234.926	255.97

## 3 load Balancing

In order to gauge load balancing I kept track of the average number of bodies each process got. The following is a table where element corresponds to the percentage of bodies that each processes had on average

Rank	0	1	2	3	4	5	6	7
Data 1	.060	.053	.184	.211	.166	.199	.059	.063
Data 2	.058	.053	.178	.206	.198	.186	.057	.061
Data 3	.0522	.058	.196	.210	.205	.178	.052	.050
Data 4	0.050	0.192	.192	.205	.198	.208	.047	.050

Clearly the load was not distributed evenly. Given that collectives were used exclusively to communicate between processes, processes with more bodies necessarily slowed all the other processes down.

## 4 Raw output

DATA 1

N: 800

K: 1024

DT: 0.031250

----- SIMULATION INFO (t: 0.000005)-----

Beginning of time step: 0

Current Center of Mass: [ 2.1538750e-08, 1.1488625e-09, 4.3345750e-09]

Current Average Velocity: [ -1.5606000e-08, -6.2910000e-09, 2.2887374e-10]

----- SIMULATION INFO (t: 0.808221)-----

Beginning of time step: 128

Current Center of Mass: [ -4.0885250e-08, -2.4015137e-08, 5.2500699e-09]

Current Average Velocity: [ -1.5606000e-08, -6.2910000e-09, 2.2887374e-10]

```

----- SIMULATION INFO (t: 1.588229)-----
Beginning of time step: 256
Current Center of Mass: [ -1.0330925e-07, -4.9179138e-08, 6.1655649e-09]
Current Average Velocity: [ -1.5606000e-08, -6.2910000e-09, 2.2887375e-10]
----- SIMULATION INFO (t: 2.321344)-----
Beginning of time step: 384
Current Center of Mass: [ -1.6573325e-07, -7.4343138e-08, 7.0810599e-09]
Current Average Velocity: [ -1.5606000e-08, -6.2910001e-09, 2.2887375e-10]
----- SIMULATION INFO (t: 2.996952)-----
Beginning of time step: 512
Current Center of Mass: [ -2.2815725e-07, -9.9507137e-08, 7.9965545e-09]
Current Average Velocity: [ -1.5606000e-08, -6.2910000e-09, 2.2887375e-10]
----- SIMULATION INFO (t: 3.624232)-----
Beginning of time step: 640
Current Center of Mass: [ -2.9058125e-07, -1.2467114e-07, 8.9120495e-09]
Current Average Velocity: [ -1.5606000e-08, -6.2910000e-09, 2.2887374e-10]
----- SIMULATION INFO (t: 4.223723)-----
Beginning of time step: 768
Current Center of Mass: [ -3.5300525e-07, -1.4983513e-07, 9.8275447e-09]
Current Average Velocity: [ -1.5606000e-08, -6.2910000e-09, 2.2887375e-10]
----- SIMULATION INFO (t: 4.808110)-----
Beginning of time step: 896
Current Center of Mass: [ -4.1542924e-07, -1.7499914e-07, 1.0743042e-08]
Current Average Velocity: [ -1.5606000e-08, -6.2910000e-09, 2.2887375e-10]
----- SIMULATION INFO (t: 5.383916)-----
Beginning of time step: 1024
Current Center of Mass: [ -4.7785323e-07, -2.0016314e-07, 1.1658541e-08]
Current Average Velocity: [ -1.5606000e-08, -6.2910000e-09, 2.2887376e-10]

```

DATA 2

N: 1600

K: 1024

DT: 0.031250

```

----- SIMULATION INFO (t: 0.000004)-----
Beginning of time step: 0
Current Center of Mass: [ -4.1281257e-09, -1.8359312e-10, -1.6534656e-08]
Current Average Velocity: [ -6.7892307e-10, -3.5106275e-09, 2.7413719e-09]
----- SIMULATION INFO (t: 3.094835)-----

```

```

Beginning of time step: 128
Current Center of Mass: [ -6.8438179e-09, -1.4226103e-08, -5.5691687e-09]
Current Average Velocity: [ -6.7892310e-10, -3.5106275e-09, 2.7413719e-09]
----- SIMULATION INFO (t: 6.205870)-----
Beginning of time step: 256
Current Center of Mass: [ -9.5595104e-09, -2.8268613e-08, 5.3963187e-09]
Current Average Velocity: [ -6.7892307e-10, -3.5106275e-09, 2.7413719e-09]
----- SIMULATION INFO (t: 9.195942)-----
Beginning of time step: 384
Current Center of Mass: [ -1.2275203e-08, -4.2311124e-08, 1.6361806e-08]
Current Average Velocity: [ -6.7892306e-10, -3.5106276e-09, 2.7413719e-09]
----- SIMULATION INFO (t: 11.969422)-----
Beginning of time step: 512
Current Center of Mass: [ -1.4990896e-08, -5.6353634e-08, 2.7327293e-08]
Current Average Velocity: [ -6.7892306e-10, -3.5106275e-09, 2.7413719e-09]
----- SIMULATION INFO (t: 14.577942)-----
Beginning of time step: 640
Current Center of Mass: [ -1.7706589e-08, -7.0396145e-08, 3.8292780e-08]
Current Average Velocity: [ -6.7892305e-10, -3.5106275e-09, 2.7413719e-09]
----- SIMULATION INFO (t: 17.103526)-----
Beginning of time step: 768
Current Center of Mass: [ -2.0422280e-08, -8.4438653e-08, 4.9258267e-08]
Current Average Velocity: [ -6.7892316e-10, -3.5106275e-09, 2.7413719e-09]
----- SIMULATION INFO (t: 19.619497)-----
Beginning of time step: 896
Current Center of Mass: [ -2.3137971e-08, -9.8481164e-08, 6.0223754e-08]
Current Average Velocity: [ -6.7892310e-10, -3.5106275e-09, 2.7413719e-09]
----- SIMULATION INFO (t: 22.178836)-----
Beginning of time step: 1024
Current Center of Mass: [ -2.5853664e-08, -1.1252367e-07, 7.1189242e-08]
Current Average Velocity: [ -6.7892310e-10, -3.5106275e-09, 2.7413719e-09]

```

DATA 3

N: 3200

K: 1024

DT: 0.031250

```

----- SIMULATION INFO (t: 0.000005)-----
Beginning of time step: 0
Current Center of Mass: [ 2.7384375e-09, -8.9806911e-09, -3.7085991e-09]
Current Average Velocity: [ 3.6056231e-10, 1.9317600e-08, 3.6455503e-09]

```

```

----- SIMULATION INFO (t: 12.395048)-----
Beginning of time step: 128
Current Center of Mass: [ 4.1806871e-09, 6.8289709e-08, 1.0873602e-08]
Current Average Velocity: [ 3.6056220e-10, 1.9317600e-08, 3.6455503e-09]
----- SIMULATION INFO (t: 24.884049)-----
Beginning of time step: 256
Current Center of Mass: [ 5.6229348e-09, 1.4556011e-07, 2.5455804e-08]
Current Average Velocity: [ 3.6056219e-10, 1.9317600e-08, 3.6455503e-09]
----- SIMULATION INFO (t: 36.977460)-----
Beginning of time step: 384
Current Center of Mass: [ 7.0651851e-09, 2.2283051e-07, 4.0038005e-08]
Current Average Velocity: [ 3.6056235e-10, 1.9317600e-08, 3.6455503e-09]
----- SIMULATION INFO (t: 48.389388)-----
Beginning of time step: 512
Current Center of Mass: [ 8.5074340e-09, 3.0010091e-07, 5.4620206e-08]
Current Average Velocity: [ 3.6056229e-10, 1.9317600e-08, 3.6455503e-09]
----- SIMULATION INFO (t: 59.297114)-----
Beginning of time step: 640
Current Center of Mass: [ 9.9496831e-09, 3.7737131e-07, 6.9202407e-08]
Current Average Velocity: [ 3.6056228e-10, 1.9317600e-08, 3.6455503e-09]
----- SIMULATION INFO (t: 69.982303)-----
Beginning of time step: 768
Current Center of Mass: [ 1.1391931e-08, 4.5464171e-07, 8.3784608e-08]
Current Average Velocity: [ 3.6056222e-10, 1.9317600e-08, 3.6455503e-09]
----- SIMULATION INFO (t: 80.715332)-----
Beginning of time step: 896
Current Center of Mass: [ 1.2834181e-08, 5.3191211e-07, 9.8366810e-08]
Current Average Velocity: [ 3.6056235e-10, 1.9317600e-08, 3.6455503e-09]
----- SIMULATION INFO (t: 91.710556)-----
Beginning of time step: 1024
Current Center of Mass: [ 1.4276430e-08, 6.0918251e-07, 1.1294901e-07]
Current Average Velocity: [ 3.6056231e-10, 1.9317600e-08, 3.6455503e-09]

```

DATA 4

N: 6400

K: 1024

DT: 0.031250

```

----- SIMULATION INFO (t: 0.000005)-----
Beginning of time step: 0
Current Center of Mass: [ -2.0187578e-08, 1.0121546e-08, -3.9576078e-09]

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    Current Average Velocity: [ -5.5401981e-09, 3.5788871e-09, 7.4360197e-09]
----- SIMULATION INFO (t: 49.499988)-----
    Beginning of time step: 128
    Current Center of Mass: [ -4.2348368e-08, 2.4437094e-08, 2.5786471e-08]
    Current Average Velocity: [ -5.5401967e-09, 3.5788869e-09, 7.4360197e-09]
----- SIMULATION INFO (t: 99.245374)-----
    Beginning of time step: 256
    Current Center of Mass: [ -6.4509157e-08, 3.8752642e-08, 5.5530550e-08]
    Current Average Velocity: [ -5.5401976e-09, 3.5788870e-09, 7.4360197e-09]
----- SIMULATION INFO (t: 146.887110)-----
    Beginning of time step: 384
    Current Center of Mass: [ -8.6669948e-08, 5.3068191e-08, 8.5274628e-08]
    Current Average Velocity: [ -5.5401974e-09, 3.5788871e-09, 7.4360197e-09]
----- SIMULATION INFO (t: 191.660034)-----
    Beginning of time step: 512
    Current Center of Mass: [ -1.0883074e-07, 6.7383739e-08, 1.1501871e-07]
    Current Average Velocity: [ -5.5401975e-09, 3.5788871e-09, 7.4360197e-09]
----- SIMULATION INFO (t: 233.989914)-----
    Beginning of time step: 640
    Current Center of Mass: [ -1.3099153e-07, 8.1699288e-08, 1.4476279e-07]
    Current Average Velocity: [ -5.5401974e-09, 3.5788871e-09, 7.4360197e-09]
----- SIMULATION INFO (t: 274.661741)-----
    Beginning of time step: 768
    Current Center of Mass: [ -1.5315232e-07, 9.6014835e-08, 1.7450686e-07]
    Current Average Velocity: [ -5.5401974e-09, 3.5788870e-09, 7.4360197e-09]
----- SIMULATION INFO (t: 314.449315)-----
    Beginning of time step: 896
    Current Center of Mass: [ -1.7531310e-07, 1.1033038e-07, 2.0425094e-07]
    Current Average Velocity: [ -5.5401975e-09, 3.5788871e-09, 7.4360197e-09]
----- SIMULATION INFO (t: 353.823311)-----
    Beginning of time step: 1024
    Current Center of Mass: [ -1.9747390e-07, 1.2464593e-07, 2.3399502e-07]
    Current Average Velocity: [ -5.5401974e-09, 3.5788870e-09, 7.4360197e-09]

```

```

-----PARALLEL-----

```

```

DATA 1
N: 800
K: 1024
DT: 0.031250

```

```

----- SIMULATION INFO (t: 0.000004)-----
Beginning of time step: 0
Current Center of Mass: [ 2.1538750e-08, 1.1488625e-09, 4.3345750e-09]
Current Average Velocity: [ -1.5606000e-08, -6.2910000e-09, 2.2887375e-10]
----- SIMULATION INFO (t: 0.786905)-----
Beginning of time step: 128
Current Center of Mass: [ -4.0885250e-08, -2.4015137e-08, 5.2500701e-09]
Current Average Velocity: [ -1.5606000e-08, -6.2909999e-09, 2.2887376e-10]
----- SIMULATION INFO (t: 1.543383)-----
Beginning of time step: 256
Current Center of Mass: [ -1.0330925e-07, -4.9179138e-08, 6.1655655e-09]
Current Average Velocity: [ -1.5606000e-08, -6.2910000e-09, 2.2887377e-10]
----- SIMULATION INFO (t: 2.142623)-----
Beginning of time step: 384
Current Center of Mass: [ -1.6573325e-07, -7.4343138e-08, 7.0810601e-09]
Current Average Velocity: [ -1.5606000e-08, -6.2910000e-09, 2.2887382e-10]
----- SIMULATION INFO (t: 2.566184)-----
Beginning of time step: 512
Current Center of Mass: [ -2.2815725e-07, -9.9507139e-08, 7.9965543e-09]
Current Average Velocity: [ -1.5606000e-08, -6.2910000e-09, 2.2887378e-10]
----- SIMULATION INFO (t: 2.904153)-----
Beginning of time step: 640
Current Center of Mass: [ -2.9058125e-07, -1.2467114e-07, 8.9120486e-09]
Current Average Velocity: [ -1.5606000e-08, -6.2910000e-09, 2.2887375e-10]
----- SIMULATION INFO (t: 3.170492)-----
Beginning of time step: 768
Current Center of Mass: [ -3.5300525e-07, -1.4983514e-07, 9.8275425e-09]
Current Average Velocity: [ -1.5606000e-08, -6.2910000e-09, 2.2887379e-10]
----- SIMULATION INFO (t: 3.376870)-----
Beginning of time step: 896
Current Center of Mass: [ -4.1542925e-07, -1.7499914e-07, 1.0743038e-08]
Current Average Velocity: [ -1.5606000e-08, -6.2909999e-09, 2.2887381e-10]
----- SIMULATION INFO (t: 3.549023)-----
Beginning of time step: 1024
Current Center of Mass: [ -4.7785326e-07, -2.0016314e-07, 1.1658535e-08]
Current Average Velocity: [ -1.5606000e-08, -6.2910000e-09, 2.2887378e-10]

```

DATA 2

N: 1600

K: 1024  
DT: 0.031250

Rank: 1 time: 0.000004 percent of bodies: 0.146250

```
----- SIMULATION INFO (t: 0.000005)-----  
Beginning of time step: 0  
Current Center of Mass: [ -4.1281247e-09, -1.8359309e-10, -1.6534656e-08]  
Current Average Velocity: [ -6.7892312e-10, -3.5106275e-09, 2.7413719e-09]  
----- SIMULATION INFO (t: 3.052485)-----  
Beginning of time step: 128  
Current Center of Mass: [ -6.8438178e-09, -1.4226103e-08, -5.5691687e-09]  
Current Average Velocity: [ -6.7892312e-10, -3.5106275e-09, 2.7413719e-09]  
----- SIMULATION INFO (t: 6.045031)-----  
Beginning of time step: 256  
Current Center of Mass: [ -9.5595105e-09, -2.8268613e-08, 5.3963188e-09]  
Current Average Velocity: [ -6.7892323e-10, -3.5106275e-09, 2.7413719e-09]  
----- SIMULATION INFO (t: 8.435317)-----  
Beginning of time step: 384  
Current Center of Mass: [ -1.2275204e-08, -4.2311123e-08, 1.6361806e-08]  
Current Average Velocity: [ -6.7892310e-10, -3.5106275e-09, 2.7413719e-09]  
----- SIMULATION INFO (t: 10.187785)-----  
Beginning of time step: 512  
Current Center of Mass: [ -1.4990895e-08, -5.6353634e-08, 2.7327295e-08]  
Current Average Velocity: [ -6.7892316e-10, -3.5106275e-09, 2.7413719e-09]  
----- SIMULATION INFO (t: 11.698229)-----  
Beginning of time step: 640  
Current Center of Mass: [ -1.7706587e-08, -7.0396144e-08, 3.8292782e-08]  
Current Average Velocity: [ -6.7892310e-10, -3.5106275e-09, 2.7413719e-09]  
----- SIMULATION INFO (t: 13.096621)-----  
Beginning of time step: 768  
Current Center of Mass: [ -2.0422279e-08, -8.4438654e-08, 4.9258271e-08]  
Current Average Velocity: [ -6.7892309e-10, -3.5106275e-09, 2.7413719e-09]  
----- SIMULATION INFO (t: 14.470738)-----  
Beginning of time step: 896  
Current Center of Mass: [ -2.3137970e-08, -9.8481163e-08, 6.0223761e-08]  
Current Average Velocity: [ -6.7892311e-10, -3.5106275e-09, 2.7413719e-09]  
----- SIMULATION INFO (t: 15.834821)-----  
Beginning of time step: 1024  
Current Center of Mass: [ -2.5853661e-08, -1.1252367e-07, 7.1189249e-08]  
Current Average Velocity: [ -6.7892308e-10, -3.5106275e-09, 2.7413719e-09]
```



```

DATA 3
N: 3200
K: 1024
DT: 0.031250
Rank: 1  time: 0.000004 percent of bodies: 0.137187
----- SIMULATION INFO (t: 0.000004)-----
    Beginning of time step: 0
    Current Center of Mass: [ 2.7384375e-09, -8.9806912e-09, -3.7085990e-09]
    Current Average Velocity: [ 3.6056235e-10, 1.9317600e-08, 3.6455503e-09]
----- SIMULATION INFO (t: 12.315910)-----
    Beginning of time step: 128
    Current Center of Mass: [ 4.1806864e-09, 6.8289709e-08, 1.0873602e-08]
    Current Average Velocity: [ 3.6056221e-10, 1.9317600e-08, 3.6455502e-09]
----- SIMULATION INFO (t: 24.448493)-----
    Beginning of time step: 256
    Current Center of Mass: [ 5.6229355e-09, 1.4556011e-07, 2.5455803e-08]
    Current Average Velocity: [ 3.6056218e-10, 1.9317600e-08, 3.6455503e-09]
----- SIMULATION INFO (t: 34.284936)-----
    Beginning of time step: 384
    Current Center of Mass: [ 7.0651850e-09, 2.2283051e-07, 4.0038004e-08]
    Current Average Velocity: [ 3.6056228e-10, 1.9317600e-08, 3.6455503e-09]
----- SIMULATION INFO (t: 41.727228)-----
    Beginning of time step: 512
    Current Center of Mass: [ 8.5074333e-09, 3.0010091e-07, 5.4620206e-08]
    Current Average Velocity: [ 3.6056225e-10, 1.9317600e-08, 3.6455503e-09]
----- SIMULATION INFO (t: 48.225032)-----
    Beginning of time step: 640
    Current Center of Mass: [ 9.9496817e-09, 3.7737131e-07, 6.9202407e-08]
    Current Average Velocity: [ 3.6056220e-10, 1.9317600e-08, 3.6455503e-09]
----- SIMULATION INFO (t: 54.406432)-----
    Beginning of time step: 768
    Current Center of Mass: [ 1.1391932e-08, 4.5464171e-07, 8.3784608e-08]
    Current Average Velocity: [ 3.6056223e-10, 1.9317600e-08, 3.6455503e-09]
----- SIMULATION INFO (t: 60.553425)-----
    Beginning of time step: 896
    Current Center of Mass: [ 1.2834181e-08, 5.3191211e-07, 9.8366810e-08]
    Current Average Velocity: [ 3.6056218e-10, 1.9317600e-08, 3.6455503e-09]
----- SIMULATION INFO (t: 66.764520)-----
    Beginning of time step: 1024

```

Current Center of Mass: [ 1.4276430e-08, 6.0918251e-07, 1.1294901e-07]  
Current Average Velocity: [ 3.6056225e-10, 1.9317600e-08, 3.6455503e-09]

DATA 4

N: 6400

K: 1024

DT: 0.031250

```
----- SIMULATION INFO (t: 0.000005)-----  
Beginning of time step: 0  
Current Center of Mass: [ -2.0187578e-08, 1.0121546e-08, -3.9576078e-09]  
Current Average Velocity: [ -5.5401974e-09, 3.5788871e-09, 7.4360197e-09]  
----- SIMULATION INFO (t: 48.705346)-----  
Beginning of time step: 128  
Current Center of Mass: [ -4.2348368e-08, 2.4437094e-08, 2.5786471e-08]  
Current Average Velocity: [ -5.5401973e-09, 3.5788871e-09, 7.4360197e-09]  
----- SIMULATION INFO (t: 96.695538)-----  
Beginning of time step: 256  
Current Center of Mass: [ -6.4509158e-08, 3.8752643e-08, 5.5530550e-08]  
Current Average Velocity: [ -5.5401975e-09, 3.5788867e-09, 7.4360197e-09]  
----- SIMULATION INFO (t: 135.794347)-----  
Beginning of time step: 384  
Current Center of Mass: [ -8.6669947e-08, 5.3068191e-08, 8.5274629e-08]  
Current Average Velocity: [ -5.5401975e-09, 3.5788870e-09, 7.4360197e-09]  
----- SIMULATION INFO (t: 165.009956)-----  
Beginning of time step: 512  
Current Center of Mass: [ -1.0883074e-07, 6.7383739e-08, 1.1501871e-07]  
Current Average Velocity: [ -5.5401975e-09, 3.5788869e-09, 7.4360197e-09]  
----- SIMULATION INFO (t: 190.092338)-----  
Beginning of time step: 640  
Current Center of Mass: [ -1.3099153e-07, 8.1699287e-08, 1.4476279e-07]  
Current Average Velocity: [ -5.5401974e-09, 3.5788870e-09, 7.4360197e-09]  
----- SIMULATION INFO (t: 213.097443)-----  
Beginning of time step: 768  
Current Center of Mass: [ -1.5315232e-07, 9.6014838e-08, 1.7450686e-07]  
Current Average Velocity: [ -5.5401976e-09, 3.5788870e-09, 7.4360197e-09]  
----- SIMULATION INFO (t: 234.926483)-----  
Beginning of time step: 896  
Current Center of Mass: [ -1.7531311e-07, 1.1033038e-07, 2.0425094e-07]  
Current Average Velocity: [ -5.5401975e-09, 3.5788870e-09, 7.4360197e-09]  
----- SIMULATION INFO (t: 255.974442)-----
```

Beginning of time step: 1024  
Current Center of Mass: [ -1.9747390e-07, 1.2464593e-07, 2.3399502e-07]  
Current Average Velocity: [ -5.5401974e-09, 3.5788870e-09, 7.4360197e-09]

## 5 Environment

```
MKLROOT=/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/mkl
MANPATH=/usr/local/cluster/hpc/MPI/OpenMPI/1.8.6-intel15/share/man:/home/apps/fas/Langs/
5_update2/composer_xe_2015.2.164/debugger/gdb/intel64/share/man:/home/apps/fas/Langs/
hare/man:/opt/rocks/share/man:
GDB_HOST=/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/debugger/gdb/in
HOSTNAME=compute-33-1.local
IPPROOT=/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/ipp
INTEL_LICENSE_FILE=/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/licen
TERM=xterm
SHELL=/bin/bash
HISTSIZE=1000
GDBSERVER_MIC=/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/debugger/g
SSH_CLIENT=10.191.63.252 40510 22
LIBRARY_PATH=/usr/local/cluster/hpc/MPI/OpenMPI/1.8.6-intel15/lib:/home/apps/fas/Langs/
s/Langs/Intel/2015_update2/composer_xe_2015.2.164/ipp/lib/intel64:/home/apps/fas/Langs/
/Intel/2015_update2/composer_xe_2015.2.164/mkl/lib/intel64:/home/apps/fas/Langs/Intel/
PERL5LIB=/opt/rocks/lib/perl5
FPATH=/usr/local/cluster/hpc/MPI/OpenMPI/1.8.6-intel15/include:/home/apps/fas/Langs/Int
QTDIR=/usr/lib64/qt-3.3
QTINC=/usr/lib64/qt-3.3/include
MIC_LD_LIBRARY_PATH=/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/mpir
c:/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/compiler/lib/mic:/home
c/coi/device-linux-release/lib:/opt/intel/mic/myo/lib:/home/apps/fas/Langs/Intel/2015_u
SSH_TTY=/dev/pts/42
ANT_HOME=/opt/rocks
USER=jnb37
LD_LIBRARY_PATH=/usr/local/cluster/hpc/MPI/OpenMPI/1.8.6-intel15/lib:/home/apps/fas/Lan
/Intel/2015_update2/composer_xe_2015.2.164/ipp/./compiler/lib/intel64:/home/apps/fas/L
/Intel/2015_update2/composer_xe_2015.2.164/ipp/tools/intel64/perfsys:/opt/intel/mic/co
te2/composer_xe_2015.2.164/compiler/lib/intel64:/home/apps/fas/Langs/Intel/2015_update2
poser_xe_2015.2.164/tbb/lib/intel64/gcc4.4:/home/apps/fas/Langs/Intel/2015_update2/comp
MIC_LIBRARY_PATH=/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/compil
mic:/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/tbb/lib/mic
```

```

ROCKS_ROOT=/opt/rocks
CPATH=/usr/local/cluster/hpc/MPI/OpenMPI/1.8.6-intel15/include:/home/apps/fas/Langs/Int
update2/composer_xe_2015.2.164/mkl/include:/home/apps/fas/Langs/Intel/2015_update2/comp
YHPC_COMPILER=Intel
OMPI_MCA_orte_precondition_transports=f20cd2d28f432704-15e3f8c3bb8e89d6
NLSPATH=/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/compiler/lib/int
/ipp/lib/intel64/locale/%l_%t/%N:/home/apps/fas/Langs/Intel/2015_update2/composer_xe_20
mposer_xe_2015.2.164/debugger/gdb/intel64_mic/share/locale/%l_%t/%N:/home/apps/fas/Lang
/%N
MAIL=/var/spool/mail/jnb37
PATH=/usr/local/cluster/hpc/MPI/OpenMPI/1.8.6-intel15/bin:/home/apps/fas/Langs/Intel/20
PATH=/usr/local/cluster/hpc/MPI/OpenMPI/1.8.6-intel15/bin:/home/apps/fas/Langs/Intel/20
YHPC_COMPILER_MINOR=164
TBBROOT=/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/tbb
C_INCLUDE_PATH=/usr/local/cluster/hpc/MPI/OpenMPI/1.8.6-intel15/include
F90=ifort
PWD=/home/fas/cpsc424/jnb37/scratch/jnb37_ps4_cpsc424
_LMFILES=/home/apps/fas/Modules/Base/yale_hpc:/home/apps/fas/Modules/Langs/Intel/15:/
YHPC_COMPILER_MAJOR=2
JAVA_HOME=/usr/java/latest
GDB_CROSS=/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/debugger/gdb/
DOMAIN=omega
LANG=en_US.iso885915
MODULEPATH=/home/apps/fas/Modules
MOABHOMEDIR=/opt/moab
YHPC_COMPILER_RELEASE=2015
LOADEDMODULES=Base/yale_hpc:Langs/Intel/15:MPI/OpenMPI/1.8.6-intel15
KDEDIRS=/usr
F77=ifort
MPM_LAUNCHER=/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/debugger/mp
CXX=icpc
SSH_ASKPASS=/usr/libexec/openssh/gnome-ssh-askpass
HISTCONTROL=ignoredups
INTEL_PYTHONHOME=/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/debugg
SHLVL=1
HOME=/home/fas/cpsc424/jnb37
FC=ifort
LOGNAME=jnb37
QTLIB=/usr/lib64/qt-3.3/lib
CVS_RSH=ssh

```

```
SSH_CONNECTION=10.191.63.252 40510 10.191.12.33 22
MODULESHOME=/usr/share/Modules
LESSOPEN=||/usr/bin/lesspipe.sh %s
arch=intel64
INFOPATH=/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/debugger/gdb/in
CC=icc
INCLUDE=/home/apps/fas/Langs/Intel/2015_update2/composer_xe_2015.2.164/mkl/include
MPI_PATH=/usr/local/cluster/hpc/MPI/OpenMPI/1.8.6-intel15
G_BROKEN_FILENAMES=1
BASH_FUNC_module()=() { eval ` /usr/bin/modulecmd bash $* `
}
_=/bin/env
OLDPWD=/home/fas/cpsc424/jnb37
```