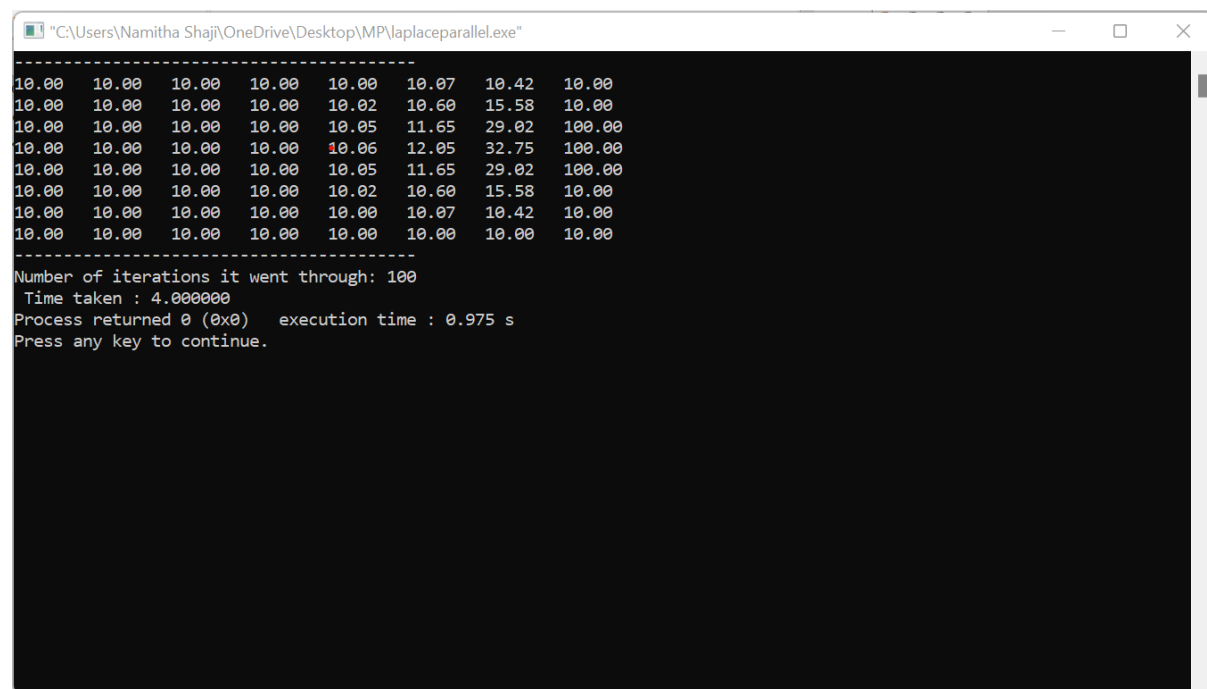## Compilation of code on Codeblocks
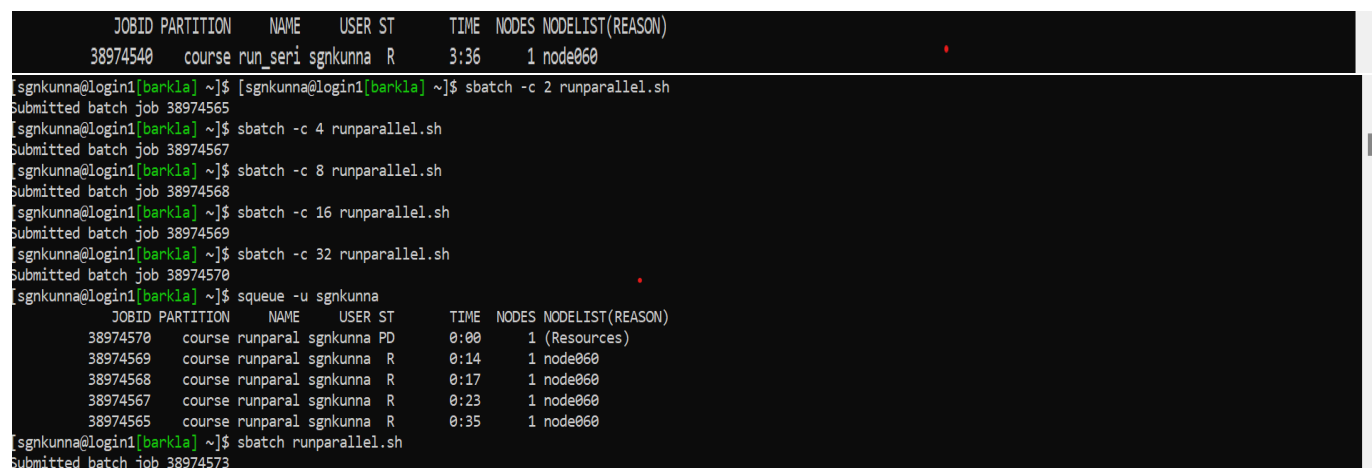
```
-------------- Build file: "no target" in "no project" (compiler: unknown)--------------

gcc.exe  -c "C:\Users\Namitha Shaji\OneDrive\Desktop\MP\laplaceparallel.c" -o "C:\Users\Namitha Shaji\OneDrive\Desktop\MP\laplaceparallel.o"
gcc.exe  -o "C:\Users\Namitha Shaji\OneDrive\Desktop\MP\laplaceparallel.exe" "C:\Users\Namitha Shaji\OneDrive\Desktop\MP\laplaceparallel.o"
Process terminated with status 0 (0 minute(s), 0 second(s))
0 error(s), 0 warning(s) (0 minute(s), 0 second(s))


Checking for existence: C:\Users\Namitha Shaji\OneDrive\Desktop\MP\laplaceparallel.exe
Executing: '"C:\Program Files\CodeBlocks/cb_console_runner.exe" "C:\Users\Namitha Shaji\OneDrive\Desktop\MP\laplaceparallel.exe"' (in 'C:\Users\Namitha Shaji\OneDrive
\Desktop\MP')
Set variable: PATH=C:\MinGW\bin;C:\MinGW;C:\Windows\System32;C:\Windows;C:\Windows\System32\wbem;C:\Windows\System32\WindowsPowerShell\v1.0;C:\Windows\System32
\OpenSSH;C:\Program Files (x86)\NVIDIA Corporation\PhysX\Common;C:\Program Files\NVIDIA Corporation\NVIDIA NvDLISR;C:\winglpk-4.65\glpk-4.65\w64;C:\Users\Namitha
Shaji\AppData\Local\Microsoft\WindowsApps;\;C:\Users\Namitha Shaji\AppData\Local\Programs\Microsoft VS Code\bin
```

Screenshot of output for smaller values (n=64 and limit=100)

Screenshot of the compilation and output on Barkla

Serial Code run

```
[sgnkunna@login1[barkla] ~]$ cat slurm-38974540.out
Node list              : node060
Number of nodes allocated  : 1 or 1
Number of threads or processes    :
Number of processes per node : 1
Requested tasks per node    :
Requested CPUs per task     :
Scheduling priority         : 0
compiling Laplace.c to Laplace.exe
-----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
-----------------------------------------
Number of iterations it went through: 100000
 Time taken : 184.650000
-----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
-----------------------------------------
Number of iterations it went through: 100000
 Time taken : 215.230000
-----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
```

```
Number of iterations it went through: 100000
 Time taken : 215.230000

-----------------------------------------

10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00

10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00

10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00

10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00

10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00

10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00

10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00

10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00

-----------------------------------------

Number of iterations it went through: 100000
 Time taken : 194.190000
```

1 CORE

```
Scheduling priority         : 0
compiling laplaceparallel.c to laplaceparallel.exe
using 1 OpenMP threads
-----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
-----------------------------------------
Number of iterations it went through: 100000
 Time taken : 130.058646
-----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
-----------------------------------------
Number of iterations it went through: 100000
 Time taken : 120.546889
-----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
-----------------------------------------
Number of iterations it went through: 100000
 Time taken : 121.093170
```

2 CORES

```
sgnkunna@login1:~
[sgnkunna@login1[barkla] ~]$ cat slurm-38974565.out
Node list                        : node060
Number of nodes allocated        : 1 or 1
Number of threads or processes            :
Number of processes per node : 1
Requested tasks per node     :
Requested CPUs per task          : 2
Scheduling priority              : 0
compiling laplaceparallel.c to laplaceparallel.exe
using 2 OpenMP threads
----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
----------------------------------------
Number of iterations it went through: 100000
 Time taken : 163.311403
----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
----------------------------------------
Number of iterations it went through: 100000
 Time taken : 150.457413
----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
```

```
Number of iterations it went through: 100000
 Time taken : 150.457413
----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
----------------------------------------
Number of iterations it went through: 100000
 Time taken : 144.438354
[sgnkunna@login1[barkla] ~]$
```

4 CORES

```
sgnkunna@login1:~
[sgnkunna@login1[barkla] ~]$ cat slurm-38974567.out
Node list                        : node060
Number of nodes allocated        : 1 or 1
Number of threads or processes            :
Number of processes per node : 1
Requested tasks per node     :
Requested CPUs per task          : 4
Scheduling priority              : 0
compiling laplaceparallel.c to laplaceparallel.exe
using 4 OpenMP threads
----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
----------------------------------------
Number of iterations it went through: 100000
 Time taken : 159.948727
----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
----------------------------------------
Number of iterations it went through: 100000
 Time taken : 159.289710
----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
```

```
Number of iterations it went through: 100000
 Time taken : 159.289710
-----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
-----------------------------------------
Number of iterations it went through: 100000
 Time taken : 151.049111
[sgnkunna@login1[barkla] ~]$
```

8 CORES

```
[sgnkunna@login1[barkla] ~]$ cat slurm-38974568.out
Node list                 : node060
Number of nodes allocated  : 1 or 1
Number of threads or processes       :
Number of processes per node : 1
Requested tasks per node   :
Requested CPUs per task    : 8
Scheduling priority        : 0
compiling laplaceparallel.c to laplaceparallel.exe
using 8 OpenMP threads
-----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
-----------------------------------------
Number of iterations it went through: 100000
 Time taken : 147.759796
-----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
-----------------------------------------
Number of iterations it went through: 100000
 Time taken : 167.649660
-----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
```

```
-----------------------------------------
Number of iterations it went through: 100000
 Time taken : 167.649660
-----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
-----------------------------------------
Number of iterations it went through: 100000
 Time taken : 149.736113
[sgnkunna@login1[barkla] ~]$
```

16 CORES

```
[sgnkunna@login1[barkla] ~]$ cat slurm-38974569.out
Node list            : node060
Number of nodes allocated   : 1 or 1
Number of threads or processes        :
Number of processes per node : 1
Requested tasks per node    :
Requested CPUs per task     : 16
Scheduling priority         : 0
compiling laplaceparallel.c to laplaceparallel.exe
using 16 OpenMP threads
----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
----------------------------------------
Number of iterations it went through: 100000
 Time taken : 148.457595
----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
----------------------------------------
Number of iterations it went through: 100000
 Time taken : 149.451124
----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
```

```
Number of iterations it went through: 100000
 Time taken : 149.451124
----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
----------------------------------------
Number of iterations it went through: 100000
 Time taken : 146.661355
[sgnkunna@login1[barkla] ~]$
```

32 CORES

```
Select sgnkunna@login1:~
[sgnkunna@login1[barkla] ~]$ cat slurm-38974570.out
Node list            : node060
Number of nodes allocated   : 1 or 1
Number of threads or processes        :
Number of processes per node : 1
Requested tasks per node    :
Requested CPUs per task     : 32
Scheduling priority         : 0
compiling laplaceparallel.c to laplaceparallel.exe
using 32 OpenMP threads
----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
----------------------------------------
Number of iterations it went through: 100000
 Time taken : 121.088827
----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
----------------------------------------
Number of iterations it went through: 100000
 Time taken : 124.977086
----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
```

```
-----------------------------------------
Number of iterations it went through: 100000
 Time taken : 124.977086
-----------------------------------------
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.04   10.26   11.39   15.67   27.88   54.99   100.00
10.00   10.03   10.23   11.20   14.83   24.98   47.74   100.00
10.00   10.02   10.15   10.76   12.92   18.28   26.15   10.00
10.00   10.01   10.06   10.32   11.17   12.87   13.86   10.00
10.00   10.00   10.00   10.00   10.00   10.00   10.00   10.00
-----------------------------------------
Number of iterations it went through: 100000
 Time taken : 124.681408
[sgnkunna@login1[barkla] ~]$
```