UMT Test Problem Set

Version 1.0

For the definition of terms such as SNCS, see the Sequoia Benchmark Glossary on the Sequoia Benchmark Web site.

Single CPU

Set 1 S6, G = {1, 16, 64, 96}, zones = $13 \times 13 \times 13$, subdivision = 10%

Set 2 G = 1, {S6, S12, S16}, zones = $13 \times 13 \times 13$, subdivision = 10%

Set 3 S12, G = 16, zones = $13 \times 13 \times 13$, subdivision = 10%

Set 4 S12, G = 16, zones = $N \times N \times N$, {N = 15, 20, … by 5 up to the largest size that can be run on the benchmarks system}, subdivision = 10%

Run A Vendor choice to maximize the figure of merit*, {S6 or S12 or S16}, $G \leq 96$, zones = $N \times N \times N$ with N = anything, subdivision = 10%

Single Node

Set 5 **MPI strong scaling**

S12, G = 16, number of zones per MPI task and the CMG mesh-block layout is defined below, subdivision = 10%. Run all cases listed below up to and including $N_{MPI} = N_{C/Node}$.

MPI	SMS	Zones
1	1, 1, 1,	18, 20, 21
2	1, 2, 1,	18, 10, 21
3	1, 1, 3,	18, 20, 7
4	2, 2, 1,	9, 10, 21
5	1, 5, 1,	18, 4, 21
6	1, 2, 3,	18, 10, 7
7	1, 1, 7,	18, 20, 3
8	2, 4, 1,	9, 5, 21
9	3, 1, 3,	6, 20, 7
10	2, 5, 1,	9, 4, 21
12	2, 2, 3,	9, 10, 7
14	1, 2, 7,	18, 10, 3
15	1, 5, 3,	18, 4, 7
16	2, 4, 2,	9, 5, 10

Set 6 **MPI weak scaling**

S12, G = 16, number of zones per MPI task =

$\left\lfloor \frac{18}{\sqrt[3]{N_{C/Node}}} \right\rfloor \times \left\lfloor \frac{20}{\sqrt[3]{N_{C/Node}}} \right\rfloor \times \left\lfloor \frac{21}{\sqrt[3]{N_{C/Node}}} \right\rfloor$ where [] denotes integer truncation. Run with all values of $N_{MPI} \leq N_{C/Node}$, while holding the number of zones per MPI process constant.

Example: if $N_{C/Node}$ = 8, then do eight runs, with zones = 9, 10, 10, and

MPI	SMS
1	1, 1, 1
2	1, 2, 1
3	1, 1, 3
4	2, 2, 1
5	1, 5, 1
6	1, 2, 3
7	1, 1, 7
8	2, 4, 1

Set 7 **OpenMP strong scaling**

S12, G = 16, zones /node = $18 \times 20 \times 21$, subdivision = 10%. Run with all values of $N_{OMP} \leq N_{C/Node}$ and $N_{OMP} = 2*N_{C/Node}$, holding the number of zones on the node constant.

Example: if $N_{C/Node}$ = 4, then do five runs, with

MPI	OMP
1	1
1	2
1	3
1	4
1	8

Set 8 **Mixed OpenMP and MPI scaling**

S12, G = 16, zones/node and CMG SMS defined as above in Set 5 for the given value of N_{MPI}, subdivision = 10%. All variations of N_{MPI} and N_{OMP} such that $N_{MPI} \times N_{OMP} = N_{C/Node}$.

Example: if $N_{C/Node}$ = 8, then do four runs, with

MPI	OMP	SMS	Zones
1	8	1, 1, 1,	18, 20, 21
2	4	1, 2, 1,	18, 10, 21
4	2	2, 2, 1,	9, 10, 21
8	1	2, 4, 1,	9, 5, 21

Multiple Nodes

Set 9 S12, G = 16, zones/node = 13x13x13 subdivision = 10%

$N_{OMP} = N_{C/Node}, (N_{C/Node} - 1)$

N_{MPI} tasks per node ≤ (Memory/Node) / 2 GB or 1, whichever is greater

N_{MPI} = SNCS

Run B Vendor choice to maximize the figure of merit[1], {S6 or S12}, G =32, zones /node = $N \times N \times N$ with N = {11 and 15}, subdivision = 10%

N_{MPI} tasks per node ≤ (Memory/Node) / 2 GB or 1, whichever is greater

N_{OMP} threads per MPI task ≥ $N_{C/Node}$ / N_{MPI}

Run on all nodes of the benchmark system

Run C S12, G = 16, zones /node = 13 × 13 × 13, subdivision = 10%

N_{MPI} tasks per node ≤ (Memory/Node) / 2 GB or 1, whichever is greater

N_{OMP} threads per MPI task ≥ $N_{C/Node}$ / N_{MPI}

Run on all nodes of the benchmark system

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[1] Figure of merit = (Corners × Angles × Groups × (sum over time steps of inner iterations) / Time (seconds)) × [a scale factor yet to be specified].

Note: This number is printed out at the end of a run.