CS 475/575 -- Spring Quarter 2022
Project #2
Numeric Integration with OpenMP Reduction
100 Points
Due: April 26

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This is my first time using bonus day

1. Tell what machine you ran this on
   Answer:
   I run the program on flip2 of MobaXterm

2. What do you think the actual volume is?
   I run the 1and 4 NUMT and 1000 NUMNODE, I think the actual volume is around 7.76

```
[paoh@flip1 ~/CS575-1$] ./montecarlo
1 NUMT ; 1000 NUMNODES ; volume =   7.76 ; megaHeights/sec =   3.62
```

```
[paoh@flip1 ~/CS575-1$] ./montecarlo
4 NUMT ; 1000 NUMNODES ; volume =   7.76 ; megaHeights/sec =   3.68
```

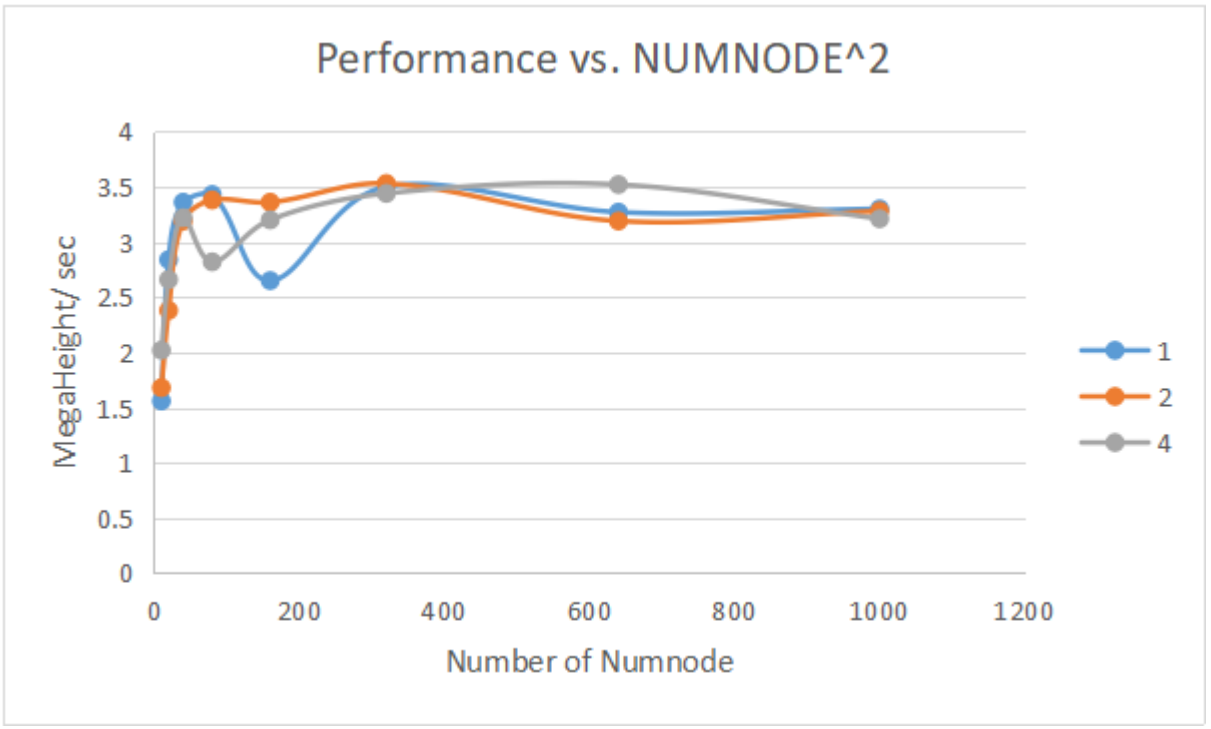
```
[paoh@flip1 ~/CS575-1$] . loop.sh
NUMT = 1
1 NUMT ; 10 NUMNODES ; volume =   7.64 ; megaHeights/sec =   1.56
1 NUMT ; 20 NUMNODES ; volume =   7.74 ; megaHeights/sec =   2.84
1 NUMT ; 40 NUMNODES ; volume =   7.75 ; megaHeights/sec =   3.36
1 NUMT ; 80 NUMNODES ; volume =   7.76 ; megaHeights/sec =   3.43
1 NUMT ; 160 NUMNODES ; volume =   7.76 ; megaHeights/sec =   2.65
1 NUMT ; 320 NUMNODES ; volume =   7.76 ; megaHeights/sec =   3.50
1 NUMT ; 640 NUMNODES ; volume =   7.76 ; megaHeights/sec =   3.27
1 NUMT ; 1000 NUMNODES ; volume =   7.76 ; megaHeights/sec =   3.30
NUMT = 2
2 NUMT ; 10 NUMNODES ; volume =   7.64 ; megaHeights/sec =   1.68
2 NUMT ; 20 NUMNODES ; volume =   7.74 ; megaHeights/sec =   2.38
2 NUMT ; 40 NUMNODES ; volume =   7.75 ; megaHeights/sec =   3.19
2 NUMT ; 80 NUMNODES ; volume =   7.76 ; megaHeights/sec =   3.38
2 NUMT ; 160 NUMNODES ; volume =   7.76 ; megaHeights/sec =   3.36
2 NUMT ; 320 NUMNODES ; volume =   7.76 ; megaHeights/sec =   3.53
2 NUMT ; 640 NUMNODES ; volume =   7.76 ; megaHeights/sec =   3.19
2 NUMT ; 1000 NUMNODES ; volume =   7.76 ; megaHeights/sec =   3.28
NUMT = 4
4 NUMT ; 10 NUMNODES ; volume =   7.64 ; megaHeights/sec =   2.02
4 NUMT ; 20 NUMNODES ; volume =   7.74 ; megaHeights/sec =   2.66
4 NUMT ; 40 NUMNODES ; volume =   7.75 ; megaHeights/sec =   3.22
4 NUMT ; 80 NUMNODES ; volume =   7.76 ; megaHeights/sec =   2.82
4 NUMT ; 160 NUMNODES ; volume =   7.76 ; megaHeights/sec =   3.20
4 NUMT ; 320 NUMNODES ; volume =   7.76 ; megaHeights/sec =   3.44
4 NUMT ; 640 NUMNODES ; volume =   7.76 ; megaHeights/sec =   3.52
4 NUMT ; 1000 NUMNODES ; volume =   7.76 ; megaHeights/sec =   3.21
```

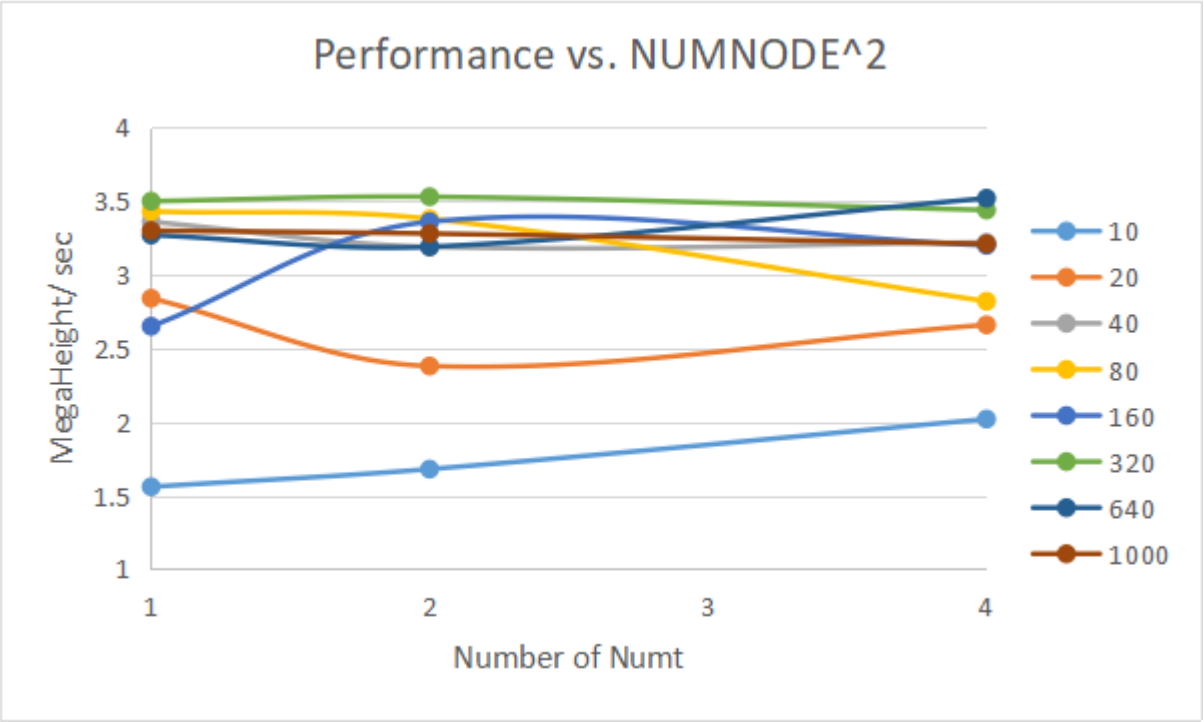
3. Show the performances you achieved in tables and two graphs showing:

   a. Performance as a function of NUMNODES with colored lines showing different NUMT values

b. Performance as a function of NUMT with colored lines showing different NUMNODES values(See the example in the Project Notes.)

	A	B	C	D	E	F	G	H	I	J
1	SUM of MegaHe	NUMNODES								
2	NUMT	10	20	40	80	160	320	640	1000	Grand Total
3	1	1.56	2.84	3.36	3.43	2.65	3.5	3.27	3.3	23.91
4	2	1.68	2.38	3.19	3.38	3.36	3.53	3.19	3.28	23.99
5	4	2.02	2.66	3.22	2.82	3.2	3.44	3.52	3.21	24.09
6	**Grand Total**	**5.26**	**7.88**	**9.77**	**9.63**	**9.21**	**10.47**	**9.98**	**9.79**	**71.99**





4. What patterns are you seeing in the speeds?
   Answer:
   Although it's not obvious, I see from the graph that as NUMNODE increases, the performance of NUMT also increases.

5. Why do you think it is behaving this way?
   Answer:
   The reason for this factor I think is because the program takes longer to calculate the volume of the tiles, as the floor area increases with the Numnodes².

6. What is the Parallel Fraction for this application, using the Inverse Amdahl equation?
   Answer:
   Fp = (4./3.)*(1. - (1./S))
   Fp = 4/3 * (1.-(1./3.68/3.62))
   = 4/3 * (1.-(1./1.01657459))

   ≈ 0.0217392

7. Given that Parallel Fraction, what is the maximum speed-up you could ever get?
   Answer:
   1/(1- (P/100))
   = 1/(1- (P/100))