HW5

1. TASK 1: PING PONG LATENCY

Summary:

I have used 1000 iterations of ping-pong loop to get accurate timings. Finally ran the code for 16 data points with data following message_length(L) in bytes: `0, 100, 1000, 10000, 100000, 500000, 1000000, 2000000, 3000000, 4000000, 5000000, 6000000, 7000000, 8000000, 9000000, 10000000.` The code calculates total timing Tmsg for all the above mentioned data points.

To calculate T_s, I simply used the value of Tmsg for message_length(L) =0.
To calculate T_w, I am using mean of T_w value for all the 16 data points.

T_s = 0.007997999 sec
T_w = 0.00005823312 sec

Loop Iterations used:

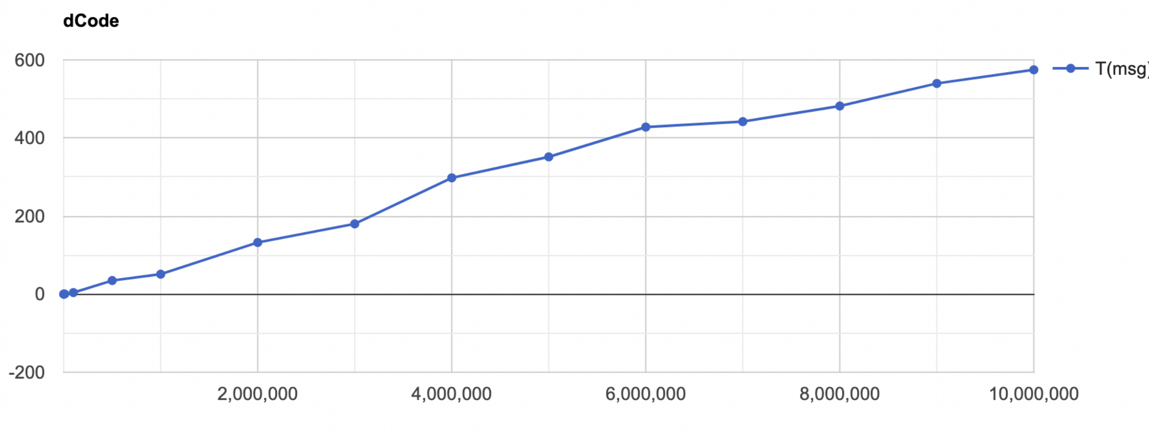
1000

Data Points:

Data Points	X Axis -> Message Length(L)	Y Axis -> T_{msg}
1	0	0.007997999
2	100	0.013313002
3	1000	0.048486501
4	10000	0.363008
5	100000	4.0599218
6	500000	34.8613816
7	1000000	51.0772118

8	2000000	132.3538463
9	3000000	179.9873296
10	4000000	297.8985994
11	5000000	351.6244534
12	6000000	427.94704218
13	7000000	441.8691686
14	8000000	481.82289031
15	9000000	539.689148131
16	10000000	574.63355542

Graph:



NOTE: X axis denotes Message length(L) in bytes, and Y axis denotes T_{msg} in seconds

Calculation for T_s:

- For L=0, $T_{msg} = T_s$
- From above data points, T_{msg} for L=0 is 0.007997999 sec
- Therefore, $T_s = 0.007997999$ sec

Calculation for T_w:

- For any data point (L, T_{msg})

$T_{msg} = T_s + T_w * L$

$\Rightarrow T_w = (T_{msg} - T_s)/L$

Data Points	**X Axis -> Message Length(L)**	**Y Axis -> T_{msg}**	**$(T_{msg} - T_s)/L$**
1	0	0.007997999	
2	100	0.013313002	0.0000531500200000000710
3	1000	0.048486501	0.0000404885009999998279
4	10000	0.363008	0.0000355009999999999597
5	100000	4.0599218	0.0000405192379999998407
6	500000	34.8613816	0.0000697067672000000078
7	1000000	51.0772118	0.0000510692137999999689
8	2000000	132.3538463	0.0000661729241500000206
9	3000000	179.9873296	0.0000599931105333333151
10	4000000	297.8985994	0.0000744726503499999889
11	5000000	351.6244534	0.00007032329
12	6000000	427.94704218	0.00007132317
13	7000000	441.8691686	0.00006312302437142862 4
14	8000000	481.82289031	0.00006022686
15	9000000	539.689148131	0.0000599645722367777787 9
16	10000000	574.63355542	0.0000574625557420000090
SUM -> $\sum_{n=1}^{15} (T_{msg} - T_s)/L$			0.00087349689

- Now, we will take mean of all the values for all data points m to get most accurate value for T_w, i,e,

$$T_w = \left(\sum_{n=1}^{m} (T_{msg} - T_s)/L \right) \div m$$

$$T_w = \left(\sum_{n=1}^{15} (T_{msg} - T_s)/L \right) \div m$$

$$T_w = \left(\sum_{n=1}^{15} (T_{msg} - T_s)/L \right) \div 15$$

$$T_w = \left(\sum_{n=1}^{m} (T_{msg} - T_s)/L \right) \div 15$$

$$T_w = 0.00087349689 \div 15$$

T_w = 0.00005823312 sec

2. TASK 2: FINITE-DIFFERENCE FOR 2D DATA DECOMPOSITION

Assume

- Dimentions = $Nx \times Ny \times Nz$**,** where Nx **=** Ny **=** N for simplicity

- 9-point stencil

- Number of processes = *P*