Scientific Computing Assignment 1

120555A
M.R.M.J. Sally

Q1 :

(a)

Based on the equation : $\pi = 4\,arctan(1)$ the problem of finding π is broken into small pieces so that we can add them up and calculate the π iteratively (numerically). To do that it has taken the integration of $\frac{d}{dx}arctan(1)$ which means in another way, $\int_0^1 \frac{1}{1+x^2}dx$. Therefore we calculate this integration as a summation of small *steps* as defined in the program.

(h) The calculated values rounded.

# Trials	SP/ DP		CPU Sequential [curand]	CPU Parallel [curand] (T = #Threads)			GPU			
				T=2	T=4	T=8	mystery	myrand	curand	curand-thrust
2^{24}	SP	PI Estimate	3.154	3.14142	3.1415	3.1416	6.0693	3.1442	3.1416	3.1411
		Error	$1.2x10^{-2}$	$-1.7x10^{-5}$	-10^{-5}	$3x10^{-5}$	2.928	$2.66x10^{-3}$	$-1.1x10^{-5}$	$-4.9x10^{-5}$
		Time (ms)	1008.763	18898.7	16474	87200	389.651	7.261000	20.801	22.342
	DP	PI Estimate	4.159	3.1428	3.1411	3.1416	3.1416	3.1443	3.1416	3.1411
		Error	1.017	$1.23x10^{-3}$	$-5.27x10^{-4}$	$-1.7x10^{-5}$	0.000	0.002657	$-1.1x10^{-}$	$-4.97x10^{-4}$
		Time (ms)	983.899	17913.0	13176	78558	20.911	6.976	32.337	26.22
2^{26}	SP	PI Estimate	3.930	3.14470	3.1417	3.1411	5.29940	3.139517	3.14158	3.1412
		Error	0.789	0.00311	$6x10^{-5}$	$-4.85x10^{-4}$	2.15781	$-2.076x10^{-4}$	$-1.1x10^{-5}$	$-3.888x10^{-4}$
		Time (ms)	4010.676	75143.8	62626	346955	389.689	15.846	36.225	22.285
	DP	PI Estimate	4.181	3.142	3.1418	3.1409	3.14159	3.139517	3.14158	3.1412
		Error	1.039395	$4.11x10^{-4}$	$2.5x10^{-4}$	$-6.51x10^{-4}$	$-1x10^{-6}$	$-2.076x10^{-3}$	$-1.1x10^{-5}$	$-3.9x10^{-4}$
		Time (ms)	3860.34	69661.3	66930	342542	83.268	19.177	34.472	26.448
2^{28}	SP	PI Estimate	4.124136	3.14150	3.1416	3.1410	3.14111	3.141507	3.14158	3.14143
		Error	0.982544	$-9.1x10^{-5}$	$-3x10^{-5}$	-1.1416	$-4.76x10^{-4}$	$-8.5x10^{-5}$	$-1.7x10^{-5}$	$-1.65x10^{-4}$
		Time (ms)	15978.45	62247.7	261909	1384583	389.712	55.44200	46.507	27.859

	DP	PI Estimate	4.186888	3.14157	3.1414	3.1410	3.14159	3.141507	3.14158	3.14143
		Error	1.045295	-2.5×10^{-5}	-2.08×10^{-4}	-5.71×10^{-4}	-3×10^{-6}	-8.5×10^{-5}	1.266×10^{-5}	-1.65×10^{-4}
		Time	15337.37	54100.8	194655	1491840	332.178	68.026	33.899	34.752

Q2 :

N	SP/ DP	CPU Sequential	CPU Parallel (T = #Threads)			GPU
			T=2	T=4	T=8	
10^8	SP	175.328995	236.576004	360.9220	796.629	1511.704956
	DP	210.415009	328.725006	694.466	1494.867	237.623001
5×10^8	SP	919.973999	1050.94006	1748.733	3805.134	291.913
	DP	1093.2970	1607.597	3533.235	7086.545	295.367
10^9	SP	2287.449	2015.563	3102.39	5204.311	508.571
	DP	11620.63	3608.49682	6750.644	13391.015	550.249

Q3 :
Tiling approach of Matrices is used for GPU Computation.

NxN	SP/ DP	CPU Sequential	CPU Parallel (T = #Threads)			GPU
			T=2	T=4	T=8	
600	SP	481.833	915.36	1086.19	1386.92	20.951
	DP	499.894	987.108	1063.69	1137.57	21.525
1200	SP	21065.8	23261.7	23882.3	24818	103.887
	DP	22531.1	15779	24716.5	25954.7	161.796
1800	SP	34918.9	14484.6	15143.2	17282.4	323.239
	DP	46714.9	25884.2	24383.5	27092.7	525.672

Students Who helped me in the assignment
K.R.V. Perera, Yasiru Kassapa, Tharindu De Silva, Thilina Piyadasun.