Jonathon Davis

Scott Source

Project 1

Program Overview:

The program can be created by running the following command

Make all

The console version of the program is run when calling the main method in Body.class

Java Body numThreads numBodies radius mass maxIterations

numThreads (int): is the number of threads that will be run in the program

numBodies (int): is the number of bodies that will be created for the simulation

radius (int) or (min-max): is the radius of each object, can be a number or range,

mass (int) or (min-max): is the mass of each object, can be a number or a range

maxIterations (long): The number of calculations the simulation will preform

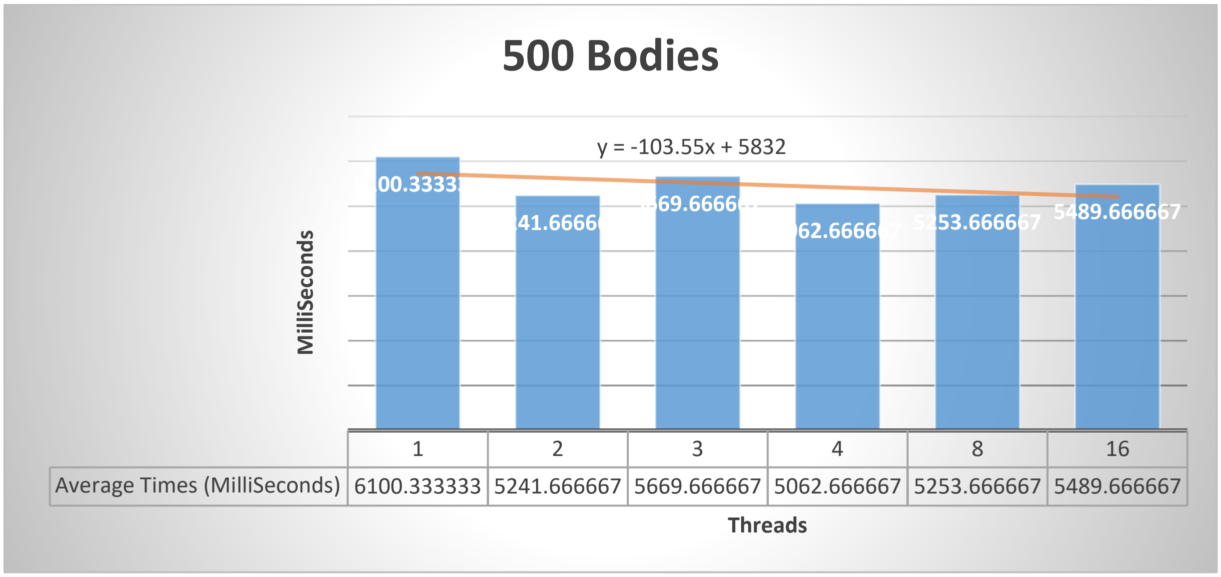
The GUI version of the program can be run when calling the main method in GUI.class

The gui will pop up a window asking for the arguments, if the window is closed a new simulation can be ran by going to Settings->New Simulation

Program Summery:

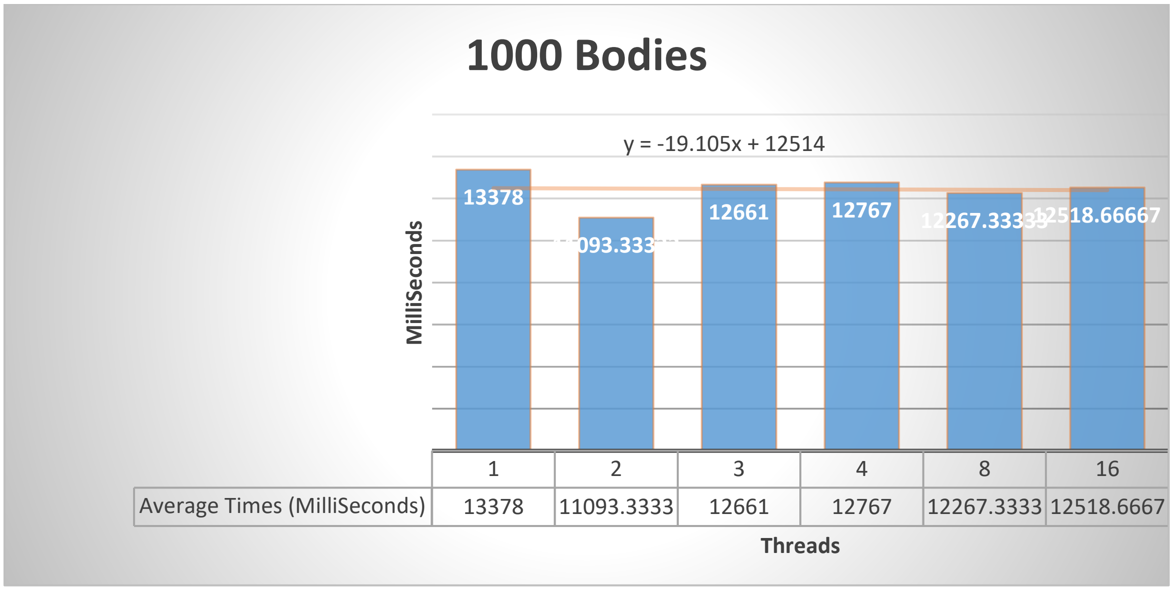
The program is a simulation of multiple bodies of different sizes, masses, positions, and velocities interacting in either a console, has two major versions, the parallel and sequential versions of the program. The two versions were created to measure the performance between sequentially executed code, and executing code in parallel. The data showed that the parallel version was on average faster than the sequential. This was the expected result as the work is divided among multiple processors.

The timing tests were conducted on the Cambridge machine with the number of threads being the only difference; for two tests one being 500 bodies (figure 1) and another 1000 bodies (figure 2). The timing starts after all the bodies are created, and ends when the number of iterations inputted is complete. This means that each time the program was run, it was given similar start conditions. The data showed that running the program in parallel is faster than running the program sequentially. However the increase in performance was only around 30% when the number of threads was increased to a total of 2. Then the programs performance began to deteriorate as more threads were created. It is important to note that due to the programs gui, the program technically ran on more than the inputted number of threads, even in the sequential version. This is because the GUI, Simulation, and WorkerThreads each ran in their own thread. For example when the program starts, the main thread will create a thread to handle the GUI, which will create a thread to manage the simulation, which will then create a WorkerThread to actually compute the simulation. Because of these extra threads, the performance of the simulation begins to drop off, even when the number of inputted threads is less than the number of processors. Each test was done three times to find a consistency (see Figure 3). The average of the three tests were used in the graphs of this report.



	1	2	3	4	8	16
Average Times (MilliSeconds)	6100.333333	5241.666667	5669.666667	5062.666667	5253.666667	5489.666667

Figure 1



	1	2	3	4	8	16
Average Times (MilliSeconds)	13378	11093.3333	12661	12767	12267.3333	12518.6667

Figure 2

Iterations	Size (radius)	Mass	Threads	DeltaT	TimeEnd (Total Time) milliseconds	Bodies
100	100	100	1	0.5	15703	1000
100	100	100	1	0.5	11080	1000
100	100	100	1	0.5	13351	1000
				Average	**13378**	
100	100	100	1	0.5	5896	500
100	100	100	1	0.5	5985	500
100	100	100	1	0.5	6420	500
				Average	**6100.333333**	
100	100	100	2	0.5	11971	1000
100	100	100	2	0.5	10727	1000
100	100	100	2	0.5	10582	1000
				Average	**11093.33333**	
100	100	100	2	0.5	5623	500
100	100	100	2	0.5	4586	500
100	100	100	2	0.5	5516	500
				Average	**5241.666667**	
100	100	100	3	0.5	12319	1000
100	100	100	3	0.5	13559	1000
100	100	100	3	0.5	12105	1000
				Average	**12661**	
100	100	100	3	0.5	6157	500
100	100	100	3	0.5	5223	500
100	100	100	3	0.5	5629	500
				Average	**5669.666667**	
100	100	100	4	0.5	12999	1000
100	100	100	4	0.5	12128	1000
100	100	100	4	0.5	13174	1000
				Average	**12767**	

100	100	100	4	0.5	4836	500
100	100	100	4	0.5	5222	500
100	100	100	4	0.5	5130	500
				Average	**5062.666667**	
100	100	100	8	0.5	12744	1000
100	100	100	8	0.5	11560	1000
100	100	100	8	0.5	12498	1000
				Average	**12267.33333**	
100	100	100	8	0.5	5365	500
100	100	100	8	0.5	5584	500
100	100	100	8	0.5	4812	500
				Average	**5253.666667**	
100	100	100	16	0.5	11950	1000
100	100	100	16	0.5	13477	1000
100	100	100	16	0.5	12129	1000
				Average	**12518.66667**	
100	100	100	16	0.5	6299	500
100	100	100	16	0.5	5351	500
100	100	100	16	0.5	4819	500
				Average	**5489.666667**	

Figure 3

			Average	
1	500	73755	**75599.7**	
1	500	74293		
1	500	78751		
2	500	91827	**91728**	
2	500	92994		
2	500	90363		
3	500	93279	**94174**	
3	500	95361		
3	500	93882		

Figure 4