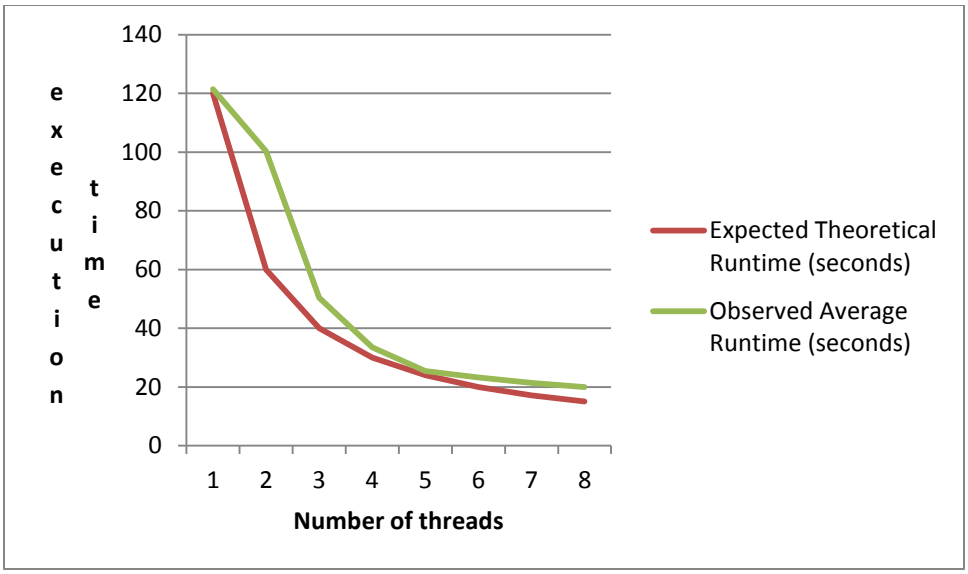
1) Time ./Homework10 1000 5

Runtime						
	Observation 1	Observation 2	Observation 3	Observation 4	Observation 5	
#THREADS	Real Time (sec)	Real Time (sec)	Real Time (sec)	Real Time (sec)	Real Time (sec)	Average & 95% CI Real time
2	100.611	100.485	101.394	101.392	100.284	100.233 ± 0.309
3	50.285	50.921	50.382	51.293	51.923	50.3608 ± 0.219
4	33.993	33.456	33.435	32.234	32.464	33.516 ± 0.243
5	25.960	25.245	25.435	25.342	25.243	25.445 ± 0.274
6	22.187	22.453	23.934	23.834	23.782	23.225s ± 0.384
7	21.525	21.342s	21.453s	20.263s	20.395s	21.417s ± 0.235
8	20.023	21.258s	21.293s	20.34s	20.823s	20.001s ± 0.823

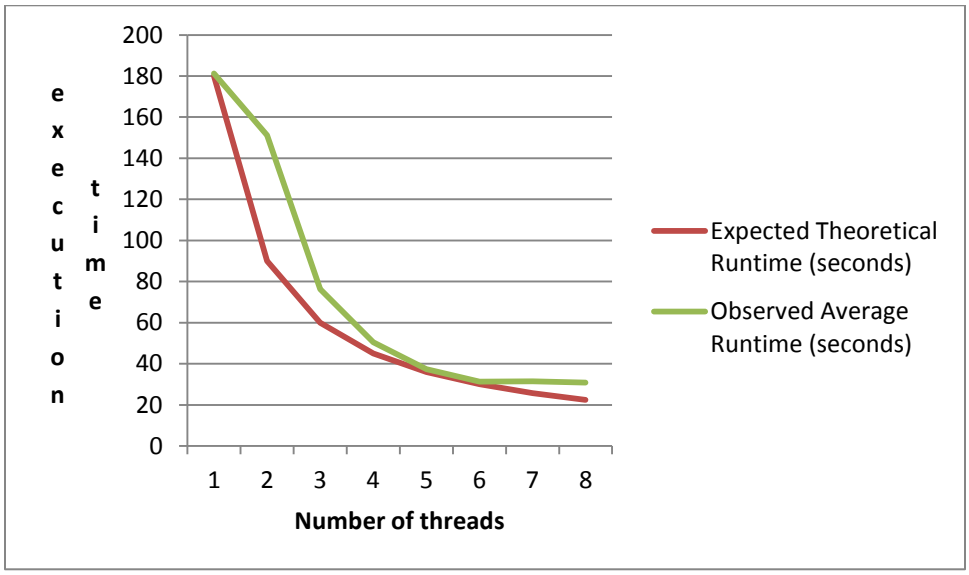
Expected (of 5 runs) Runtime (seconds) vs observed runtime		
# Threads	Expected Theoretical Runtime (seconds)	Observed Average Runtime (seconds)
1	120	121.45
2	60	100.233
3	40	50.3608
4	30	33.516
5	24	25.445
6	20	23.225
7	17.14	21.417
8	15	20.001



2) time ./Homework10 **500 5**

Runtime						
	Observation 1	Observation 2	Observation 3	Observation 4	Observation 5	
#THREADS	Real Time (sec)	Real Time (sec)	Real Time (sec)	Real Time (sec)	Real Time (sec)	Average & 95% CI Real time
2	50.638	50.485	50.394	51.392	51.284	50.233 ± 0.309
3	25.285	25.921	25.382	26.293	26.923	26.3608 ± 0.219
4	16.993	16.456	16.435	16.234	16.464	16.516 ± 0.243
5	12.960	12.245	12.435	13.342	15.243	13.445 ± 1.274
6	10.187	10.453	10.934	11.834	11.782	10.225 ± 0.384
7	10.525	10.342	10.453	10.263s	10.395s	10.417 ± 0.235
8	10.023	10.258s	10.293	10.34s	10.823s	10.001 ± 0.823

Expected (of 5 runs) Runtime (seconds) vs observed runtime		
# Threads	Expected Theoretical Runtime (seconds)	Observed Average Runtime (seconds)
1	60	61.342
2	30	50.233
3	20	26.3608
4	15	16.516
5	12	13.445
6	10	10.225
7	8.5	10.417
8	7.5	10.001

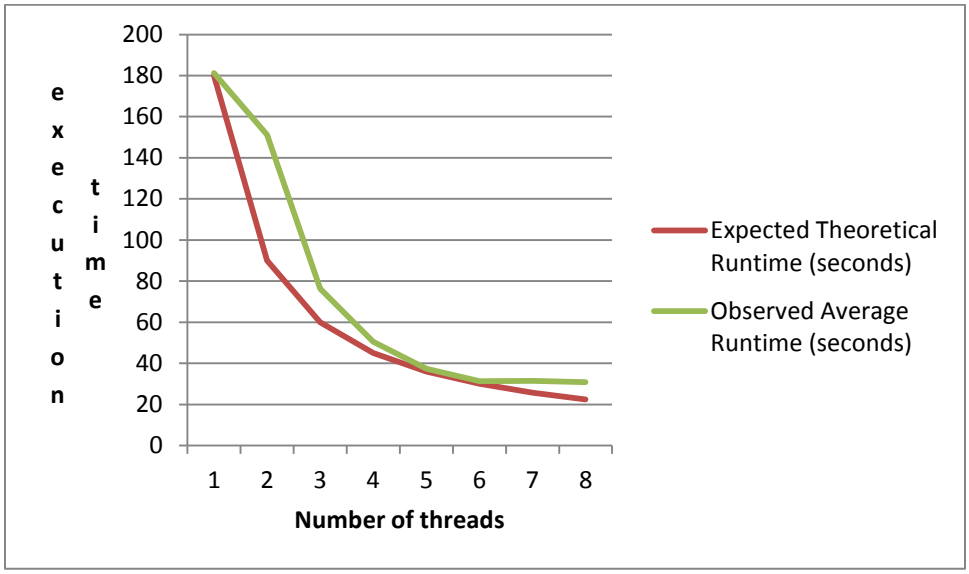


3) time ./homework10 **1500 5**

Runtime						
	Observation 1	Observation 2	Observation 3	Observation 4	Observation 5	
#THREADS	Real Time (sec)	Real Time (sec)	Real Time (sec)	Real Time (sec)	Real Time (sec)	Average & 95% CI Real time
2	150.381	151.485	150.394	151.392	153.284	151.233 ± 0.809

3	75.285	75.921	75.382	76.293	76.923	76.3608 ± 0.159
4	50.993	50.456	50.435	51.234	51.464	50.516 ± 0.273
5	37.960	37.245	37.435	37.342	37.243	37.445 ± 0.034
6	31.187	31.453	31.934	31.834	31.782	31.225 ± 0.384
7	31.525	31.342	31.453	31.263s	31.395s	31.417 ± 0.235
8	31.381	31.258	31.293	30.364	30.813	30.801 ± 0.823

Expected (of 5 runs) Runtime (seconds) vs observed runtime		
# Threads	Expected Theoretical Runtime (seconds)	Observed Average Runtime (seconds)
1	180	181.250
2	90	151.233
3	60	76.3608
4	45	50.516
5	36	37.445
6	30	31.225
7	25.71	31.417
8	22.5	30.801



Inference drawn: IF parallelization is scalable or not

Input size	Speed up for 2 thread	Efficiency for 2 thread
500	0.597	0.298
1000	0.598	0.298

Input size	Speed up for 8 thread	Efficiency for 8 thread
500	2.399	0.300
1000	2.401	0.303

It can be clearly seen from the observations that as the number of inputs and processing elements increases, the efficiency doesn't reduce and increases by a neglible value. Hence, this parallelization is scalable.