Elijah Andrushenko

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Parallel Computing

CPTS 411

Homework 1

1.

i) **Speedup = (n lg n) / ((n/p) lg n + lg p)** Amdahl's Law states Speed up is the ratio of Serial / Parallel.

ii) The Speedup is sublinear. In the table below we plugged in the speedup equation making n = 64 and p = 1, 2, 4, 8, and 16. The speedup is sublinear since for each process the speedup is less than the number of processes.

	1	2	4	8	16
Speedup	1	1.99	3.92	7.52	13.714
Linear	1	2	4	8	16

iii) **Efficiency = (n lg n) / (p * ((n/p) lg n + lg p))** Efficiency equation is Serial / p * Parallel, p being the number of processors.

iv) **Overhead = ((n/p) lg n + lg p) – (n lg n)** as stated in the homework and in Gustafson's Law overhead is Parallel – Serial.

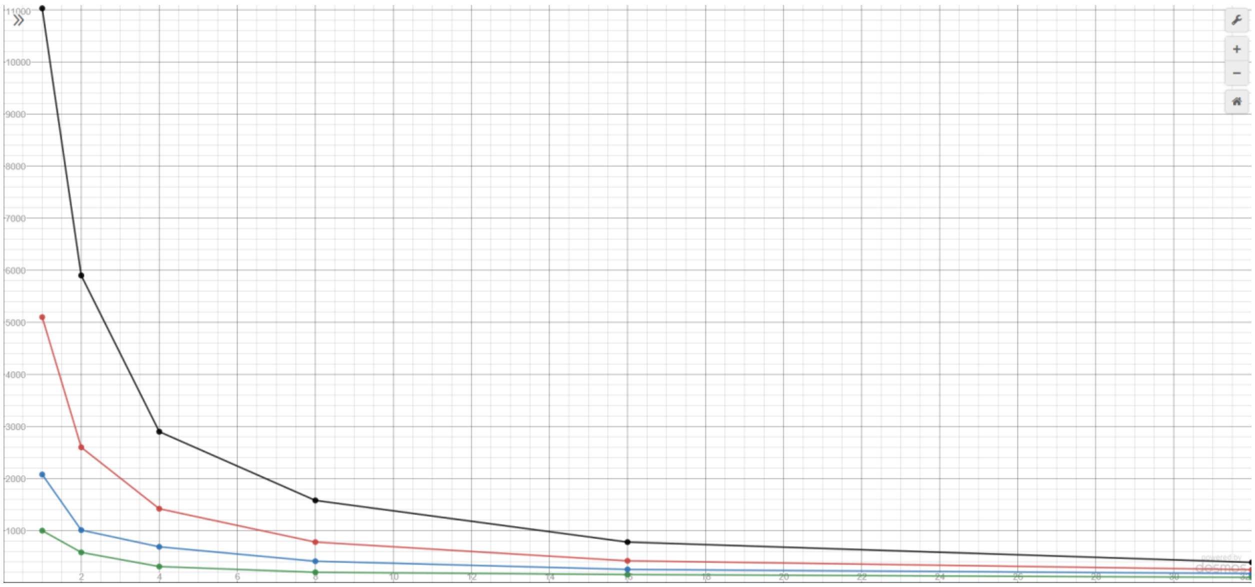
2.

a)

Parallel Runtime –> T(n ,p)

n	1	2	4	8	16	32
64	**1000**	**582**	**310**	**200**	**156**	**102**
128	**2078**	**1010**	**689**	**412**	**255**	**175**
256	**5100**	**2600**	**1420**	**780**	**420**	**250**
512	**11029**	**5900**	**2900**	**1580**	**780**	**390**

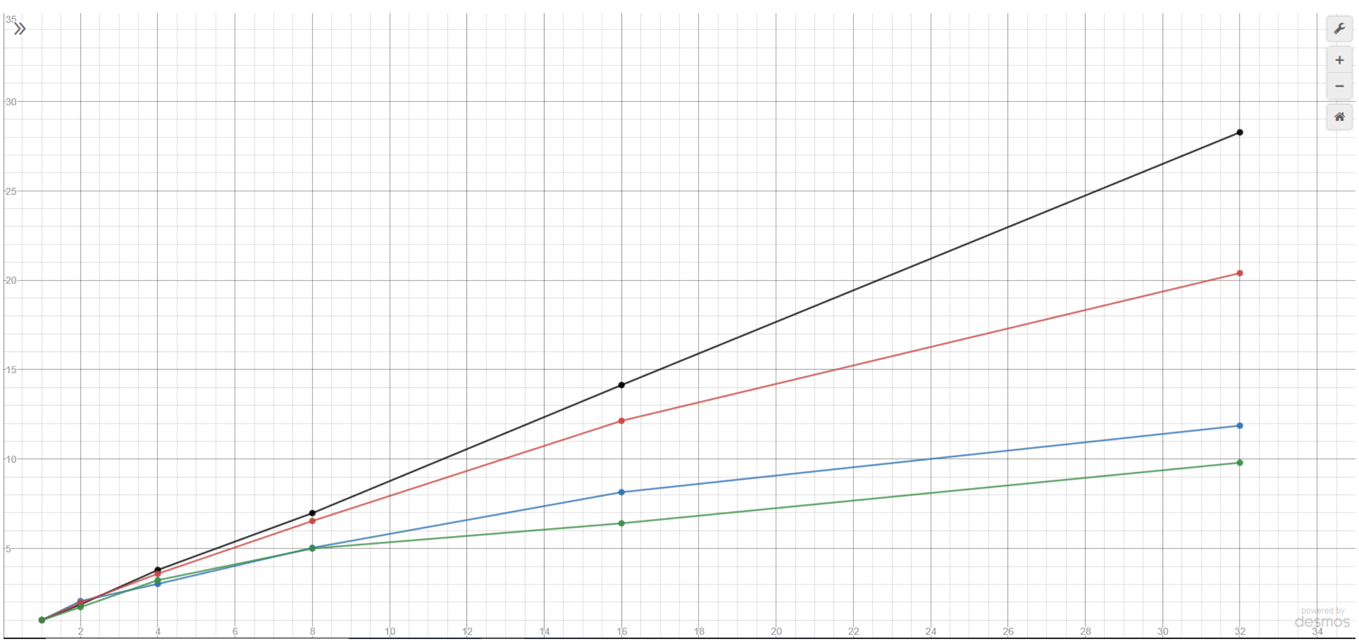
See graph below, there are PNGs saved in the zip file for a better look at the graphs



b)

Speedup -> S(n, P) = T(n, 1) / T(n , p)

n	1	2	4	8	16	32
64	**1**	**1.72**	**3.23**	**5**	**6.41**	**9.80**
128	**1**	**2.06**	**3.02**	**5.04**	**8.15**	**11.87**
256	**1**	**1.96**	**3.59**	**6.54**	**12.14**	**20.4**
512	**1**	**1.87**	**3.80**	**6.98**	**14.14**	**28.27**



c)

Efficiency –> E(n,p) = T(n ,1) / (p * T(n,p))

n	1	2	4	8	16	32
64	**1**	**0.86**	**0.81**	**0.63**	**0.40**	**0.31**
128	**1**	**1.02**	**0.75**	**0.63**	**0.51**	**0.37**
256	**1**	**0.98**	**0.90**	**0.82**	**0.76**	**0.64**
512	**1**	**0.93**	**0.95**	**0.87**	**0.88**	**0.88**