1 Question 1: MPI I/O with a Custom Data Compressor

1.1 a) and b)

Done as instructed and submitted.

1.2 c)

The obtained compression rates when varying the compression tolerance from 0 to 10 in steps of 0.2 are shown in figure 1. The losslessly zipped input file has a compression ratio of $\frac{134.2\text{MB}}{17.4\text{MB}} \approx 7.7$. As figure 1 shows, any compression tolerance ≥ 0.4 achieves a similar or higher compression ratio. This is however at the cost of being lossy by nature due to `zfp` being a lossy compressor.

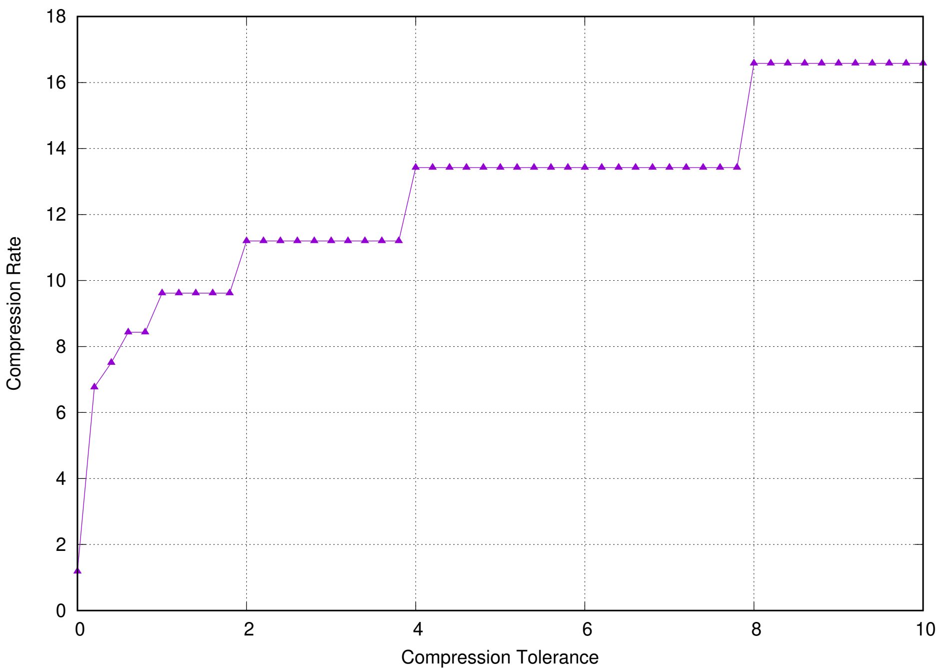

Figure 1: Compression rate vs compression tolerance (number of processes $N = 4$).

2 Question 2: Weak Scaling

2.1 a)

The weak scaling plot for the given data (figure 2) and $N = 1024,\ p = 1$ as baseline reference is shown in figure 3. The plot hints at a weak efficiency of about 85% ($\lim_{p\to\infty} \frac{t_1}{t_p} = E_w \approx 0.85$).

p	runtime [s] $N = 1024$	$N = 2048$	$N = 3072$	$N = 4096$	$N = 5120$
1	2.00	8.02	18.09	32.07	50.07
2	1.09	4.00	9.00	16.04	25.07
3	0.75	2.68	6.08	10.73	16.74
4	0.52	2.13	4.59	8.00	12.50
5	0.49	1.64	3.61	6.43	10.07
9	0.28	0.96	2.25	3.64	5.58
12	0.25	0.70	1.53	2.73	4.25
16	0.13	0.56	1.15	2.27	3.14
20	0.18	0.45	0.97	1.62	2.54
25	0.10	0.38	0.82	1.30	2.30

Figure 2: Given hypothetical data for weak scaling analysis.

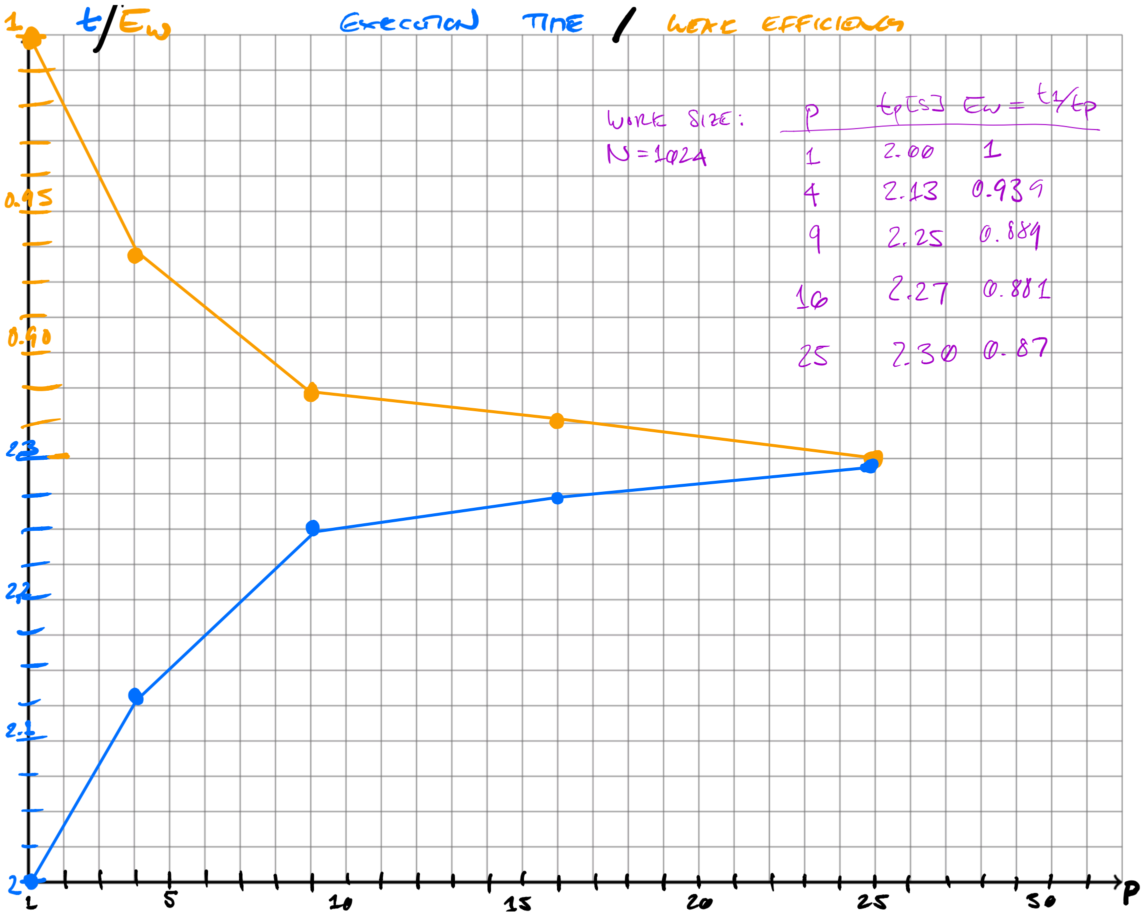

Figure 3: Hypothetical data weak scaling plot for $N = 1024,\ p = 1$ as baseline reference.