Assignment-5

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Q.N.1(a)

Using stability conditions

$$dt = \frac{1}{4 * k_{diff} * (\left(\frac{1}{n}\right)^2 + \left(\frac{1}{n_y}\right)^2)}$$

As specified in the question, nx and ny of 800 and diffusivity(k) to be 1, dt was taken to be 3.8e-7.

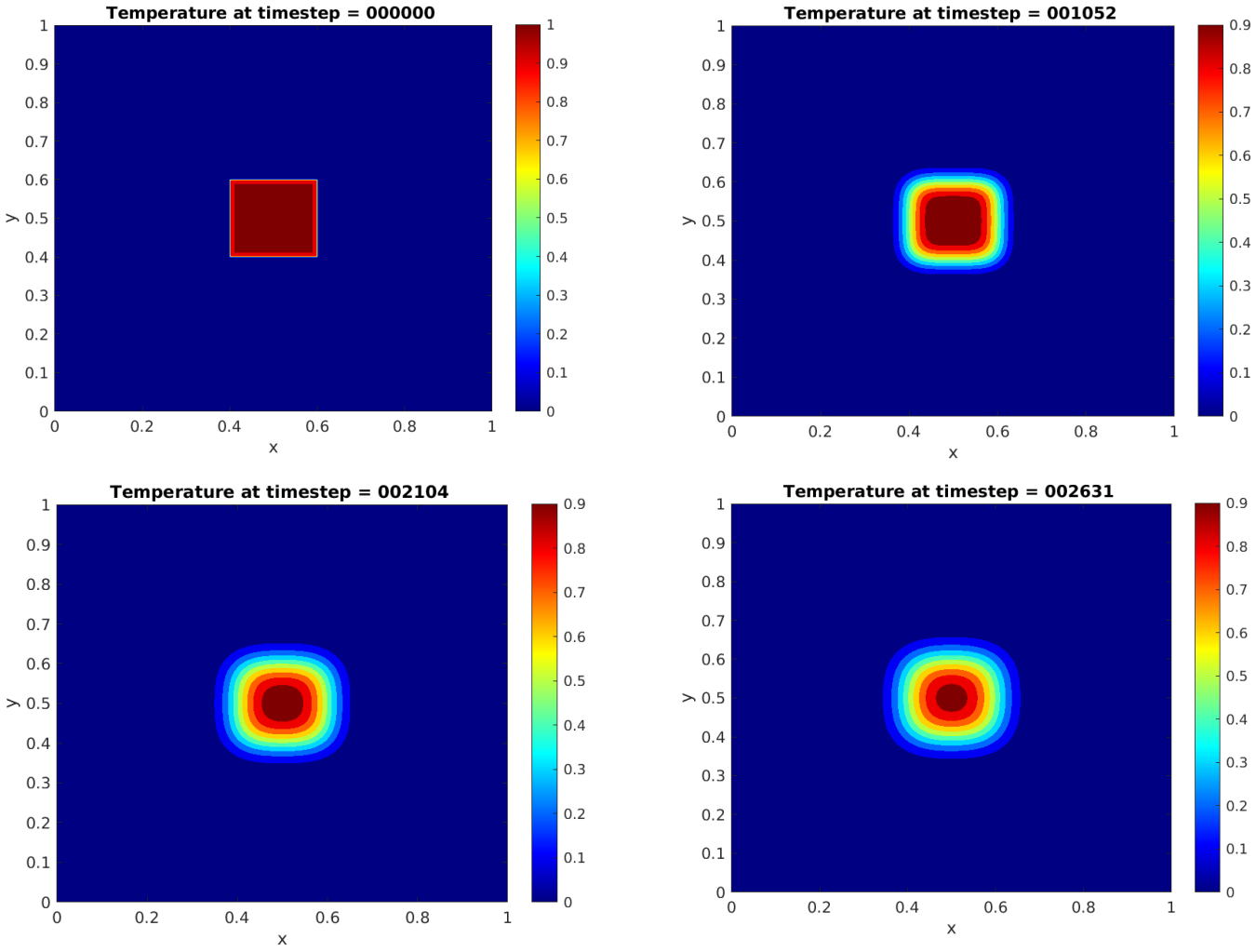

Figure 1. Contour Plots of Temperature Distribution using p=1 (Serial)

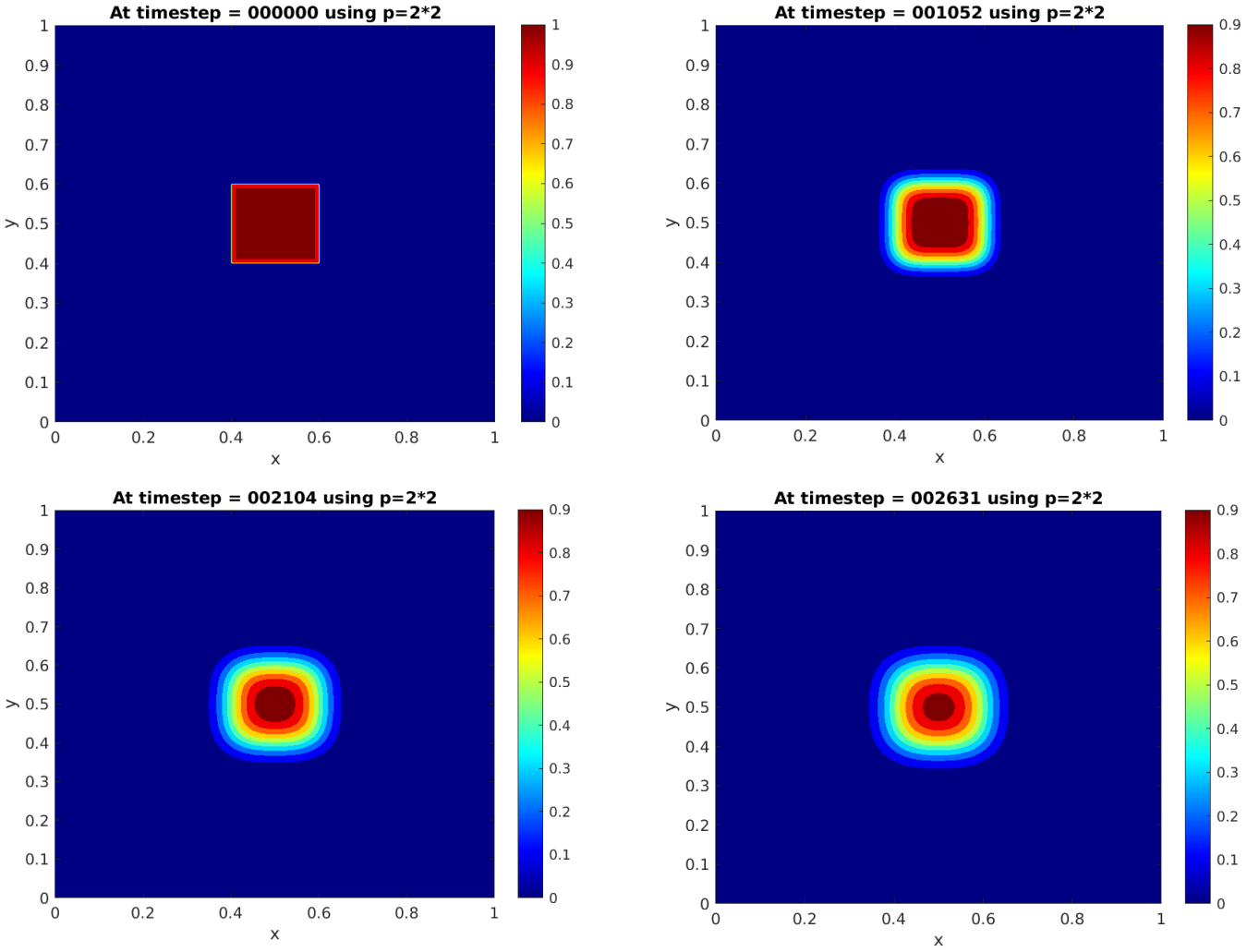

Figure 2. Contour Plots of Temperature Distribution using p=4 (2*2)

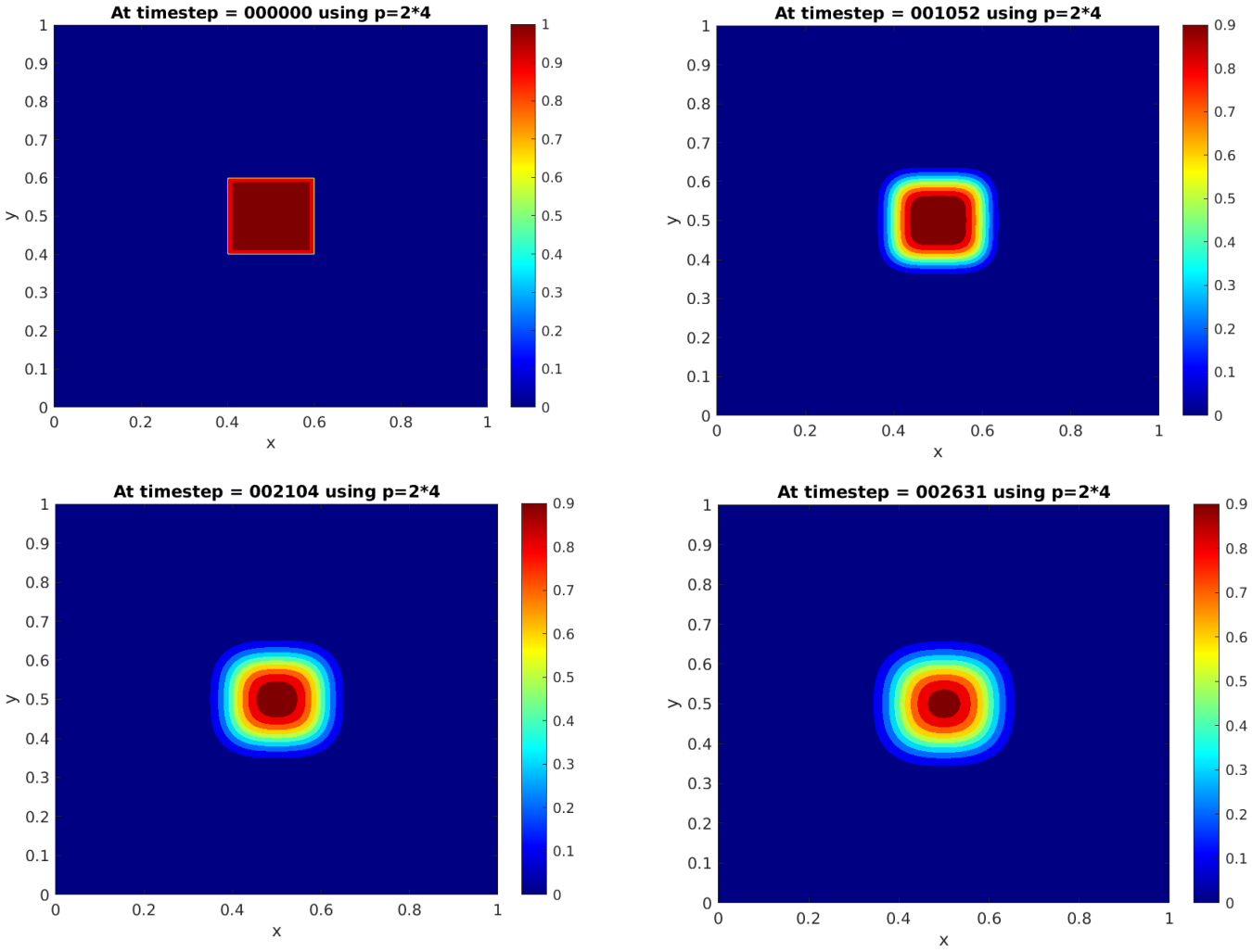

Figure 3. Contour Plots of Temperature Distribution using p=8 (2*4)

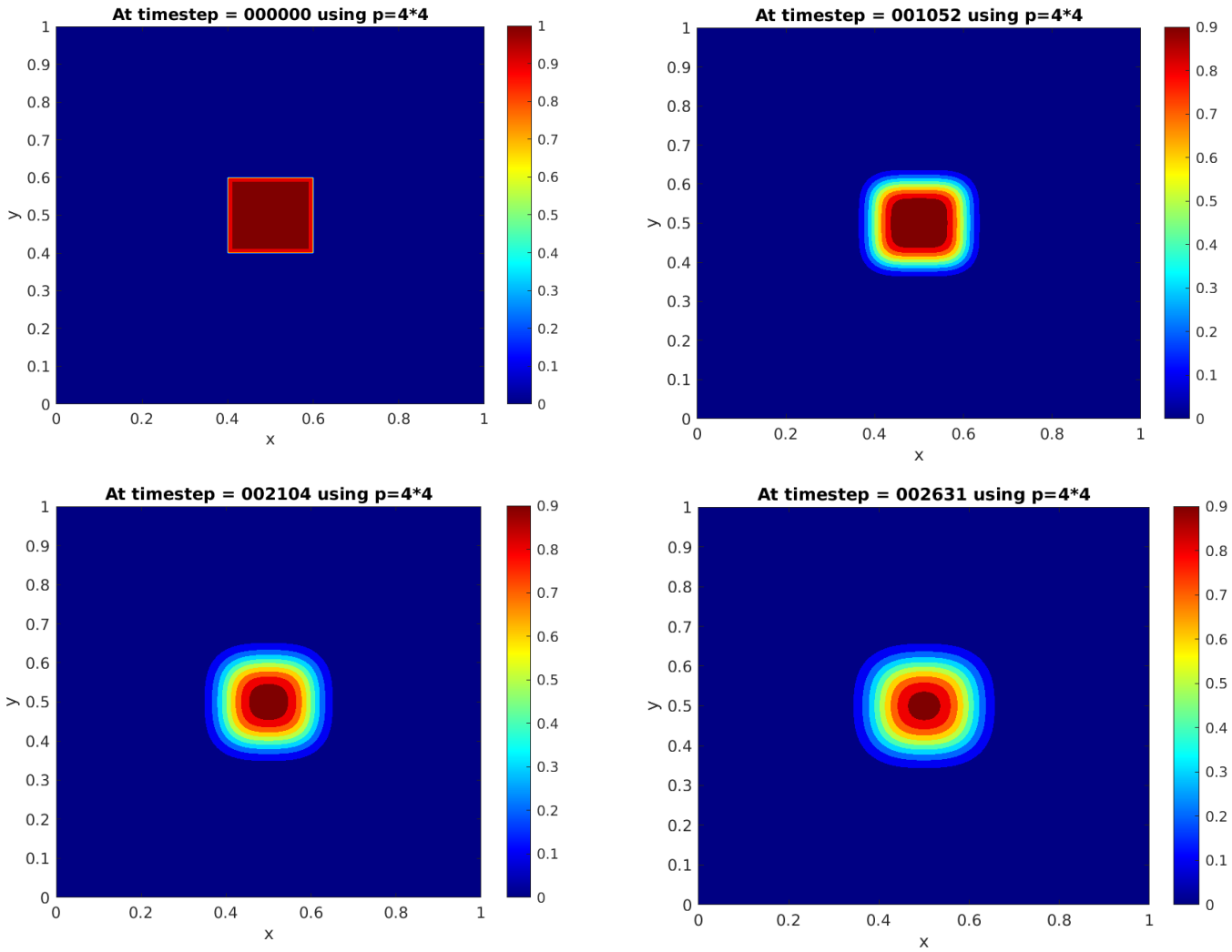

Figure 4. Contour Plots of Temperature Distribution using p=16 (4*4)

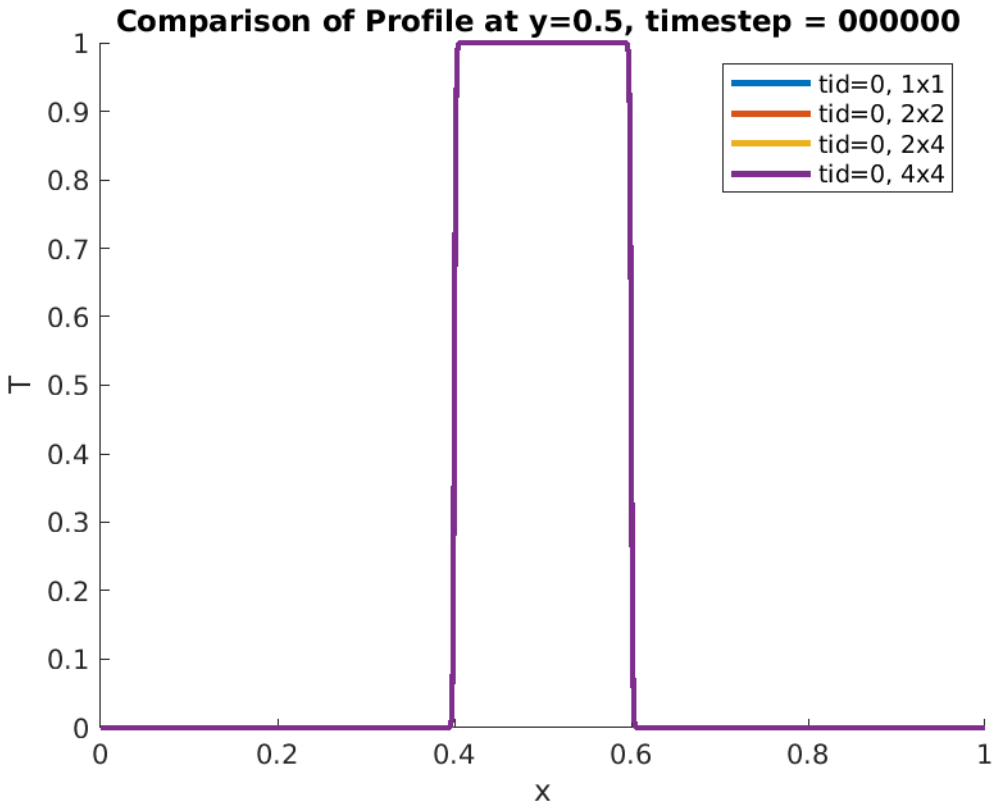

Figure 5. Comparison of profile at y=0.5 at timestep 0

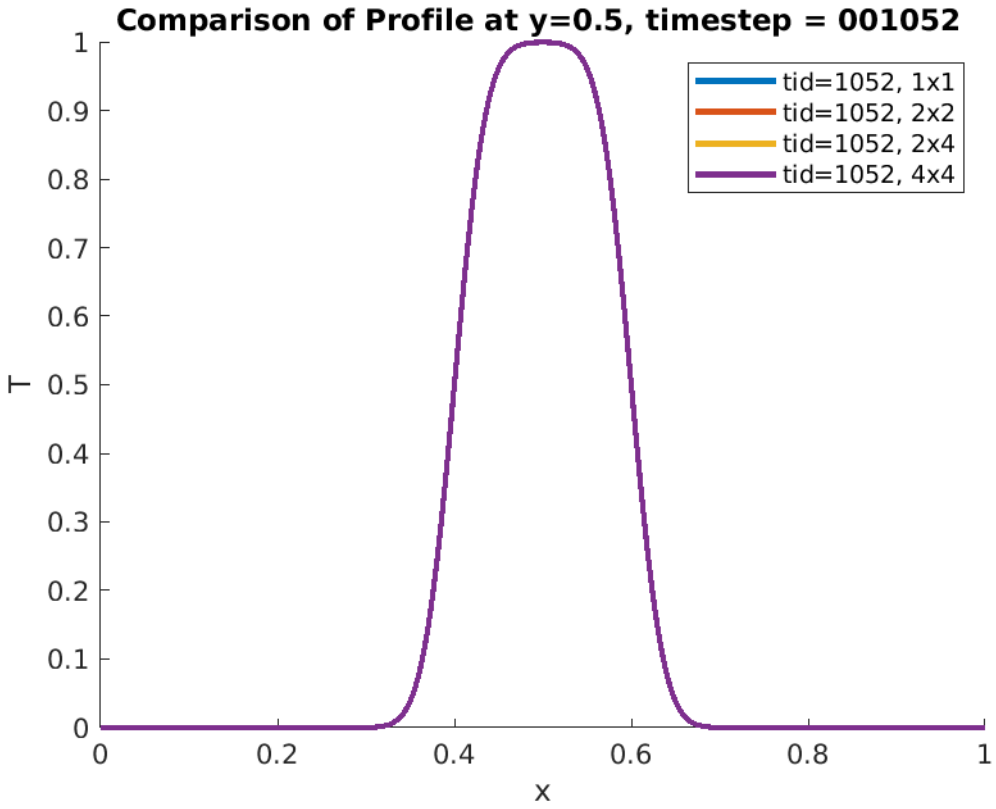

Figure 6. Comparison of profile at y=0.5 at timestep 1052

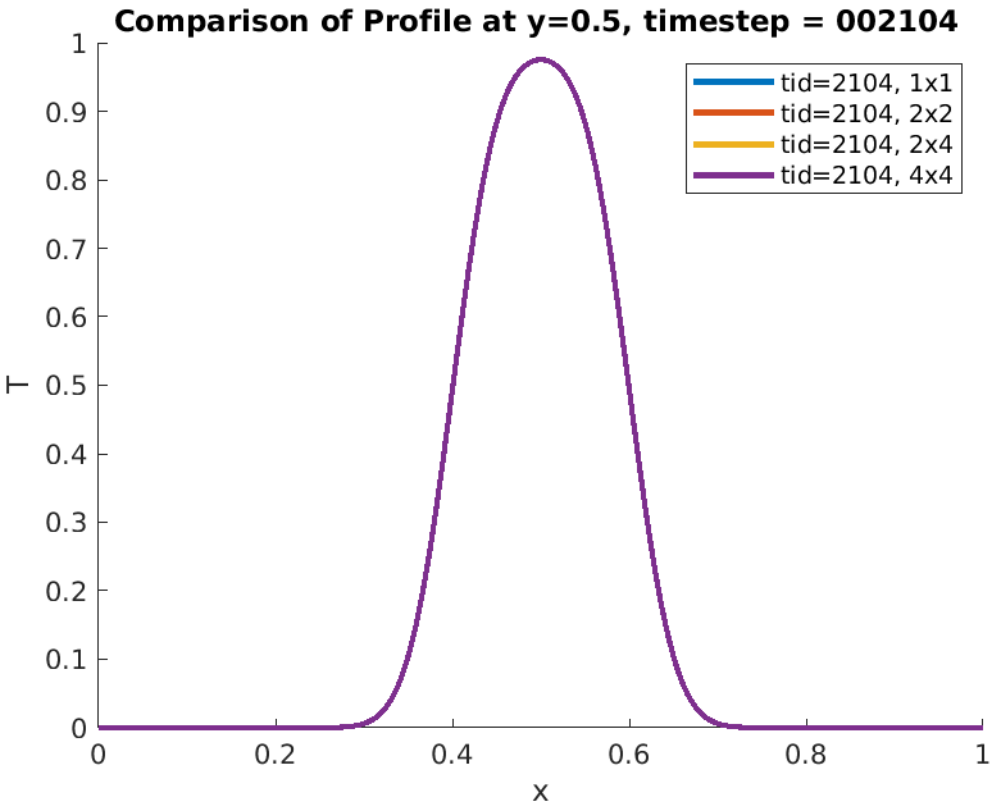

Figure 7. Comparison of profile at y=0.5 at timestep 2104

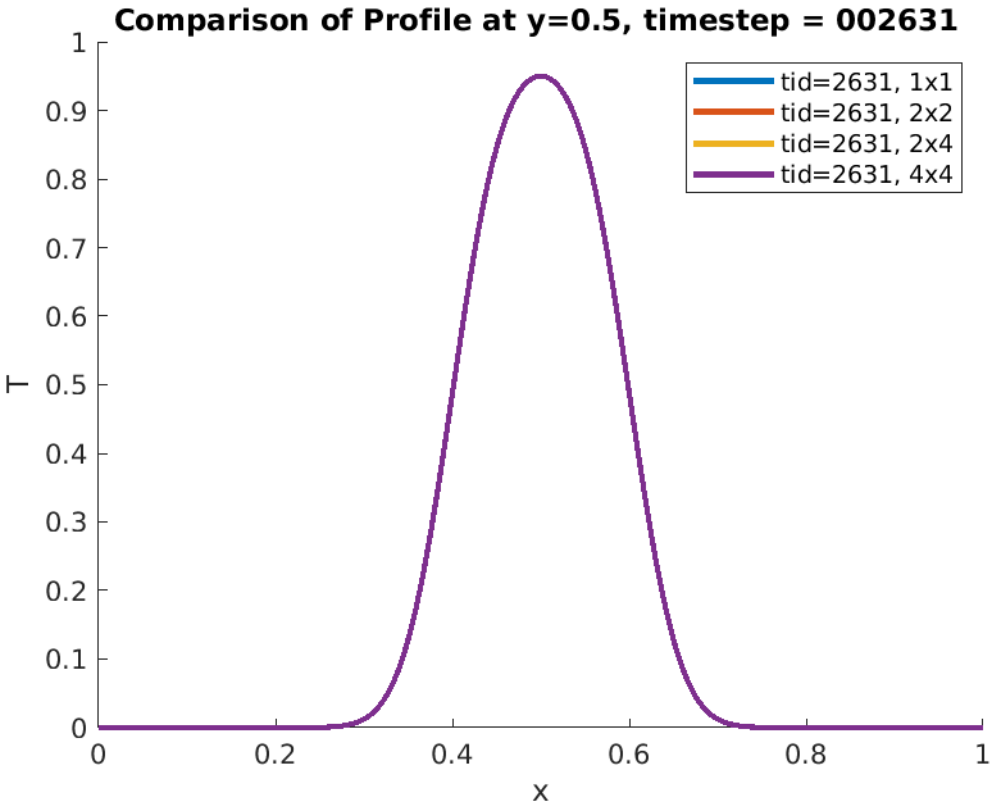

Figure 8. Comparison of profile at y=0.5 at timestep 2631

Q.N.1(b)

Table 1. Difference Between Results Obtained from Serial and Parallelized Versions

S. N	Comparison Between	Error obtained
1	Serial and p=4 (2*2)	0e0
2	Serial and p=8 (2*4)	0e0
3	Serial and p=16 (4*4)	0e0

Table 1 suggests there is no error when code is run either serial or parallel.

Q.N.1 (c)

Table 2. Time vs Number of Processors (p) for different scenarios

S. N	Algorithm	Number of processors(p)	Execution time(s)
1	Serial	1	26.14005657797679
2	p = 4 (2*2)	4	7.269733611028641
3	p = 8 (2*4)	8	3.979599676036742
4	p=16 (4*4)	16	2.185076688008849

Table 2 suggests that the execution time has been reduced by an great amount when increasing the number of processors.