Homework - 5

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Question 1.

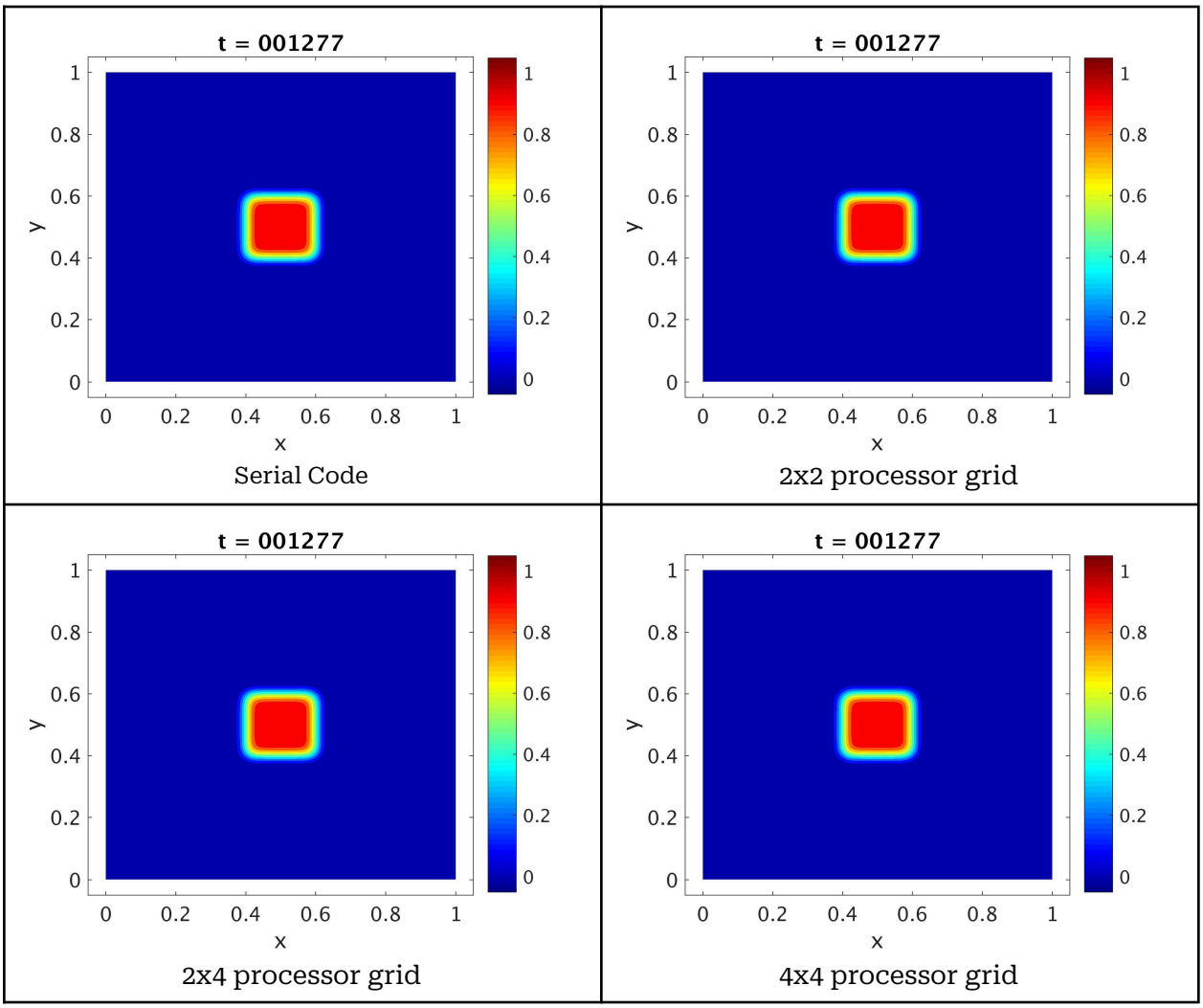


Figure 1: Contours of Temperature at 1277^{th} timestamp for serial and parallel codes

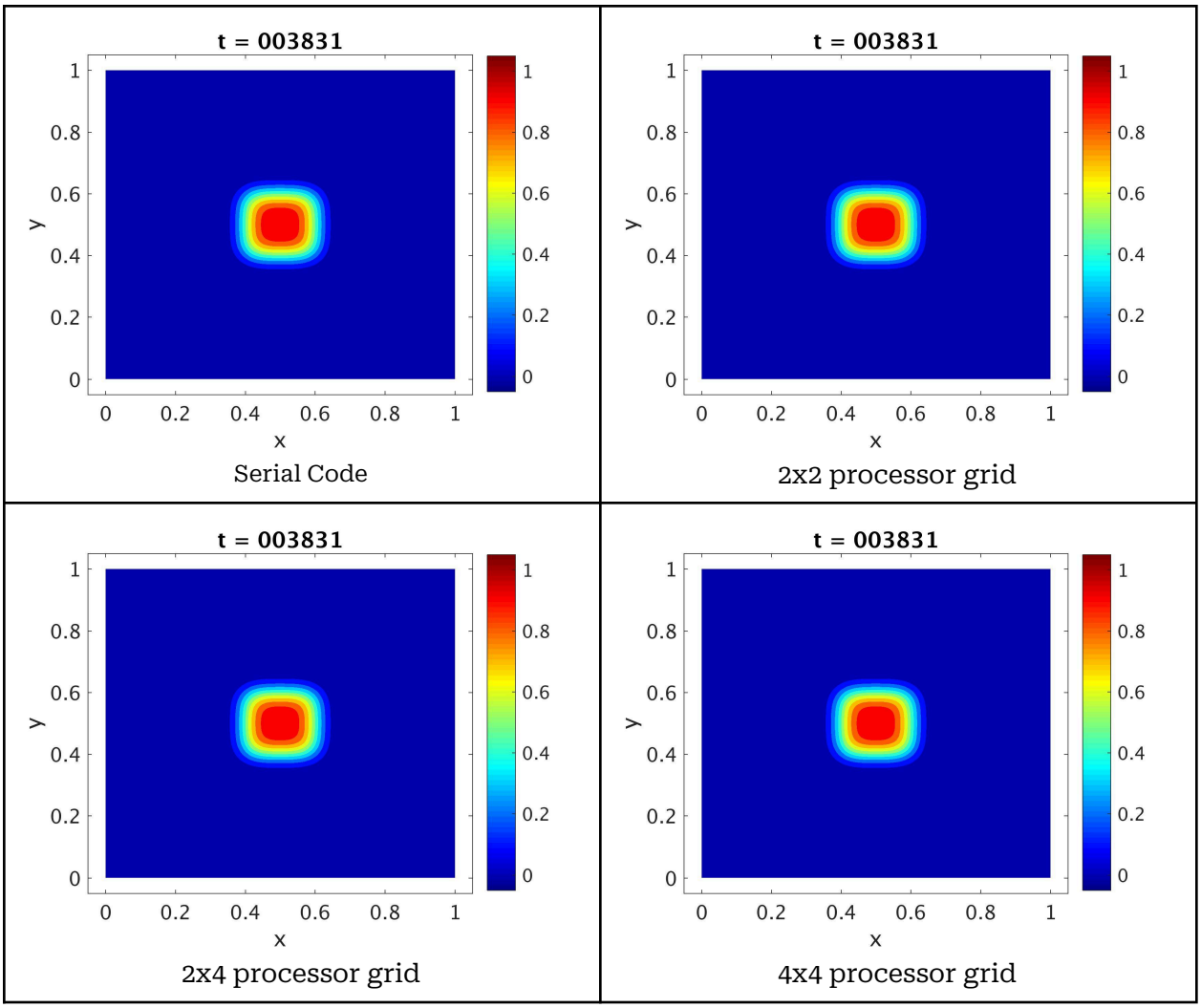
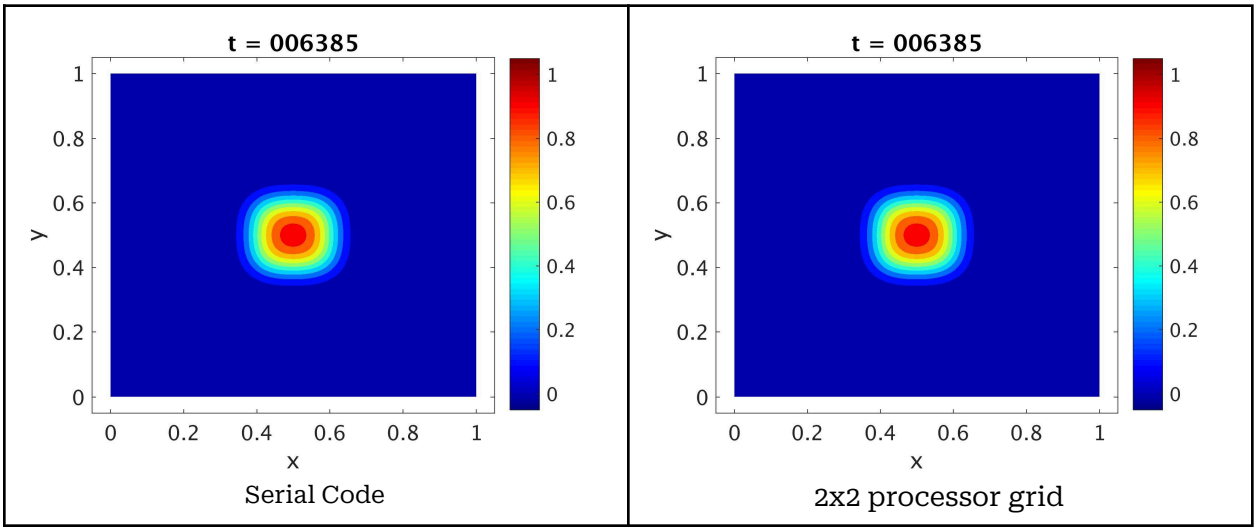


Figure 2: Contours of Temperature at 3831^{th} timestamp for serial and parallel codes



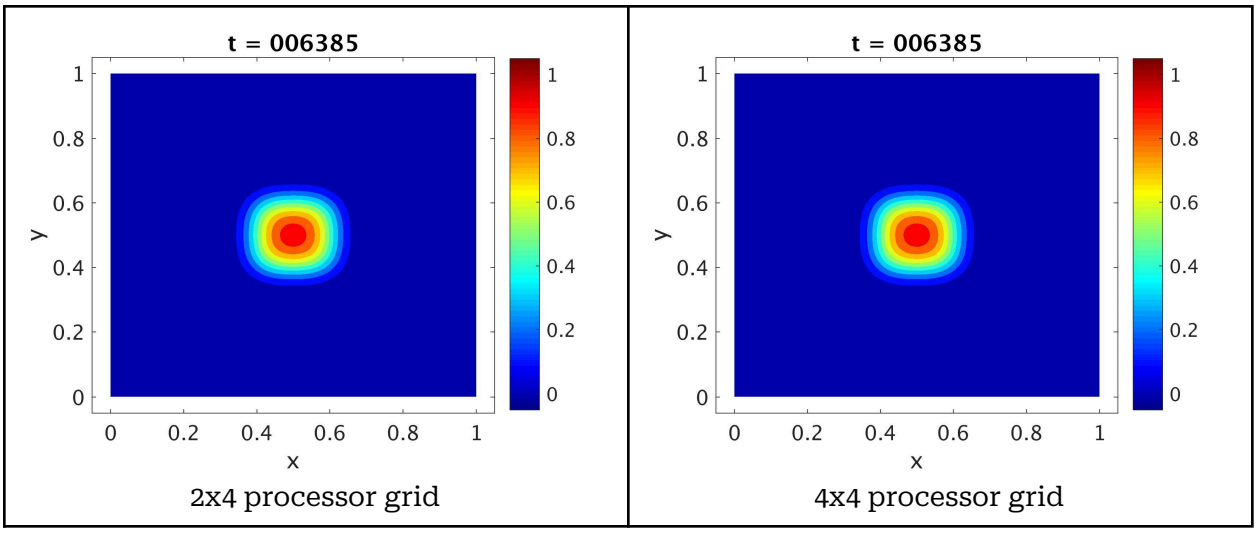


Figure 3: Contours of Temperature at 6385^{th} timestamp for serial and parallel codes

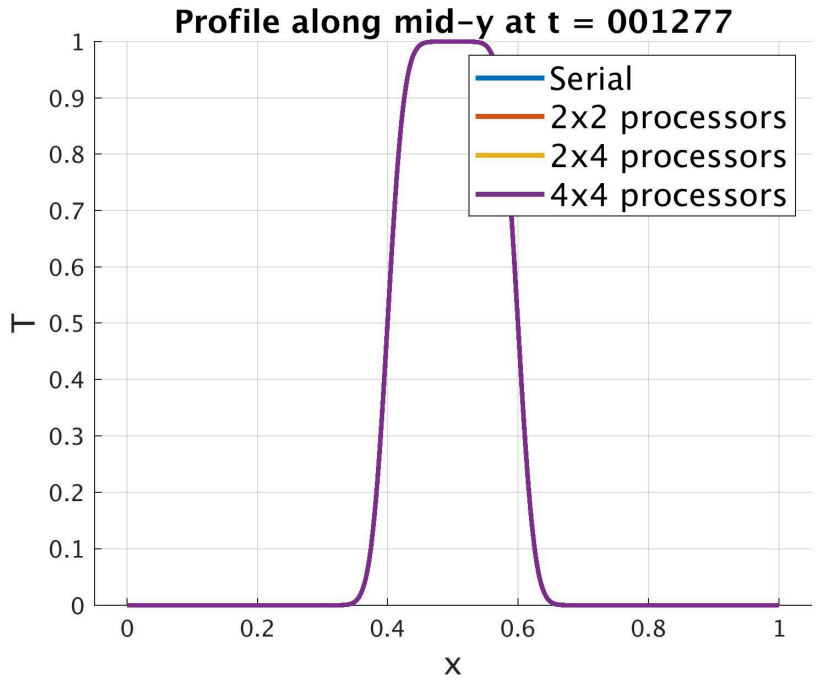


Figure 4: Profile along mid-y for Serial and parallel codes at 1277^{th} timestamp

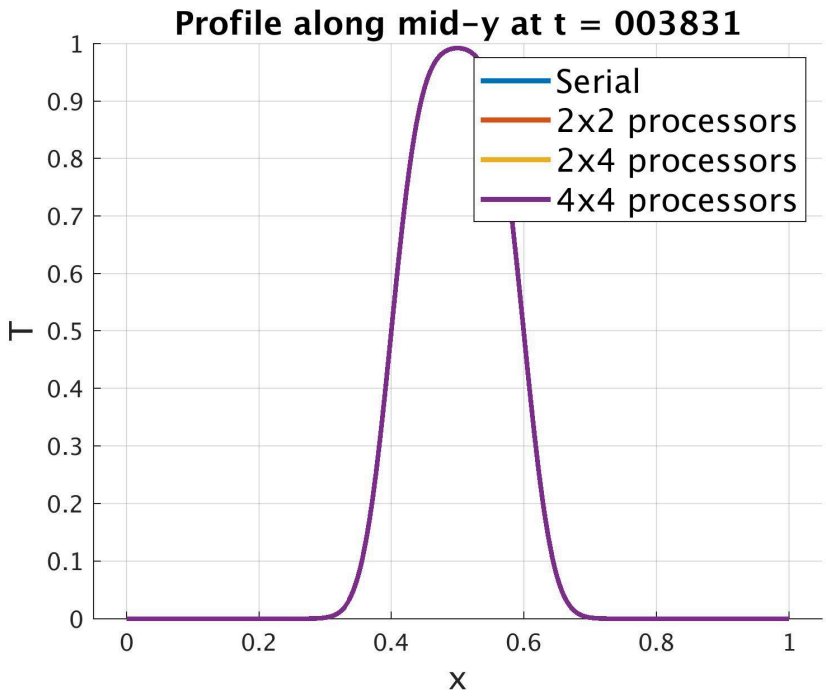


Figure 5: Profile along mid-y for Serial and parallel codes at 3831^{th} timestamp

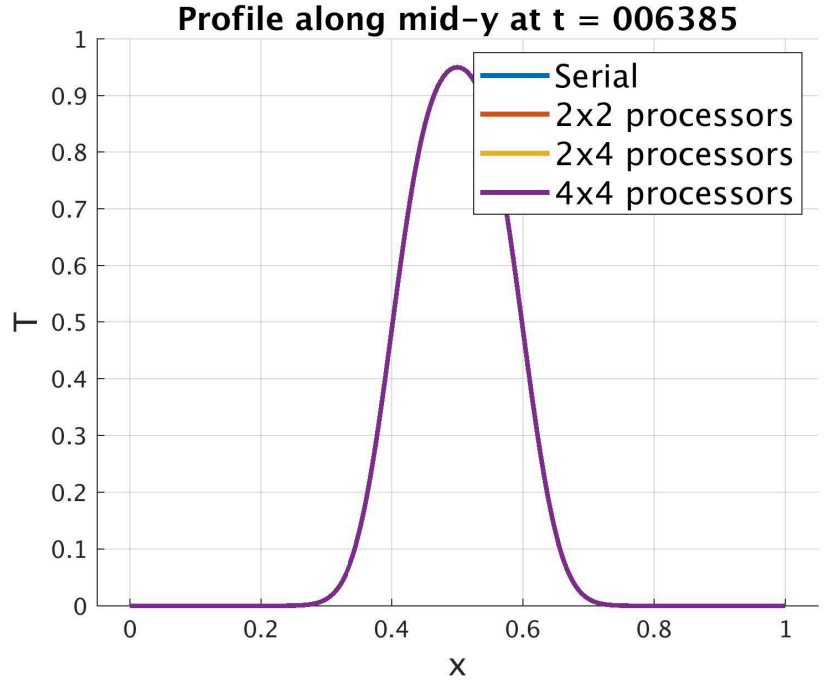


Figure 6: Profile along mid-y for Serial and parallel codes at 6385^{th} timestamp

(b)
Note: To generate the plots and contours from the output files of parallel code, I wrote a C code in the file `reconstruct.c` which combines the files `T_x_y_{timestep}_{rank}.dat` to a single file named `T_x_y_par_{timestep}.dat`.

We can compare the output files of serial code and that of parallel code (after merging the output files of different ranks) using `diff` linux command:

```
co21btech11001@edison3:~/psc/hw5-aaryan200$diff T_x_y_par_001277.dat T_x_y_001277.dat
co21btech11001@edison3:~/psc/hw5-aaryan200$diff T_x_y_par_003831.dat T_x_y_003831.dat
co21btech11001@edison3:~/psc/hw5-aaryan200$diff T_x_y_par_006385.dat T_x_y_006385.dat
co21btech11001@edison3:~/psc/hw5-aaryan200$
```

Figure 7: `diff` between parallel and serial code output files

Since the output files contain double precision values upto six decimal places and there is no difference between the output files of serial and parallel codes, we can conclude that the differences (if any) will only be under machine precision.

(c)
Note:
To compile `hc2d.c` file, execute: `gcc hc2d.c -lm -lrt -o serial`

To compile `parhc2d_skel.c` file, execute: `mpicc parhc2d_skel.c -lm -o parallel`

Code	Avg. Time Taken per step (sec)
Serial	0.017498
2x2 processor grid	0.004992
2x4 processor grid	0.007373
4x4 processor grid	0.008622