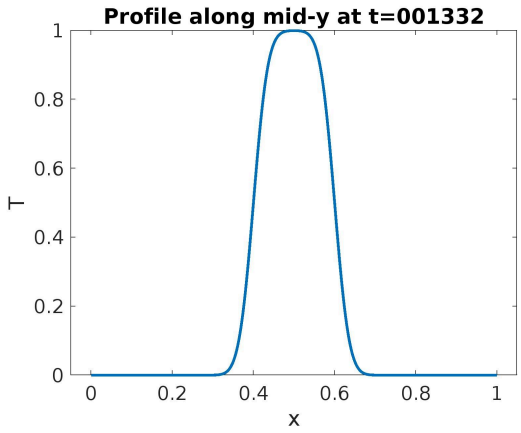
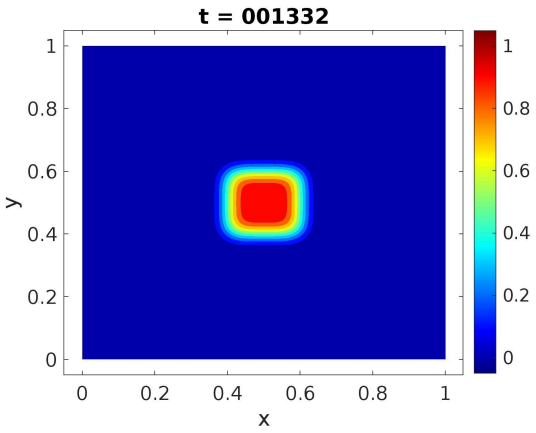
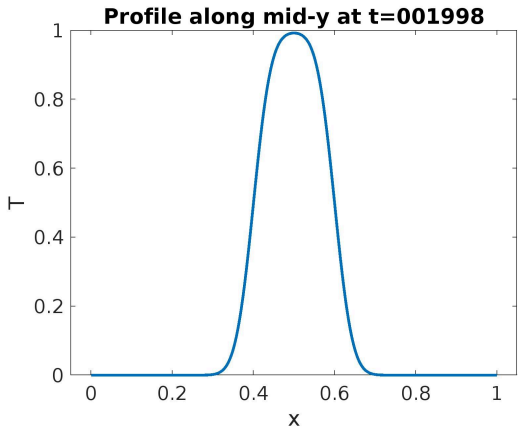
# Question 1)

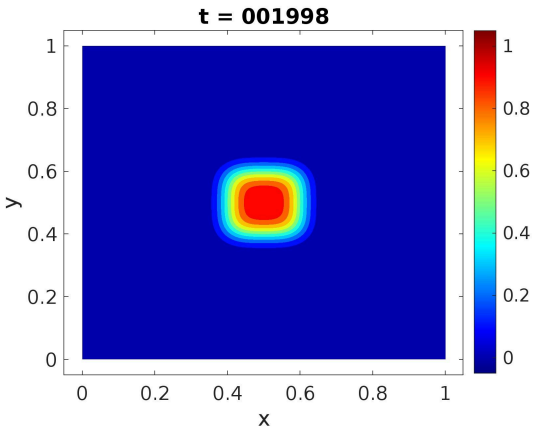
a)

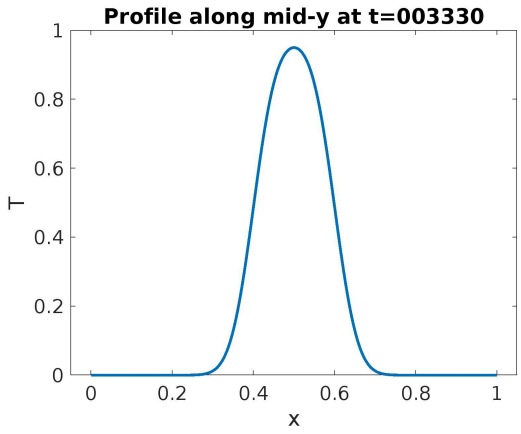
Serial Code Countor and plots:

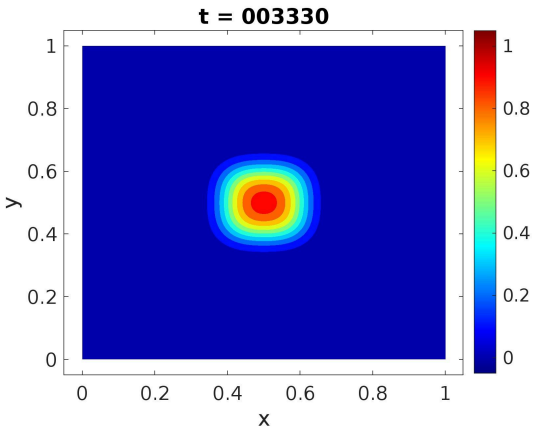


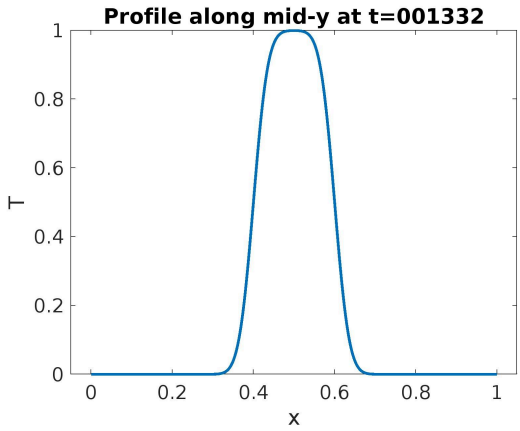



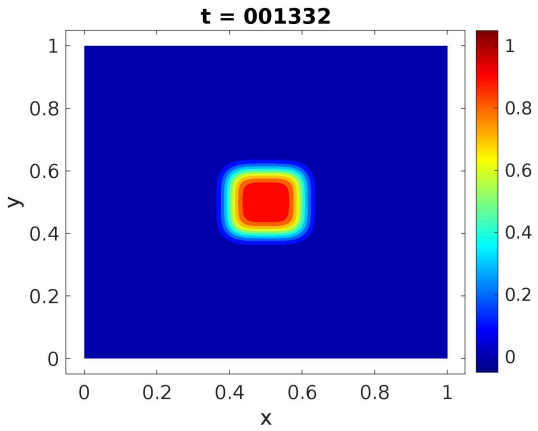



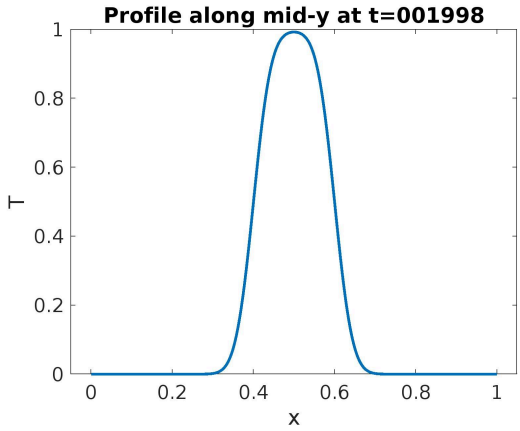



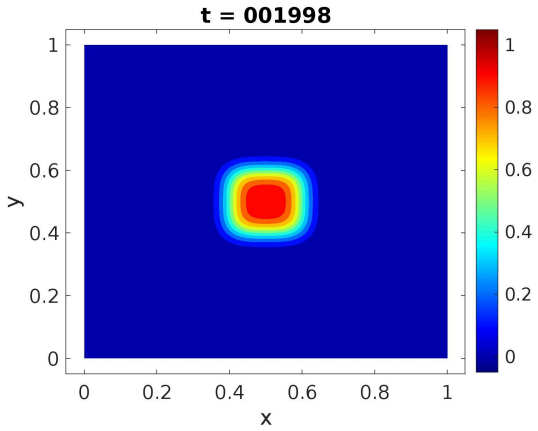



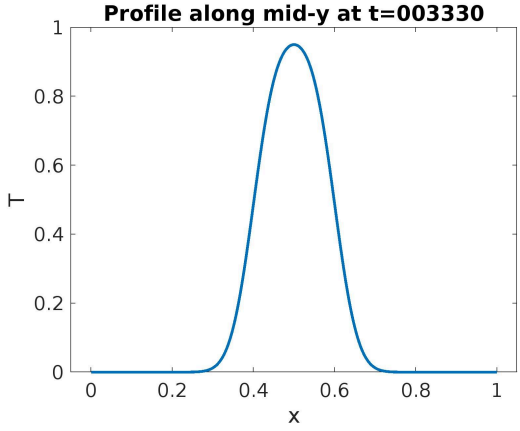

2 * 2 processor countor and plots:

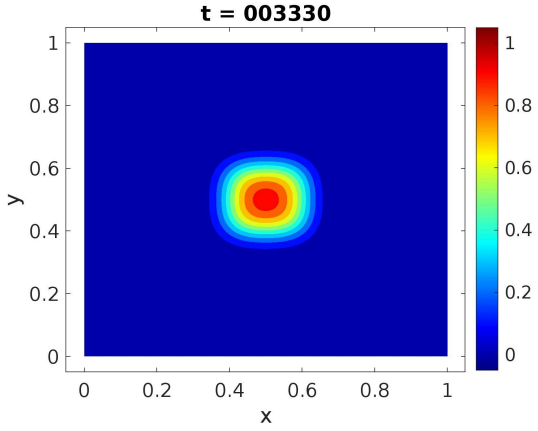


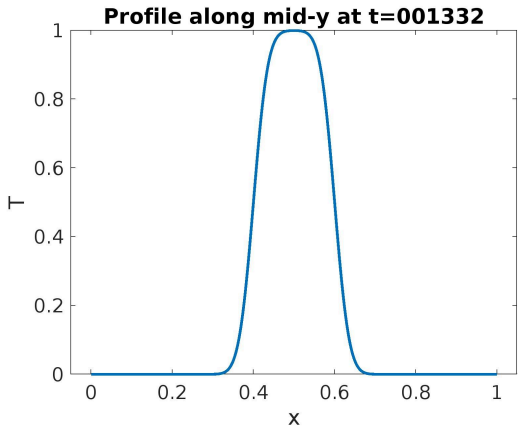



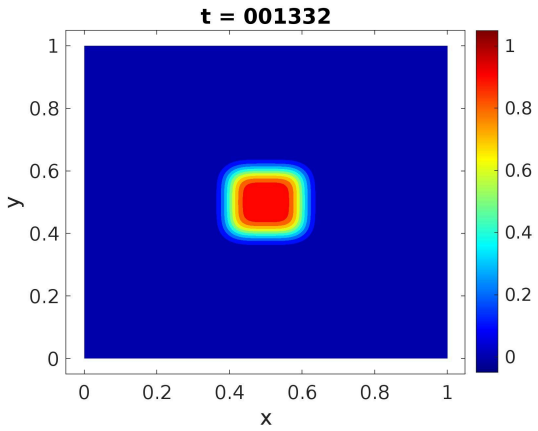



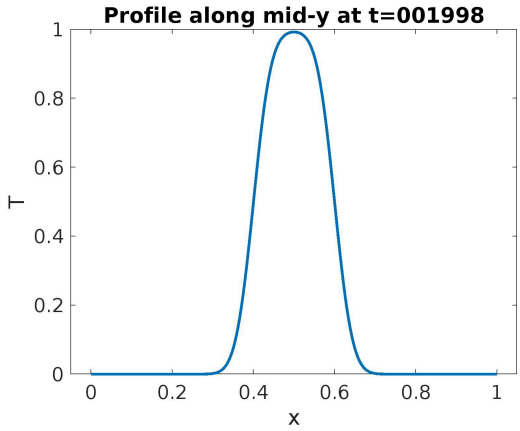



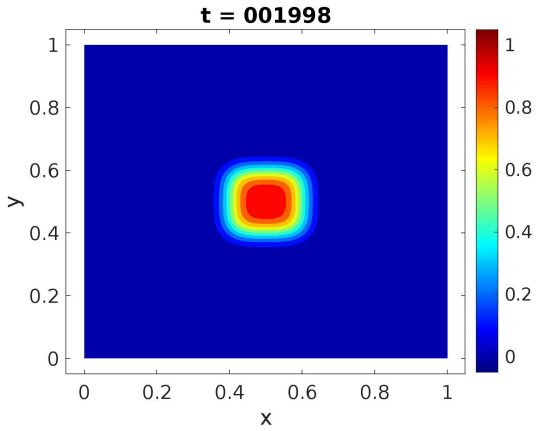



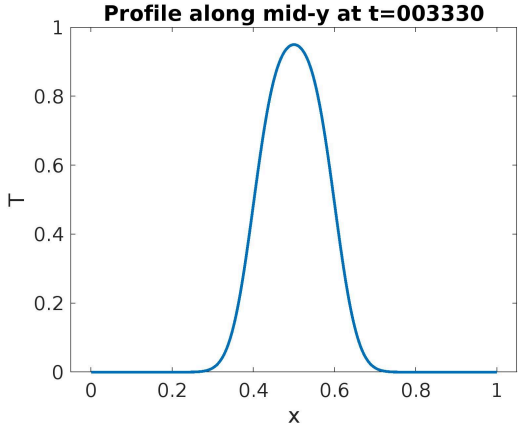

2*4 processor countor and plots:

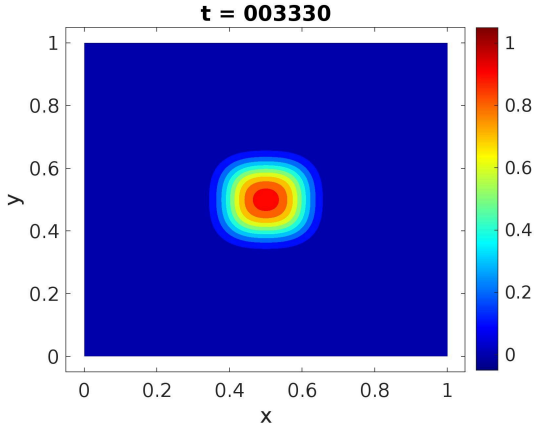


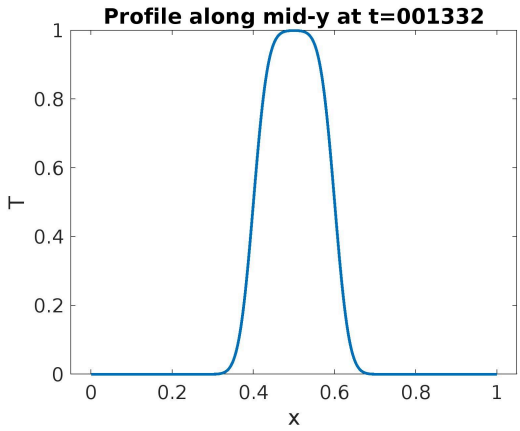



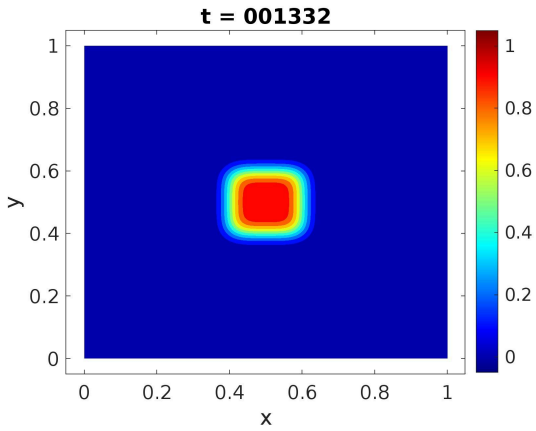



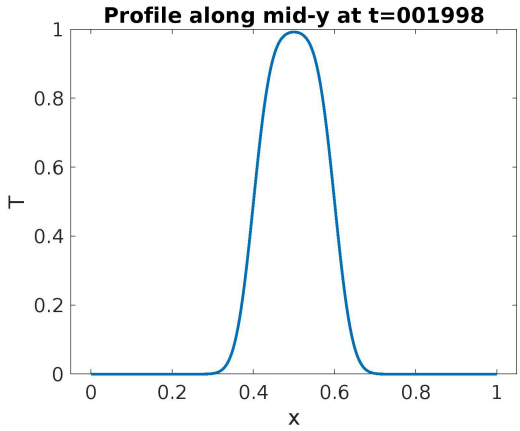



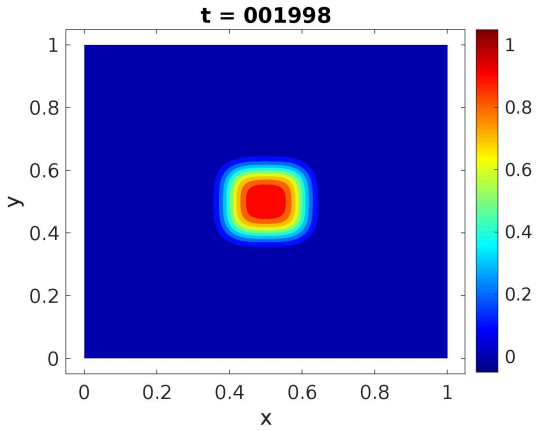



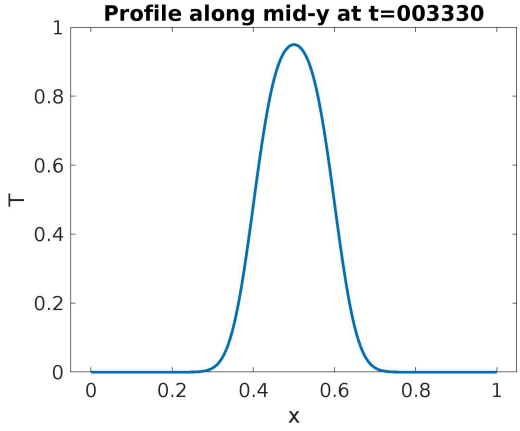

4*4 processor countor and plots:

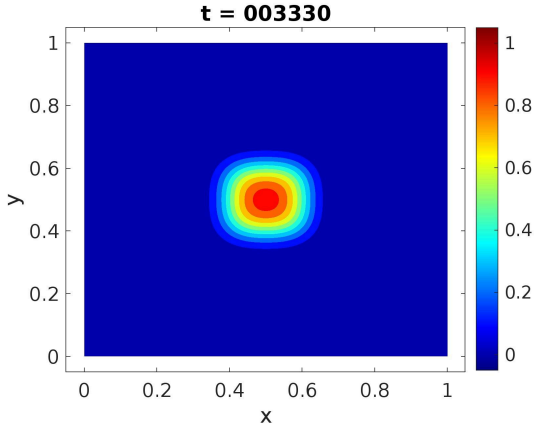

Profile along mid-y at t=001332
T
x


t = 001332
y
x


Profile along mid-y at t=001998
T
x


t = 001998
y
x


Profile along mid-y at t=003330
T
x


t = 003330
y
x

b)

Serial:

```
1 0.000000 0.000000 0.000000 0.000000
2 0.000000 0.054440 0.054440 0.013201
3 0.000000 0.054440 0.054441 0.013201
4 0.000000 0.013201 0.013201 0.003201
```

2by2:

```
1 0.000000 0.000000 0.000000 0.054440
2 0.000000 0.054443 0.000000 0.013201
3 0.000000 0.000000 0.054443 0.013201
4 0.054443 0.013201 0.013201 0.003201
```

2by4:

```
1 0.000000 0.000000 0.000000 0.000000
2 0.000000 0.054443 0.054443 0.013201
3 0.000000 0.054443 0.054443 0.013201
4 0.000000 0.000000 0.000000 0.000000
```

We got similar values for all the processors and is close to machine precision by 2.34e-3.

## c)

Time taken for serial is 0.0177
Time taken for 2 * 2 is 0.0310
Time taken for 2*4 is 0.0390
Time taken for 4*4 is 0.0395

Serial is working faster. We can say communication overhead is greater than the computing through parallel.