CHE636A Homework-5
Due date: April 11th, 2022 at 5 pm on Mookit

Question 1: Solve the following 2D equation using both explicit and implicit finite difference technique.

$$\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = \frac{\partial T}{\partial t}$$

where 0<=x<=1, 0<=y<=1, t>0

using the following initial and boundary conditions:

Initial condition: T=0 at t=0 for 0<x<1 & 0<y<1 ('T' here is the non-dimensional temperature)
Boundary condition: T=1 at the boundary (Note, this is a 2D boundary)

(a) Solve using both explicit and implicit method using same parameters (r, Nx, Ny) and compare their results for **time t=0.1** seconds using the 2D plot given below
(b) Plot the temperature profile of a particular node in the middle of the geometry (For example, if total nodes Nx=Ny=20, then you can compare temperature profile at nx=ny=10) as a function of time. That is, how does the temperature of a given node changes over time. Note that the stability condition for explicit method should be chosen accordingly since this is a 2D equation.

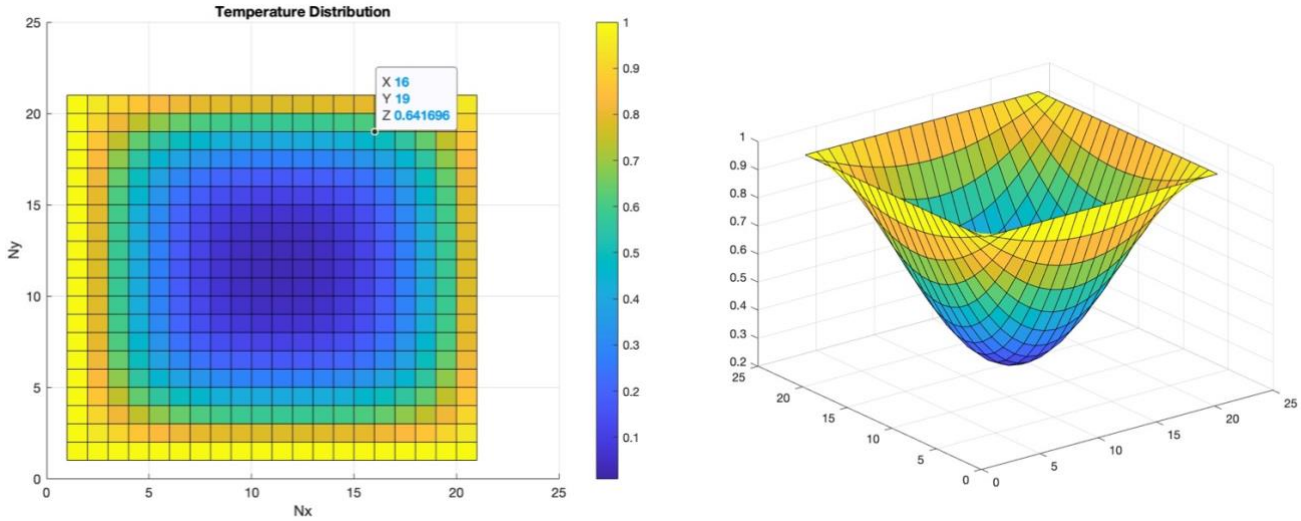

Figure 1: Temperature distribution plots in 2D

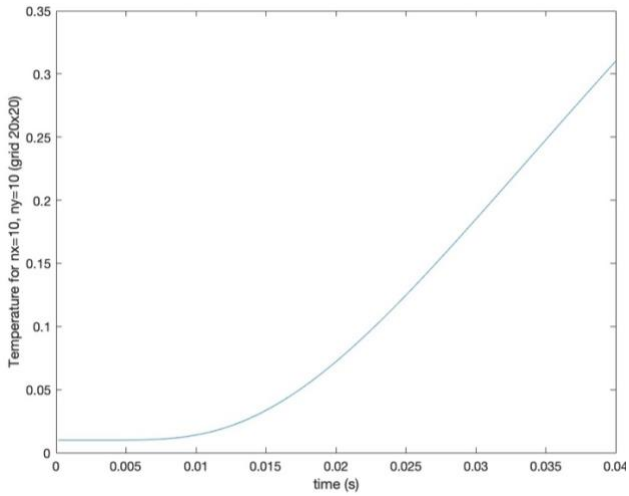

Figure 2: Temperature of a given node (example, nx=10, ny=10 when using Nx=Ny=20) as a function of time