Lab sheet - 7

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1. Consider the system in which a thin rod of length $L = 10cm$ is placed between two heat reservoirs kept at $100°C$ and $50°C$, respectively. The initial temperature of the rod is $0°C$. Write a code to compute heat evolution for 1^{st} 100sec in the rod using implicit method of solving heat equation

$$\frac{\partial u}{\partial t} = k\frac{\partial^2 u}{\partial x^2} \qquad 0 \leq x \leq L \quad , t \geq 0$$

for two values of $k\,\Delta t/\Delta x^2$ greater and less than 0.5. Initial condition: $u(0 < x < L, t = 0) = 0°C$ and Boundary condition: $u(0, t) = 100°C$ and $u(L, t) = 50°C$ at all t. Plot the result.

2. Write a program to solve the two dimensional Laplace equation

$$\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} = 0$$

describing the steady state temperature distribution on a square plate of sides $L = 100cm$. Use same length for $x-$ and $y-$ increment. Show the temperature distribution $T(x, y)$ using a surface plot for an $x - y$ grid of minimum 20 X 20 segments.

The boundary conditions are: $T(x = 0) = T(x = L) = 0°C, T(y = 0) = -100°, T(y = L) = 100$ at all time, corner points are assumed to have T equals to the average of adjoining sites.