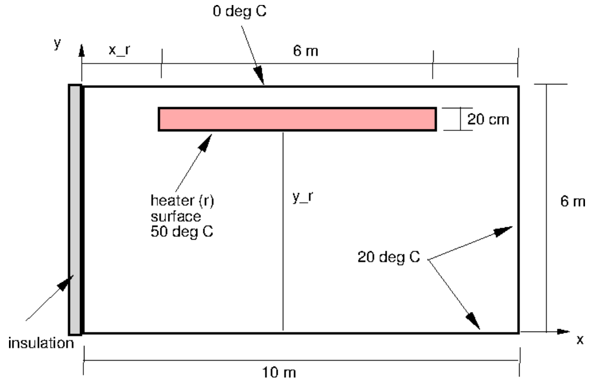
METU Department of Aerospace Eng
AE305 Numerical Methods
HW#5, Fall 2020

Compute the steady temperature distribution on a 2D model of a room shown below by solving the heat conduction equation:

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



Employ Point Jacobi, Gauss-Seidel and SOR methods for the solution.

- Use the incomplete Fortran code provided.
- Solve for the steady state temperature distribution without the radiator (heater).
- Solve for the steady state temperature distribution in the presence of the radiator.
- Compare the convergence rates (with max. ω possible for SOR) for all the methods.
- Plot the temperature distributions with and without the radiator along $x = 5$m and $y = 3$m lines. ($x - T$ and $y - T$ plots with and their legends.)
- Plot the heat flux distribution (contour and vector plots) in the room. Note that the heat flux vector is given by $\vec{q} = -k\nabla T$ (Take $k = 0.02$ W/mK)
- Experiment with the values of $\Delta x,\ \Delta y$ and the size and the location of the radiator.
- Implement Line Gauss-Seidel and direct solution methods for a 50% bonus.