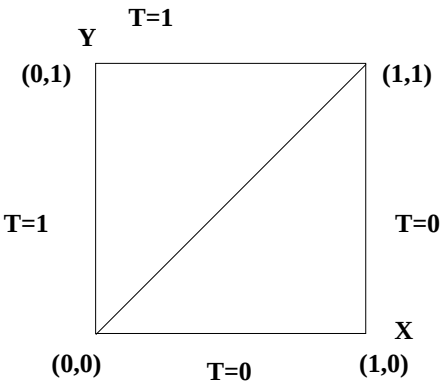
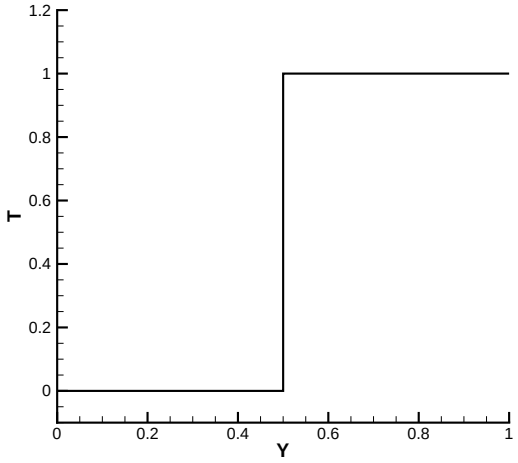
CFD Assignment 2 Convection and diffusion -Due date: Tuesday 24th November, 2020

1. The present task is to provide numerical solution of a steady Convection and diffusion problem. For a two dimensional convection diffusion equation,

$$\frac{\partial UT}{\partial x} + \frac{\partial VT}{\partial y} = \Gamma[\frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2}]$$

Here, for simplicity, U=V and the boundary conditions are shown in the following Figure.





   (a) Please compute the equation with Peclet number being 1, 10, 100 and $\infty(\Gamma = 0)$. For Γ=0, there will be a discontinuous solution at y=0.5, as shown in the above right figure.

   (b) Use mesh size at least 41x41 and 81x81.

   (c) For each Peclet number, please use Upwind, central difference, QUICK scheme and a bounded scheme of your choice.

   (d) For each Peclet number, plot the predicted temperature distributions with different schemes along x=0.5, as shown in the above right figure.

   (e) For high order scheme, how do you suppress the oscillation for $\Gamma = 0$?

2. Programming languages

   (a) Please use programming language at your own choice.

   (b) Please list your program in the report

3. Please compile your results into a report. The report should contain

   (a) Problem descriptions.

   (b) Introduction of methodology adopted

   (c) Results and discussions

   (d) Conclusion

   (e) List of programs