1. Consider the two-dimensional incompressible flow in a square cavity and flow is driven by the uniform translation of the upper surface (lid velocity Uo). Solve the governing equations in stream function and vorticity formulation using first order and second order upwind schemes for non-linear terms.

(a) Plot the stream function and vorticity contours for different Reynolds numbers Re= 100, 400 and 1000.
(b) Plot the horizontal velocity profile varies with y at x = L/2 and compare with the published results available in the literature for different Re.
(c) Plot the vertical velocity profile varies with x at y = H/2 and compare with the published results available in the literature for different Re.

Reference Paper:

Ghia U , Ghia K.N and Shin C.T “ High-Re Solutions for Incompressible Flow Using the Navier-Stokes Equations and a Multigrid Method*, Journal of Computational Physics, Vol 48: pp: 387-411, 1982.