Lid driven cavity problem

Write a code for MAC algorithm to solve steady state flow field in a lid driven square cavity. Take height and width of the cavity as 1 unit. Obtain results for Reynolds number (Re) = 400. Take the equations in dimensionless form as following

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$$

$$\frac{\partial u}{\partial t} + \frac{\partial}{\partial x}(u^2 + p) + \frac{\partial}{\partial y}(uv) = \frac{1}{Re}\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}\right)$$

$$\frac{\partial v}{\partial t} + \frac{\partial}{\partial x}(uv) + \frac{\partial}{\partial y}(v^2 + p) = \frac{1}{Re}\left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2}\right)$$

The code should be written based on pressure Poisson equation method.

Boundary conditions:

The boundary conditions for left, bottom and right sides are-

$$u = 0; \quad v = 0; \quad \frac{\partial p}{\partial \hat{n}} = 0$$

Where, $\hat{n}$ is a unit vector perpendicular to the wall.

The boundary conditions for top side (for lid) are-

$$u = 1; \quad v = 0; \quad \frac{\partial p}{\partial \hat{n}} = 0$$

Here, u, v, p are dimensionless variables.

Initial conditions:

Take the initial values as $u = 1; v = 0;\ p = 0$ at all nodal points of the computational domain.

Results to be shown:

1. Stream function contour plot.
2. u- velocity contour plot.
3. v- velocity contour plot.
4. Pressure contour plot.
5. Plot of u- velocity variation along the mid vertical line and compare with Ghia et al. data.
6. Plot of v- velocity variation along the mid horizontal line and compare with Ghia et al. data.