An infinitely long bar of thermal diffusivity $\alpha$ has a square cross section of side $2a$. It is initially at a uniform temperature $\theta_0$ and then suddenly has its $x = \pm a$ surfaces raised to a non-dimensional temperature $\theta_1$, and the $y = \pm a$ surfaces raised to non-dimensional temperature $\theta_2$. These surface temperatures are held constant at those values subsequently. The governing equations in non-dimensional form is given by

$$\frac{\partial \theta}{\partial \tau} = \frac{\partial^2 \theta}{\partial \xi^2} + \frac{\partial^2 \theta}{\partial \eta^2}$$

(1)

Set up the procedure using one fourth of the domain and symmetry conditions. Use the symmetry conditions derived in class for the insulated boundary, where the adjacent node temperatures are not assumed to be equal. Write a procedure outline for numerically solving the problem, showing the equations for the boundaries and the interior points. Calculate the coefficients for the equations using $\Delta \xi = \Delta \eta = 0.05$ and $\Delta \tau = 0.01$. Your answer should be in the matrix form. Explain all symbols used.