2. (20 marks) (Finite Difference, variable time step, American option)

Modify your code to use the penalty method for American quadratic straddle option with payoff(S)=max($K - S^2, S^2 - K$). Carry out a convergence study assuming the local volatility model assumed in Question 1 and other data in Table 1. Use CN-Rannacher with both constant and variable timesteppings described in the course notes. For the variable timestepping, use $dnorm = .1$ and an initial timestep of $\Delta\tau = T/25$. On each grid refinement, reduce the initial timestep by a factor of 4 and reduce $dnorm$ by a factor of 1/2. Be sure that your timestep selector stops at the pricing code at $t = T$ exactly.

- Show the convergence table.
- Show plots of the price and delta respectively, for the finest grid using CN-Rannacher timestepping. Explain what you see.

Submit your matlab code, plots, tables, and discussion.