Introduction to Computational Multiphysics
Practical 4: The original ghost fluid method - one more test

1. **Helium slab test**:
   Taken from Wang *et al.* "*A thermodynamically consistent and fully conservative treatment of contact discontinuities for compressible multicomponent flows*" This test demonstrates the effects of a shock wave interacting with more than one interface, each initially in equilibrium. The in ital data for this test is

$$(\rho, v, p)_1^T = \begin{cases} (1.3765, 0.3948, 1.57)^T & x < 0.25 \\ (1, 0, 1)^T & x > 0.25 \end{cases}, \quad \gamma_L = 1.4$$

$$(\rho, v, p)_2^T = (0.138, 0, 1)^T, \quad \gamma_R = 1.67$$

   Here, material 2 (helium) exists initially for $0.4 < x < 0.6$, and material 1 exists everywhere else. A suitable level set function here is

$$\phi = 0.1 - |\phi - 0.5|$$

   For this test, the boundary conditions will require a bit more care to implement - copying velocity and pressure will not change, but now density extrapolation must happen in different directions. This is especially important in the slab region, where extrapolations meet in the middle.