Consider the 3D elastostatics problem. Find $u$ such that

\begin{align*}
\text{PDE} & \quad \sigma_{ij,j} + f_i = 0 \text{ in } \Omega \\
\text{Constitutive relation} & \quad \sigma_{ij} = C_{ijkl} \epsilon_{kl} \\
\text{Kinematic relation} & \quad \epsilon_{kl} = \frac{1}{2} \left( \frac{\partial u_k}{\partial x_l} + \frac{\partial u_l}{\partial x_k} \right) \\
\text{Neumann b.c.} & \quad \sigma_{ij} n_j = h_i \text{ on } \partial \Omega_h \\
\text{Dirichlet b.c.} & \quad u_i = u^g_i \text{ on } \partial \Omega_u
\end{align*}

Consider a three-dimensional domain defined by $x_1 = [0, 1]$ m; $x_2 = [0, 1]$ m; $x_3 = [0, 1]$ m (i.e. the unit cube). Use $E = 2.0 \times 10^9$ Pa and $\nu = 0.3$. Assume traction $h_i = 0$ N.m$^{-2}$ on all surfaces where no other conditions are specified. Use linear basis functions and a 10 x 10 x 10 element mesh for submission.

Apply the following boundary conditions:

\begin{align*}
 h_1 = h_2 = 0, h_3 = 1.0 \times 10^9 \times x_1 \text{ Pa on the face } x_3 = 1 \text{ m} \quad \text{and} \quad u_1 = u_2 = u_3 = 0 \text{ m on the face } x_3 = 0 \text{ m}.
\end{align*}