1. The 12 ft. long steel column shown below is considered pin-connected at the top and bottom \((K = 1)\), and has a yield strength of \(F_y = 50\) ksi and a modulus of elasticity of \(E = 29,000\) ksi. The cross-section of the column is an I-shape with \(A = 9.13\) in\(^2\), \(I_x = 110\) in\(^4\), and \(I_y = 37.1\) in\(^4\).

a) **Determine the load at which column failure is expected to occur.** Will the failure be due to yielding or due to column buckling?

b) Using allowable stress design (ASD) procedures and a factor of safety of \(F.S. = 1.67\), **determine whether the column can support a service load combination of** \(P_{\text{service}} = D + L\) when the dead load is \(D = 180\) kips and the live load is \(L = 100\) kips.

c) Using load and resistance factor design (LRFD) procedures and a resistance factor for axial compression of \(\phi_c = 0.85\), **determine whether the column can support a factored load combination of** \(P_u = 1.2D + 1.6L\), when the dead load is \(D = 180\) kips and the live load is \(L = 100\) kips.

d) **Repeat Parts a), b) and c)** for a column length (height) of \(20\) ft, a dead load of \(D = 75\) kips, and a live load of \(L = 40\) kips.
2. Use *Visual Analysis* software to determine the force in each member of the complex truss shown below. Provide a concise table of the results of your computer analysis (along with a copy of your computer report), and indicate whether each member is in tension or compression.

*Partial answer: \( F_{IK} = 2 \text{ kips (C)} \)
3. Use Visual Analysis software to determine the force in each member of the three-dimensional space truss shown below. Provide a concise table of the results of your computer analysis (along with a copy of your computer report), and indicate whether each member is in tension or compression. The space truss is supported by a ball and socket joint at D, two "short links" at C, and one "short link" at E. The applied loads are $F_1 = (200i + 300j - 500k) \text{ lb}$ and $F_2 = (400j) \text{ lb}$. [Partial answer: $F_{EF} = 300 \text{ lb (C)}$]