

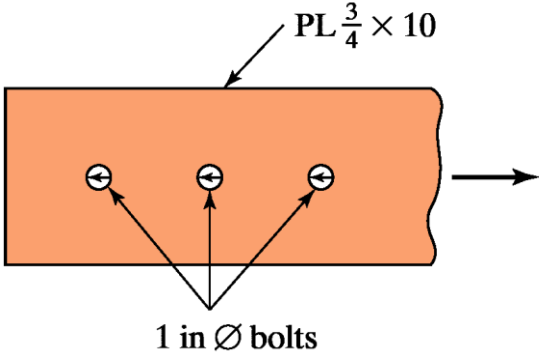
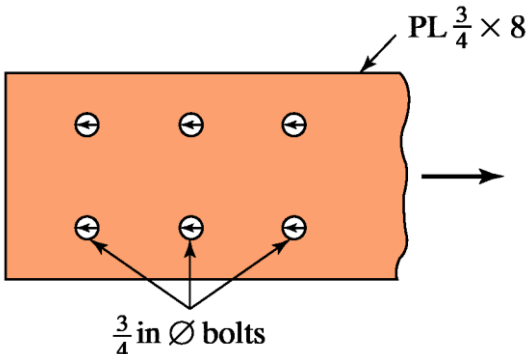
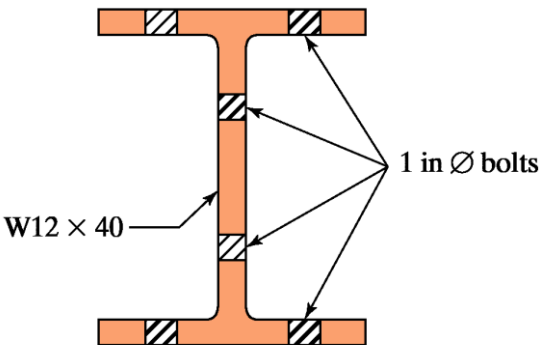
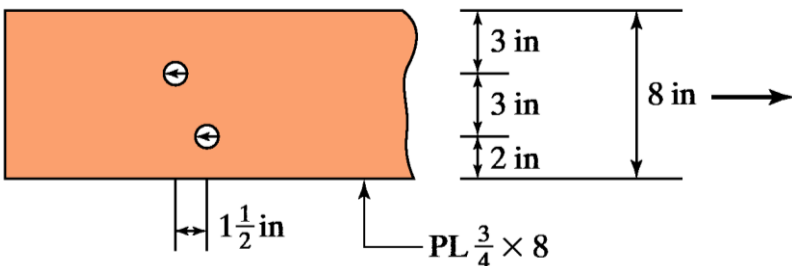
Questions bank of “Steel Structures”

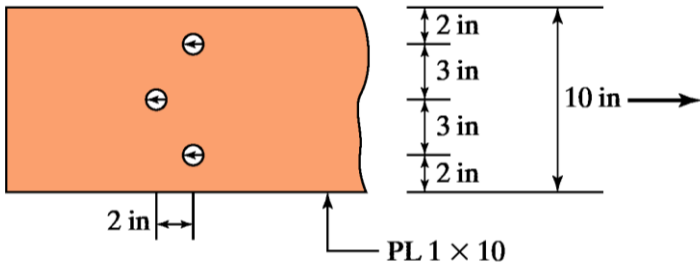
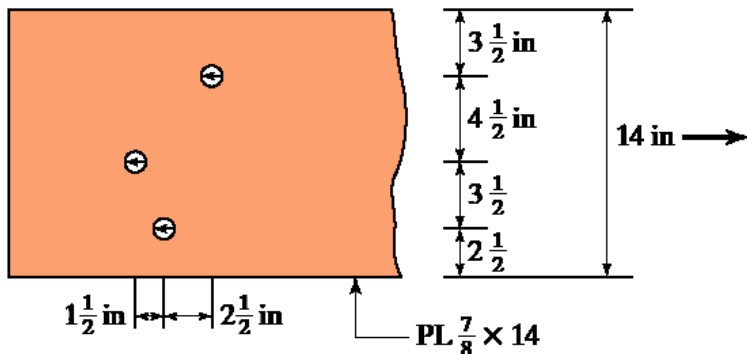
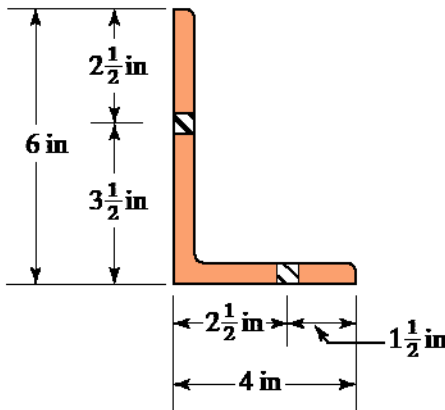
Summer school 2026-2027

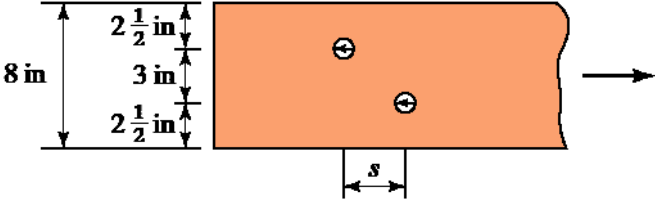
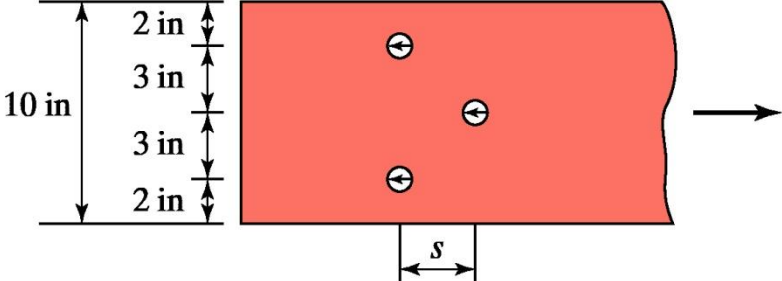
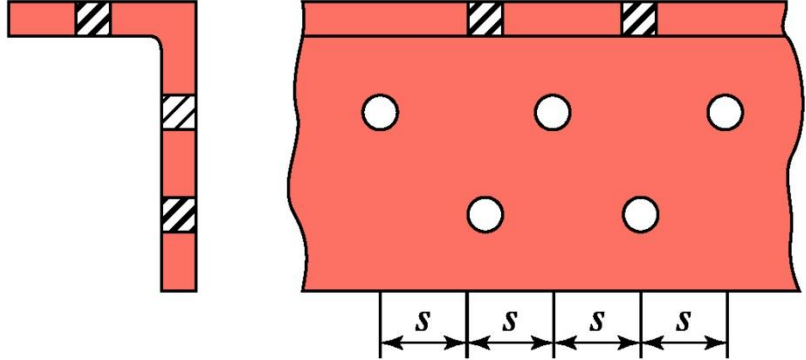
Important Notices:

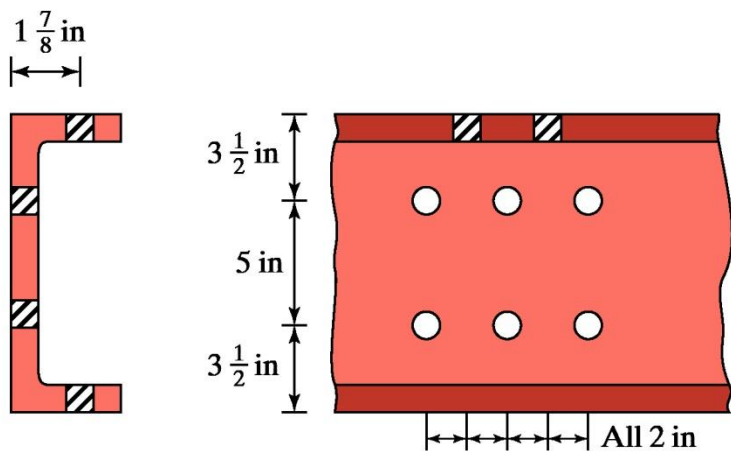
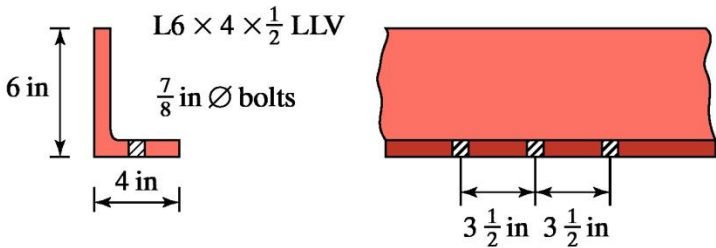
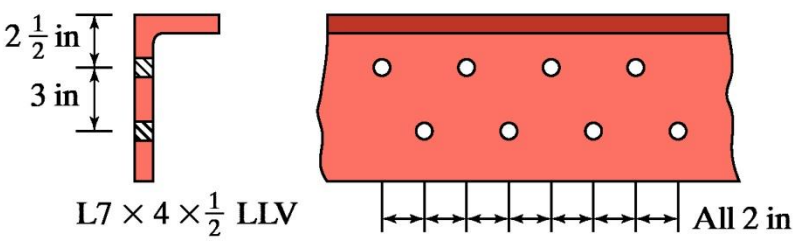
1. This question bank (QB) does not serve as a substitute for lecture notes.
2. Studying the QB is optional and not obligatory.
3. Exam questions may differ from those presented in this QB. They are not necessarily similar or limited to the content provided here.

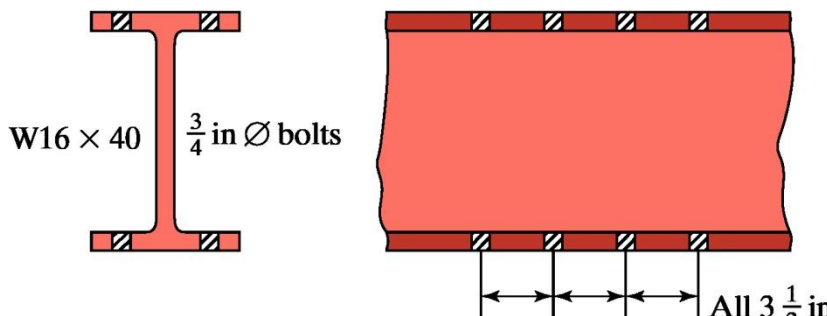
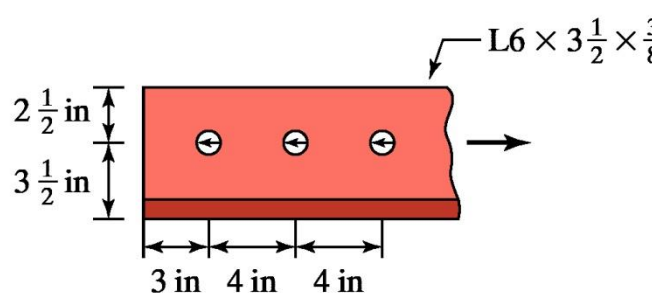
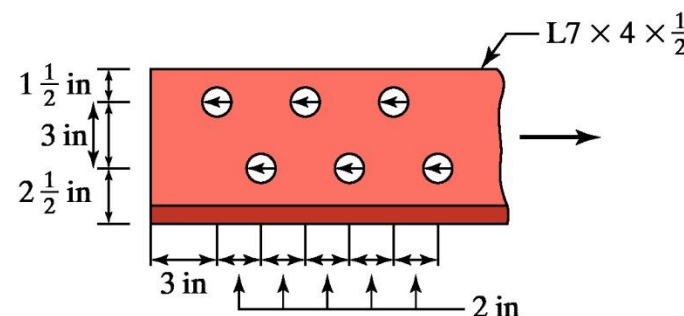
Q1	Determine the maximum combined loads using the recommended AISC expressions for LRFD. $D = 100 \text{ psf}$, $L = 70 \text{ psf}$, $R = 12 \text{ psf}$, $L_r = 20 \text{ psf}$ and $S = 30 \text{ psf}$ (Ans. 247 psf)
Q2	Determine the maximum combined loads using the recommended AISC expressions for LRFD. $D = 10,000 \text{ lb}$, $W = \pm 32,000 \text{ lb}$
Q3	Determine the maximum combined loads using the recommended AISC expressions for LRFD. $D = 9000 \text{ lb}$, $L = 5000 \text{ lb}$, $L_r = 2500 \text{ lb}$, $E = \pm 6500 \text{ lb}$ (Ans. 20,050 lb)
Q4	Determine the maximum combined loads using the recommended AISC expressions for LRFD. $D = 25 \text{ psf}$, $L_r = 20 \text{ psf}$ and $W = \pm 26 \text{ psf}$
Q5	Structural steel beams are to be placed at 8 ft on center under a reinforced concrete floor slab. If they are to support a service dead load $D = 65 \text{ psf}$ of floor area and a service live load $L = 100 \text{ psf}$ of floor area, determine the factored uniform load per foot which each beam must support. (Ans. 1904 plf)
Q7	A structural steel beam supports a roof that weighs 25 psf. An analysis of the loads has the following: $S = 12 \text{ psf}$, $L_r = 18 \text{ psf}$ and $W = 24 \text{ psf}$ (upwards) or 16 psf (downwards). If the beams are spaced 6 ft apart, determine the factored uniformly distributed loads per foot (upward and downward, if appropriate) by which each beam should be designed.

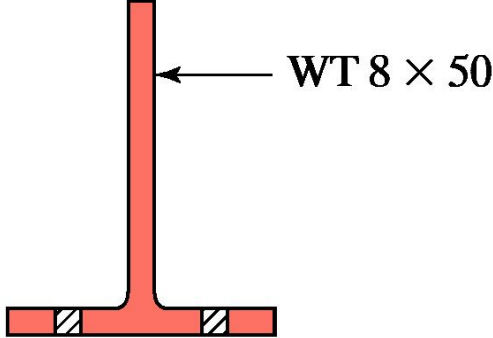
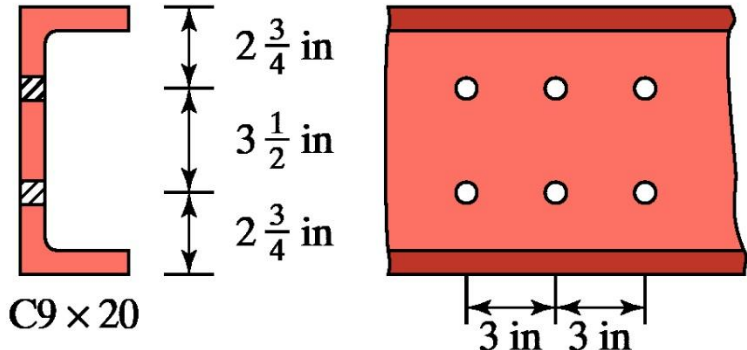
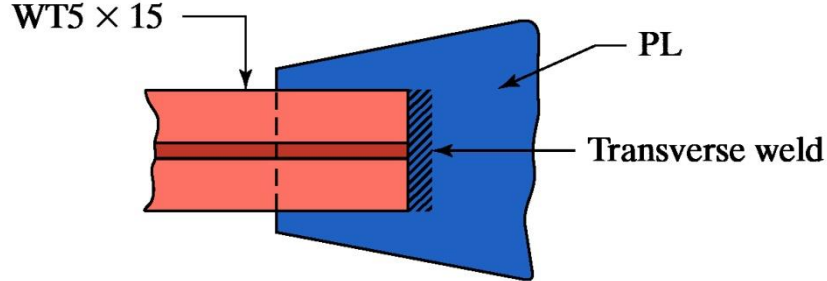
Q8	Compute the net area of the steel member shown below 
Q9	Compute the net area of the steel member shown below 
Q10	Compute the net area of the steel member shown below, knowing that the gross area of the section, A_g, is 11.8 in^2 
Q11	Compute the net area of the $3/4 \times 8$ plate shown. The holes are $3/4 \text{ in. } \varnothing$ bolts. (Ans. 4.83 in^2). 

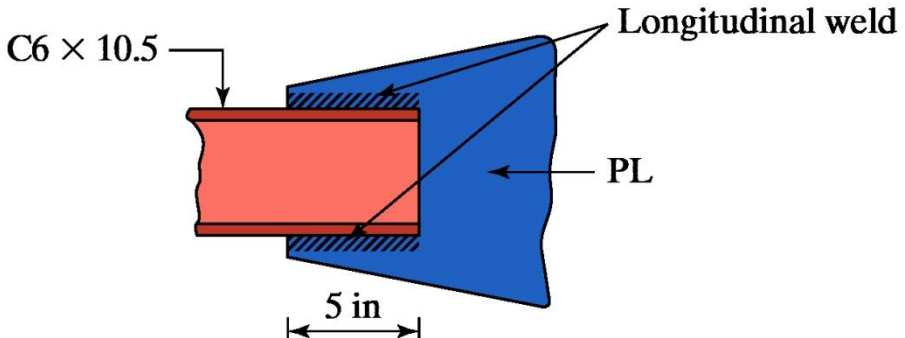
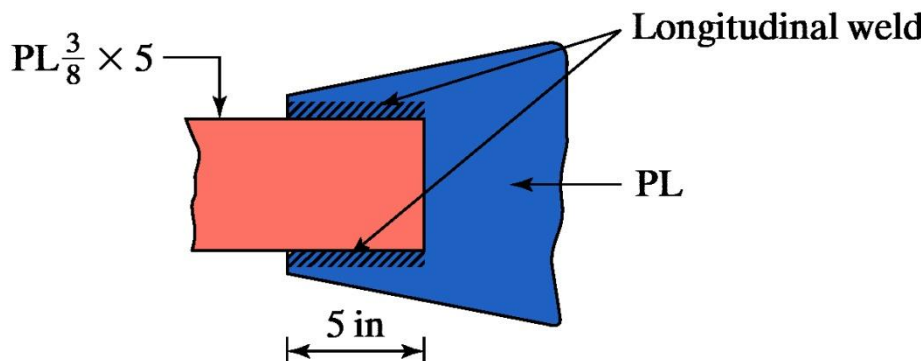
Q12	Compute the net area of the 1×10 plate shown. The holes are $7/8$ in. $\varnothing$ bolts. 
Q13	Compute the net area of the $7/8 \times 14$ plate shown. The holes are for $7/8$-in $\varnothing$ bolts. (Ans 10.54 in²) 
Q14	Compute the net area of the $6 \times 4 \times 1/2$ angle shown has one line of 1-in $\varnothing$ bolts in each leg. The bolts are 4-in on center in each line and are staggered 2 in with respect to each other. 

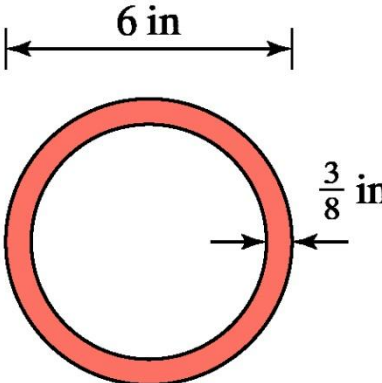
Q15	Compute the net area of The tension member shown contains holes for $\frac{3}{4}$-in $\varnothing$ bolts. At what spacing, s, will the net area for the section through one hole be the same as a rupture line passing through two holes? (Ans 3.24 in) 
Q16	The tension member shown in figure (below) contains holes for 1-in $\varnothing$ bolts. At what spacing, s, will the net area for the section through two holes be the same as a rupture line passing through all three holes? 
Q17	An $L6 \times 4 \times \frac{3}{4}$ is used as a tension member, with $\frac{7}{8}$-in $\varnothing$ bolts in each leg at the usual gage location (see Table 3.1). Two rows of bolts are used in the long leg, and one in the short leg. Determine the minimum stagger, s, necessary so that only two holes need be subtracted in determining the net area. What is the net area? 

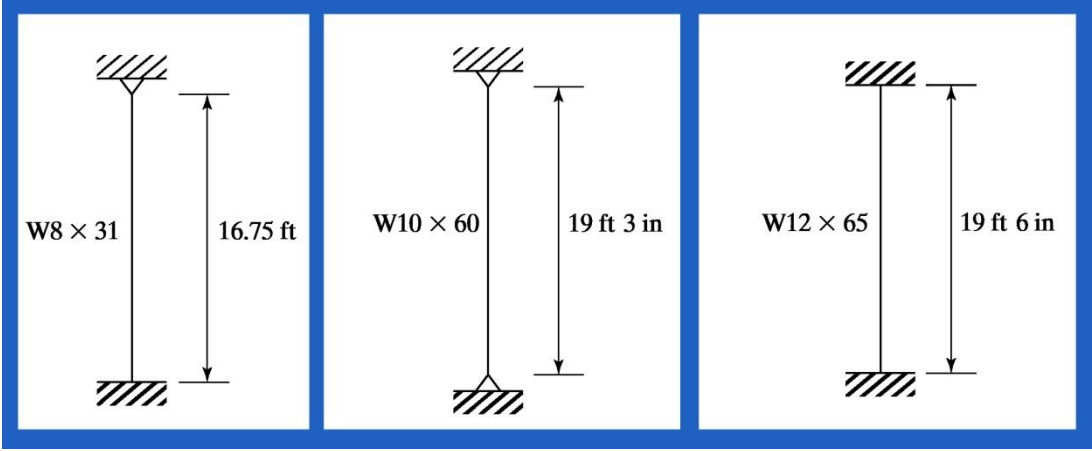
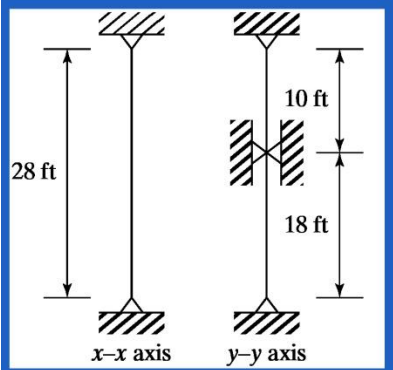
Q18	Determine the effective net cross-sectional area of the C12 × 25 shown in Fig. Holes are for 3/4 in Ø bolts. 
Q19	Determine the effective net areas of the sections shown by using the U values given in Table 3.2 of this chapter. 
Q20	Determine the effective net area of the L7 × 4 × 1/2 shown in Fig. Assume the holes are for 1-in Ø bolts. (Ans. 3.97 in²) 

Q21	Determine the effective net area of the $W16 \times 40$ shown in Fig. Assume the holes are for $\frac{3}{4}$-in $\varnothing$ bolts. (Ans. 8.53 in^2) 
Q22	Determine the LRFD design strength of section A36 steel and $\frac{7}{8}$-in $\varnothing$ bolts 
Q23	Determine the LRFD design strength of section given. A36 steel and $\frac{3}{4}$-in $\varnothing$ bolts (Ans. LRFD 170.42 k, ASD 113.39 k) 
Q24	Determine the LRFD design strength of a $W18 \times 40$ consisting having two lines of 1-in $\varnothing$ bolts in each flange. There are 4 bolts in each line, 3 in on center. Use $F_y = 50 \text{ ksi}$, $F_u = 65 \text{ ksi}$ (Answer. LRFD 391.1 k)

Q25	Determine the LRFD design strength of a WT18 × 50 having two lines of 7/8-in $\varnothing$ bolts as shown in Figure (below) knowing that there are 4 bolts in each line, 3 in on center. Use $F_y = 50 \text{ ksi}$, $F_u = 65 \text{ ksi}$ 
Q26	Determine the LRFD design strength of a W18 × 40 of A992 steel having two lines of 3/4-in $\varnothing$ bolts in each flange. There are 3 bolts in each line, 4 in on center. Use $F_y = 50 \text{ ksi}$, $F_u = 65 \text{ ksi}$ (Answer. LRFD 431.2 k)
Q27	Determine the LRFD design strength of a C9 × 20 ($F_y = 36 \text{ ksi}$, $F_u = 58 \text{ ksi}$) with 2 lines of 7/8-in $\varnothing$ bolts in the web as shown in Fig. (below). (Ans. LRFD 190.2 k, ASD 126.5 k) 
Q28	Determine the LRFD design strength of a WT5 × 15 with a transverse weld to its flange only as shown in Fig. (below). Use $F_y = 50 \text{ ksi}$, $F_u = 65 \text{ ksi}$ 

Q29	Determine the LRFD design strength of a $C6 \times 10.5$ with two longitudinal welds shown in Fig. (below). Use $F_y = 36 \text{ ksi}$, $F_u = 58 \text{ ksi}$ (Ans. LRFD 99.5 k, ASD 66.2 k) 
Q30	Determine the LRFD design strength of a $3/8 \times 5$ plate with two longitudinal welds as shown in Fig. (below). Use $F_y = 36 \text{ ksi}$, $F_u = 58 \text{ ksi}$ 
Q31	Select the lightest W12 section available to support working tensile loads of $PD = 120 \text{ k}$ and $PW = 288 \text{ k}$. The member is to be 20 ft long and is assumed to have two lines of holes for $3/4$-in $\emptyset$ bolts in each flange. There will be at least three holes in each line 3 in on center. Use $F_y = 50 \text{ ksi}$, $F_u = 65 \text{ ksi}$ (Ans. W12 $\times$ 45)
Q32	Select the lightest S section that will safely support the service tensile loads $PD = 75 \text{ k}$ and $PL = 40 \text{ k}$. The member is to be 20 ft long and is assumed to have one line of holes for $3/4$-in $\emptyset$ bolts in each flange. Assume that there are at least three holes in each line 4 in on center. Use $F_y = 36 \text{ ksi}$, $F_u = 58 \text{ ksi}$
Q33	Select the lightest C section that will safely support the service tensile loads $PD = 65 \text{ k}$ and $PL = 50 \text{ k}$. The member is to be 14 ft long and is assumed to have two lines of holes for $3/4$-in $\emptyset$ bolts in the web. Assume that there are at least three holes in each line 3 in on center. Use $F_y = 36 \text{ ksi}$, $F_u = 58 \text{ ksi}$ (Answer. C8 $\times$ 18.75 LRFD)

Q34	Select the lightest W10 section that will resist a service tensile load, PD = 175 k and PL = 210 k. The member is to be 25 ft long and is assumed to have two lines of holes in each flange and two lines of holes in the web. Assume there are four bolts in each line 3 in on center. All holes are for 7/8-in Ø bolts. Use $F_y = 36 \text{ ksi}$, $F_u = 58 \text{ ksi}$
Q35	Select the lightest C section that will safely support the service tensile loads PD=20 k and PL = 34 k. The member is to be 12 ft long and is assumed to have only a transverse weld at the end of the channel. A36 steel is used. (Answer. C6×10.5)
Q36	Determine the critical buckling load for a solid round bar of 2 in diameter, using the Euler equation. Knowing that $E = 29,000 \text{ ksi}$. $F_y = 36,000 \text{ psi}$. Assume simple ends and maximum permissible $L/r = 200$. If: $L = 4 \text{ ft } 0 \text{ in}$ (Answer. 97.52 kips) $L = 2 \text{ ft } 3 \text{ in}$ (Answer. Euler equation not applicable, F_e exceeds F_y) $L = 6 \text{ ft } 6 \text{ in}$ (Answer. 36.94 kips)
Q37	Determine the critical buckling load for the pipe section shown in Figure (below), using the Euler equation. Knowing that $E = 29,000 \text{ ksi}$. $F_y = 36,000 \text{ psi}$. If: $L = 22 \text{ ft } 0 \text{ in}$ $L = 18 \text{ ft } 0 \text{ in}$ $L = 12 \text{ ft } 0 \text{ in}$  The diagram shows a cross-section of a pipe. A horizontal dimension line above the pipe indicates an outer diameter of 6 in. A vertical dimension line to the right of the pipe indicates a wall thickness of 3/8 in.

Q38	Determine the LRFD design strength, $\phi_c P_n$, for each of the compression members shown. Use the AISC Specification and a steel with $F_y = 40 \text{ ksi}$ 
Q39	Determine $\phi_c P_n$ for each of the columns, using the AISC Specification and $F_y = 40 \text{ ksi}$. - W12 $\times$ 120 with $KL = 26 \text{ ft}$. (Answer. 768 k) - HP10 $\times$ 42 with $KL = 20 \text{ ft}$. (Answer. 269 k) - WT8 $\times$ 50 with $KL = 24 \text{ ft}$. (Answer. 209 k)
Q40	A 24 ft axially loaded W12 $\times$ 96 column that has the bracing and end support conditions shown in the figure. (Answer. 960.83 k) 
Q41	Calculate the bending stress due to a bending moment of 105 ft-k (footkips) about the strong axis on the following wide-flange beams: - W 10 $\times$ 49 - W 12 $\times$ 45 - W 14 $\times$ 38
Q42	Calculate the allowable bending moment for each of the beams in problem Q41 given $F_y = 36 \text{ ksi}$ $F_y = 50 \text{ ksi}$