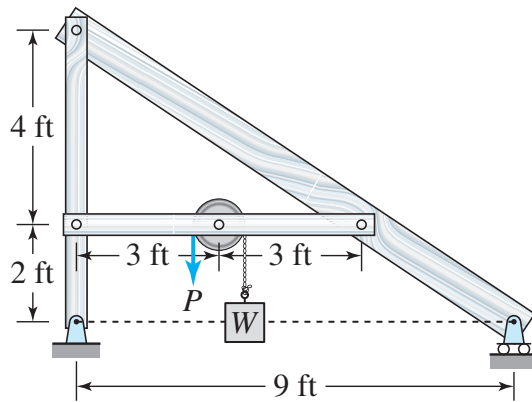


C10.7 A hoist is to be designed for lifting a maximum weight of $W = 300$ lbs. The hoist will be installed at a certain height above ground and will be constructed using lumber and assembled using steel bolts. The lumber rectangular cross-section dimensions are listed in table below. The bolt joints will be modeled as pins in single shear. Same size bolts will be used in all joints. The allowable normal stress in the wood is 1.2 ksi and the allowable shear stress in bolts is 6 ksi. Design the lightest hoist by choosing the lumber from the given table and bolt size to the nearest 1/8 inch diameter.



Cross-section Dimension
2 in x 4 in
2 in x 6 in
2 in x 8 in
4 in x 4 in
4 in x 6 in
4 in x 8 in
6 in x 6 in
6 in x 8 in
8 in x 8 in

Lumber

Allowable: 1200 psi

Width b	Height h	MomOfInertia bh ³ /12	SectionModulus c = h/2	Bending Max M Z x Allow	Area A = bh	Tension Max F A x Allow	Sorted by Max M Capacity			
							b	h	Max M	Area
Inch	Inch	Inch ⁴	Inch	Inch ³	InLb	Lb	Inch	Inch	InLb	in ²
2	4	10.667	2	5.333	6,400	8	2	4	6,400	8
2	6	36.000	3	12.000	14,400	12	4	4	12,800	16
2	8	85.333	4	21.333	25,600	16	2	6	14,400	12
4	4	21.333	2	10.667	12,800	16	2	8	25,600	16
4	6	72.000	3	24.000	28,800	24	4	6	28,800	24
4	8	170.667	4	42.667	51,200	32	6	6	43,200	36
6	6	108.000	3	36.000	43,200	36	4	8	51,200	32
6	8	256.000	4	64.000	76,800	48	6	8	76,800	48
8	8	341.333	4	85.333	102,400	64	8	8	102,400	64

Bolts

Allowable: 6000 psi

Diameter	Area A=PiD ² /4	Shear
		Max F A x Allow
Inch	Inch ²	Lb
0.125	0.0123	73.6
0.250	0.0491	294.5
0.375	0.1104	662.7
0.500	0.1963	1178.1
0.625	0.3068	1840.8
0.750	0.4418	2650.7
0.875	0.6013	3607.9
1.000	0.7854	4712.4