



# Announcements

- CBTF Quiz 4 next week (10/17-20)
- Go to your discussion sessions

## □ Upcoming deadlines:

- Thursday (10/12)
  - ME HW13
- Friday (10/13)
  - WA #2



## Recap

### • Truss Analysis

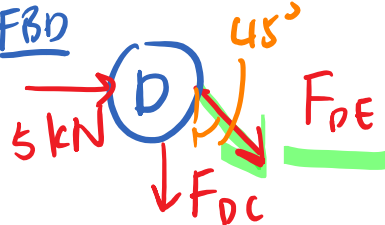
#### • Zero Force Member

BF

#### • Pin/Joint Method

~ find forces on DE

FBD



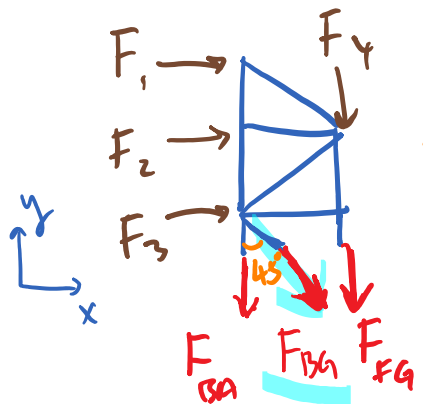
$$\sum F_x = 0$$

$$= 5 \text{ kN} + F_{DE} \sin 45^\circ$$

$$\Rightarrow F_{DE} = -5\sqrt{2} \text{ kN (C)}$$

#### • Section Method

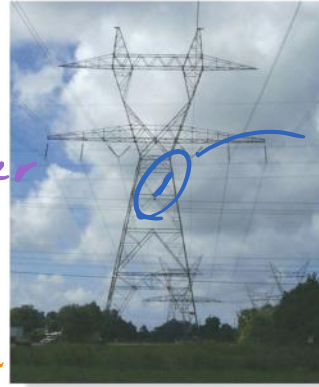
~ find forces on BG



$$\sum F_x = 0$$

$$= F_1 + F_2 + F_3 + F_{BG} \sin 45^\circ$$

$$\Rightarrow F_{BG} = -25\sqrt{2} \text{ kN (C)}$$



? Tension? (+)  
Compression? (-)  
 $F = ?$

# Frames and machines

Frames and machines are two common types of structures that have at least **one multi-force member** (Recall that trusses have nothing but two-force members).



**Frames** are generally **stationary** and used to support various external loads.

# Frames and machines

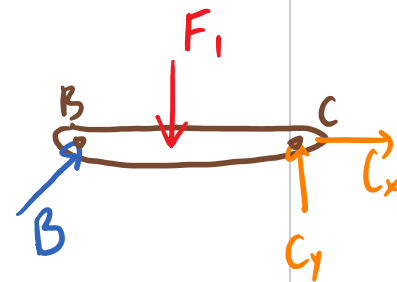
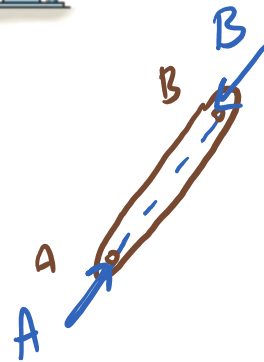
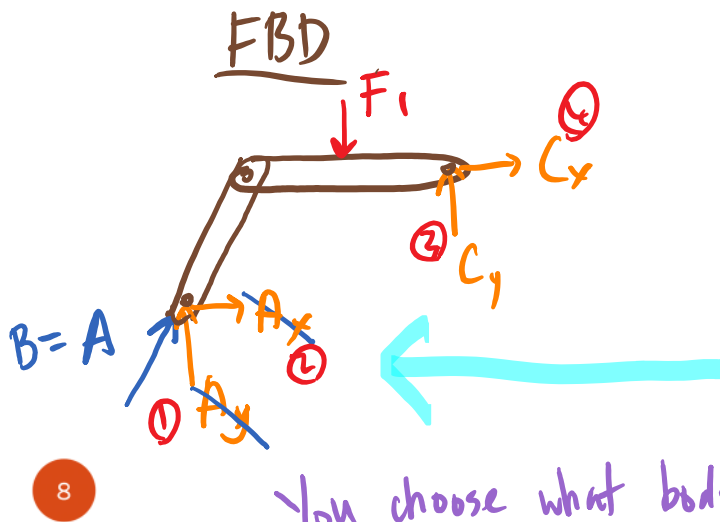
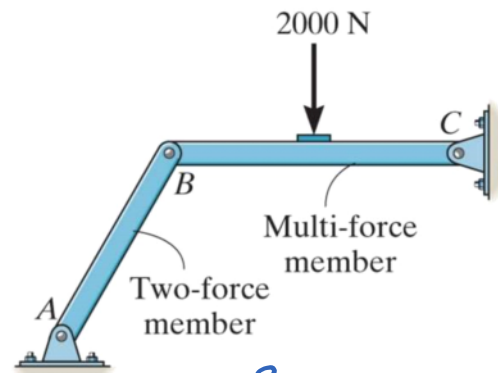
Frames and machines are two common types of structures that have at least **one multi-force member** (Recall that trusses have nothing but two-force members).



**Machines** contain **moving parts** and are designed to alter the effect of forces.

# Frames and machines

The members can be truss elements, beams, pulleys, cables, and other components. The general solution method is similar to rigid body at equilibrium analysis:



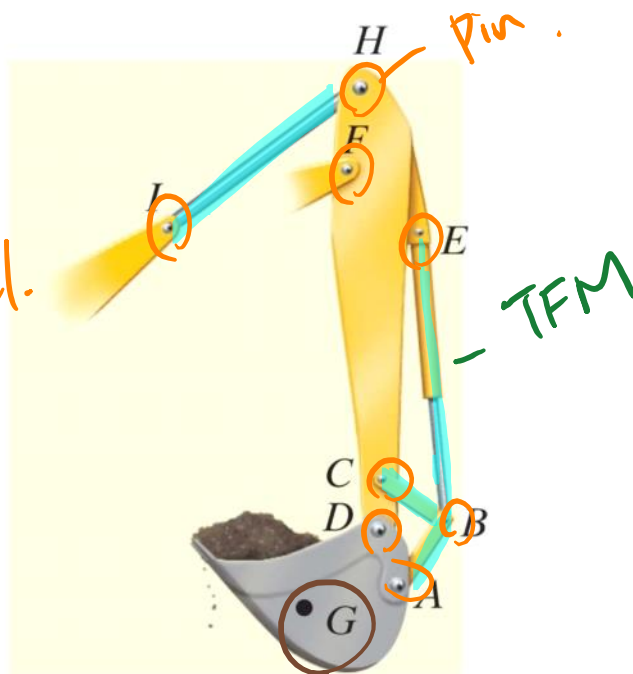
You choose what body/bodies to do analysis on!



Draw the FBD of the members of the backhoe. The bucket and its contents have a weight  $W$ .

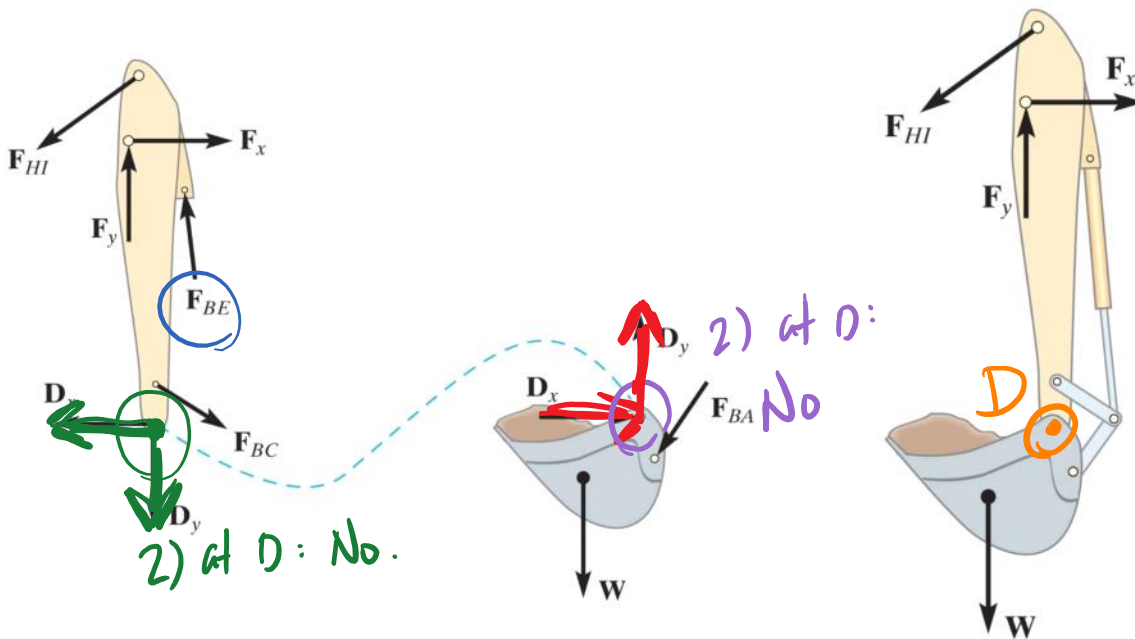


ideal.  
⇒



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Example: Find forces on HFCD  
at H.



at D:  
1.) 2 bodies  
2.) Yes

1.) What are the bodies in contact ?

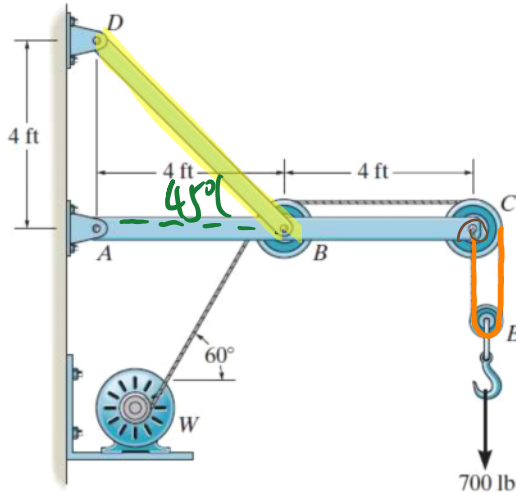
2.) Are all the bodies in contact present in FBD ?

~ Yes: don't include internal forces

~ No: show external reaction from missing body.

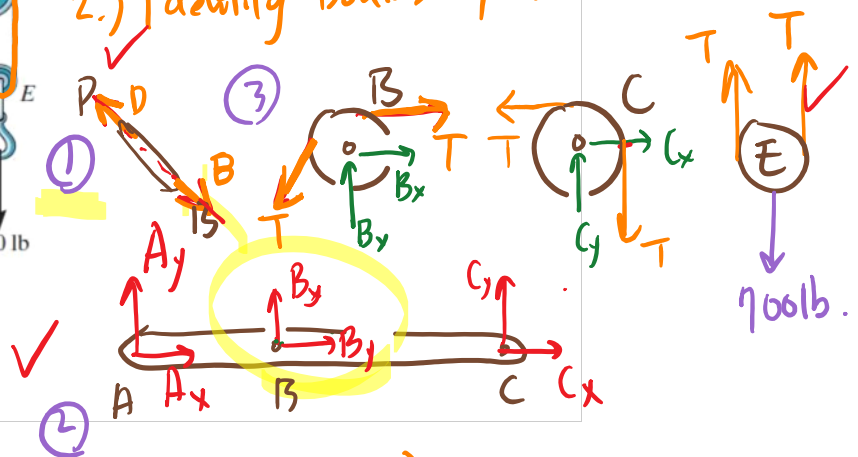
**Given:** The wall crane supports an external load of 700 lb.

**Find:** The force in the cable at winch motor W and the horizontal and vertical components of pin reactions at A, B, C, and D.



1.) Identify 2 force members.  
→ DB.

2.) Identify bodies of interest.



B (TFM)  
Pin B  
Bx (pulley)

Bx (ABC)  
By (pulley)  
By (ABC)

$$\sum F_x = -B_x - B_x + B_x = 0$$

$$\sum F_y = -B_y - B_y - B_y = 0$$