Announcements

- Quiz 3 retry continues through Saturday.

- Upcoming deadlines:
- Friday (3/1) – TODAY!
  - Written Assignment
- Tuesday (3/5)
  - PL HW

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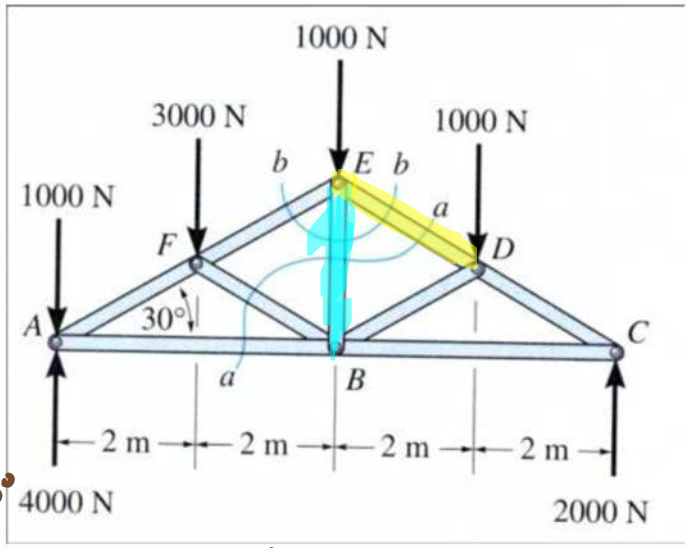
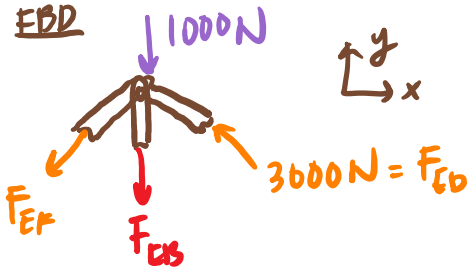
Example

$F_{ED} = 3000$ N in compression, determine F_{EB}.



Use cut b-b :

EBD



EoE

$\Sigma F_x = -F_{EF}\cos 30° - 3000\cos 30°$

$= 0 \longrightarrow F_{EF} = -3000$ N or 3000 N (compression)

$\Sigma F_y = -F_{EF}\sin 30° - F_{EB} + 3000\sin 30° - 1000\text{ N} = 0$

$\longrightarrow F_{EB} = 2000$ N (tension)

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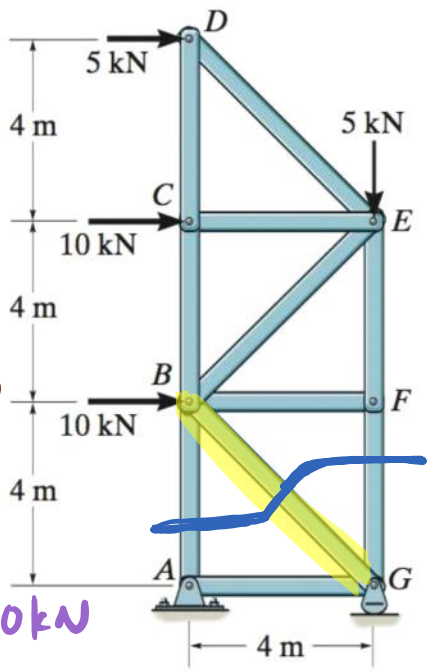
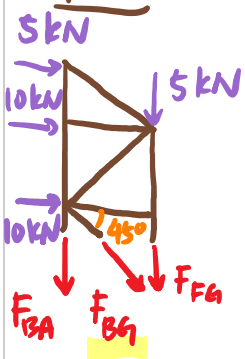
Determine the force in members BG, and state if the members are in tension or compression.



Strategy: method of section
(the member is in the middle of a large truss)

- Cut through BG + 2 more member

FBD



EoE (Q: what's unique to F_{BG} compare to F_{BA} & F_{FG}?)

$$\sum F_x = 0 = F_{BG}\cos 45° + 5\text{kN} + 10\text{kN} + 10\text{kN}$$

$$F_{BG} = \frac{-25\text{kN}}{\cos 45°} \quad \text{(compression)}$$

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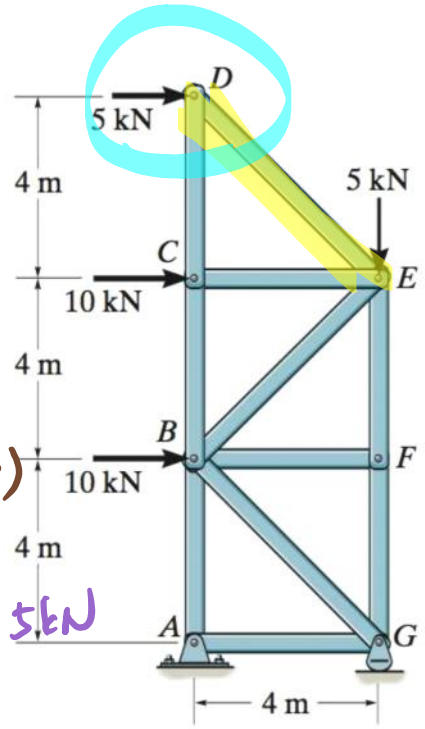
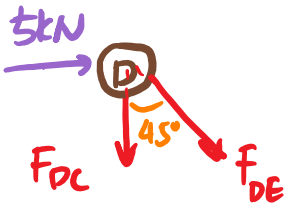
Determine the force in members *DE*, and state if the members are in tension or compression.



Strategy: method of pins (connected to a pin with a load and one other member only)

- Use pin D

FBD



EoE (what's unique to F_{DE}?)

$$\Sigma F_x = 0 = F_{DE}\cos 45° + 5\text{kN}$$

$$F_{DE} = \frac{-5\text{kN}}{\cos 45°} \quad \text{(compression)}$$

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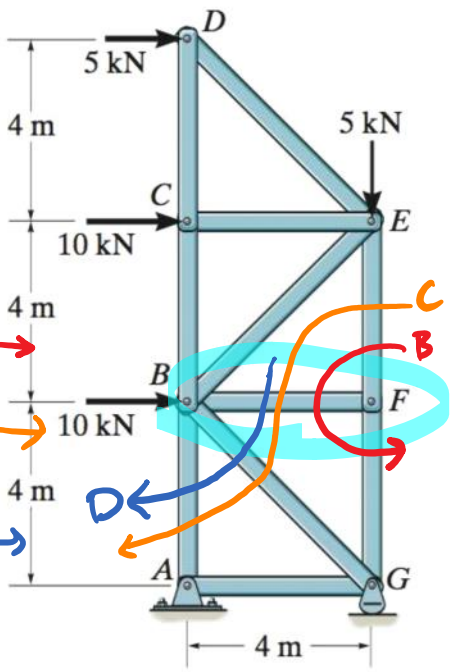
Determine the force in members *BF*, and state if the members are in tension or compression.



Strategy:

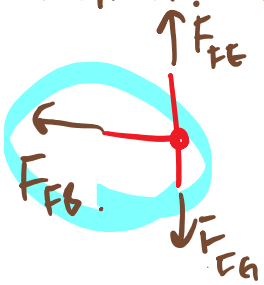
A) Method of pins

B) Method of section & cut through →

C) Method of section & cut through →

D) Method of section & cut through →

E) Other method. (ΣFM rules)



$F_{FB} = 0$

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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.

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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.

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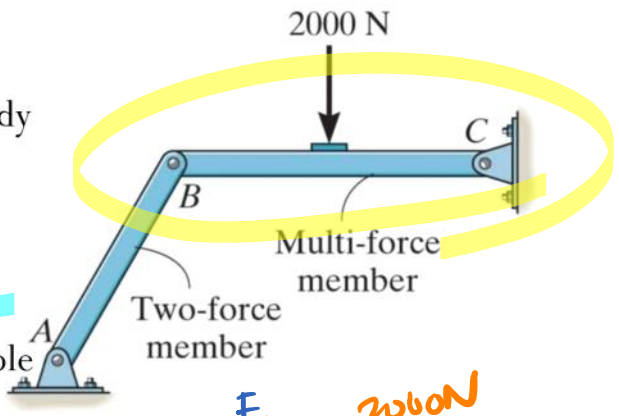
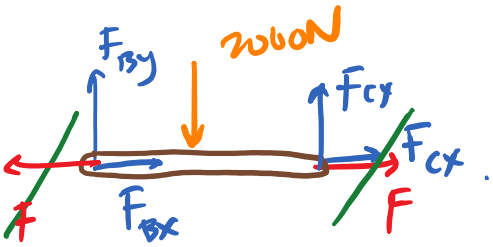
Frames and machines

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

1. Identify the structure member with force/moment of interest loading on it.
2. Perform equilibrium analysis on the whole structure to find support reactions if necessary.
3. Perform equilibrium analysis on identified member of the structure.





Example:

Find the force acting at B on member BC.

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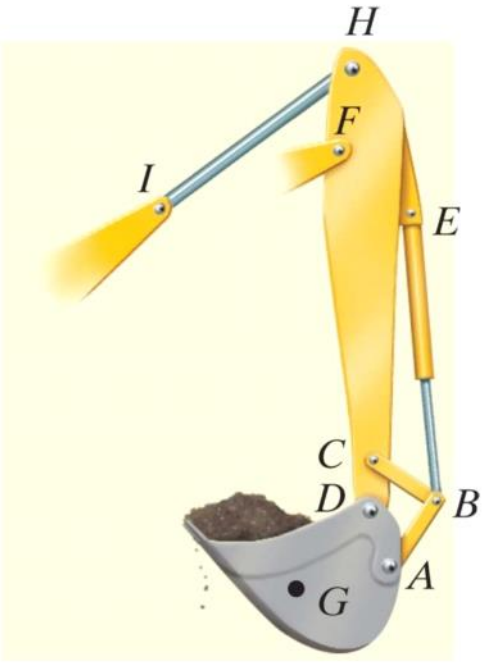
Draw the FBD of the members of the backhoe. The bucket and its contents have a weight W.



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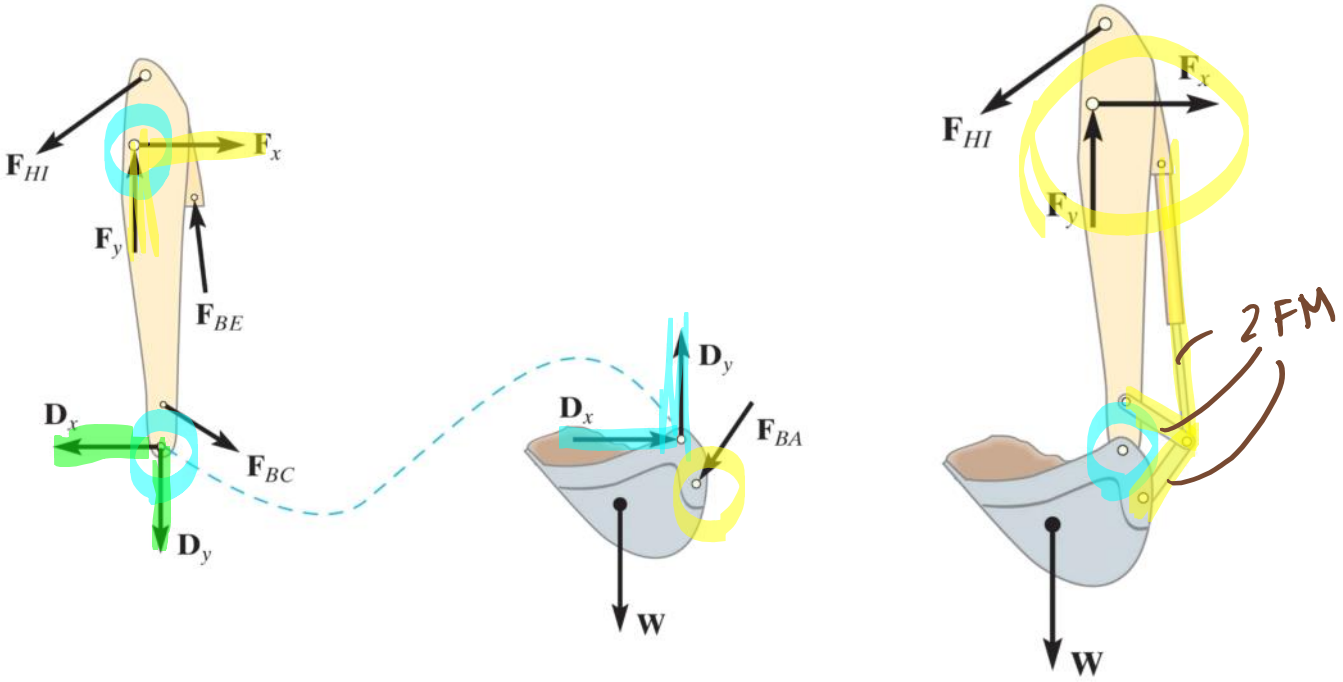

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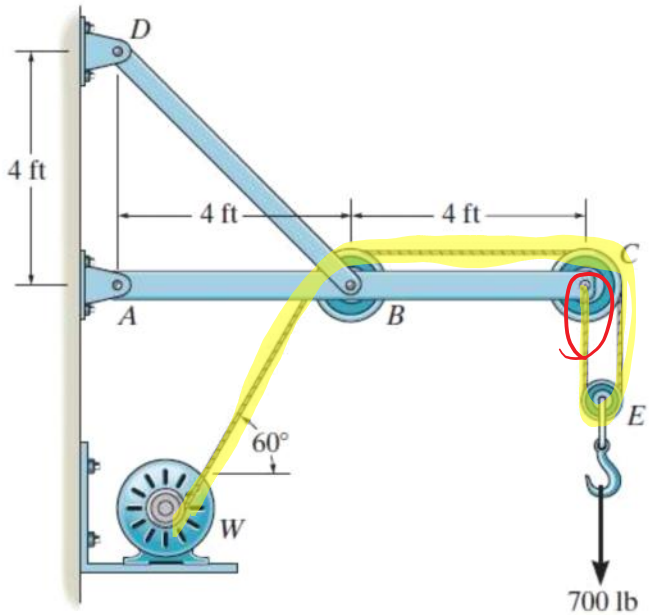
Example

Determine the force in the cable at winch motor W.



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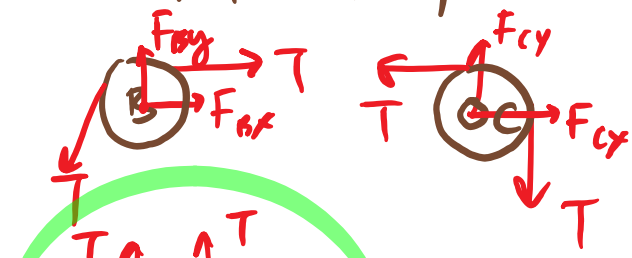
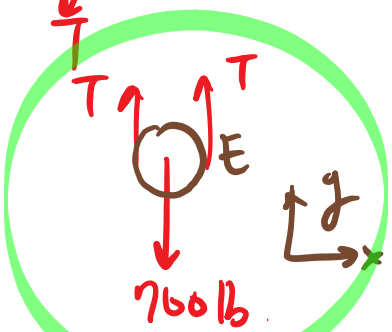
1.) ID rigid body interacting w/ force(s) of interest.





2.) EoE

$\Sigma F_y = 2T - 700\,lb = 0$

$T = 350\,lb.$

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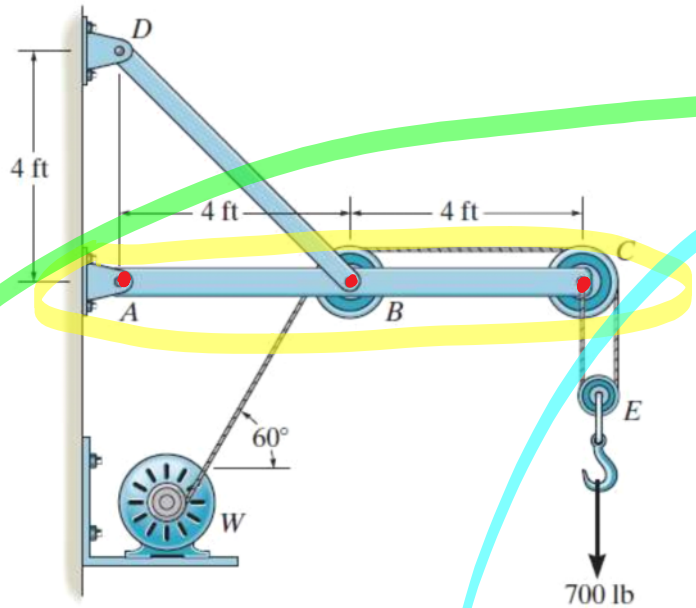
Determine the force acting at A, B, and C on member ABC.



1.) ID rigid body of interest.

FBD

A_y B_y C_y C_x A_x B_x

FBD pin A.

S_{Ay} ← from wall support

$A S_{Ax}$.

A_y A_x

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FBD pin C

P_{Cy} ← from pulley C

P_{Cx}

C_x C_y

from cable → T

• from 2-force member BD

FBD pin B

F_{BD} ← from pulley B

P_x P_y

B_x B_y