

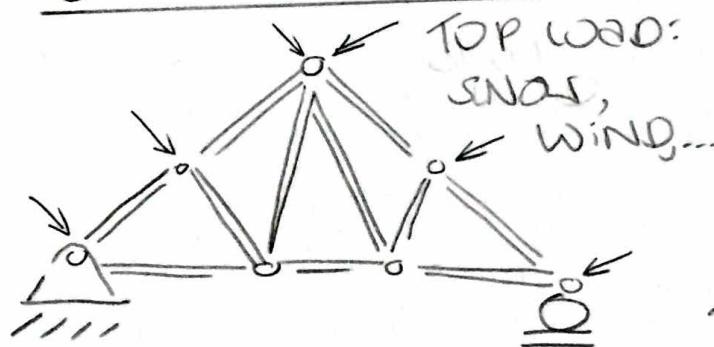
STRUCTURES WEEK

WHAT'S A TRUSS

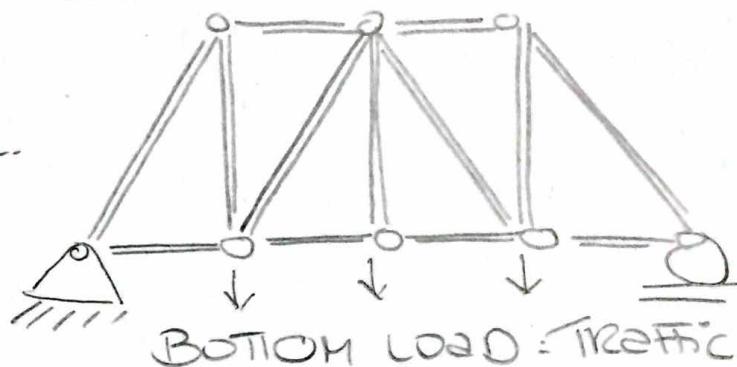
(CHAPTERS 6.1-6.3)

6.1 SIMPLE TRUSSES

EXAMPLE: ROOF



EXAMPLE: BRIDGE



◦ ASSUMPTIONS:

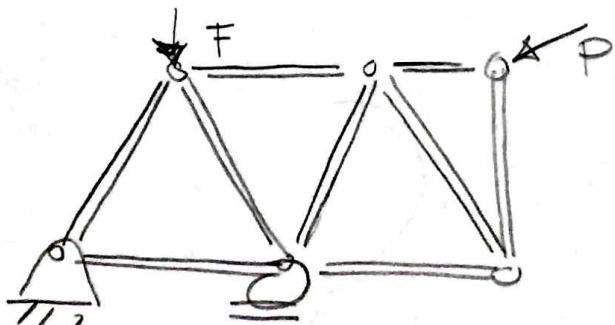
- ALL LOADS ARE APPLIED @ JOINTS
(IF WEIGHT IS IMPORTANT, THEN $\downarrow \frac{W}{2} \quad \downarrow \frac{W}{2}$)
- ALL MEMBERS ARE CONNECTED BY SMOOTH JOINTS
- ~ ONLY TWO FORCE MEMBERS!

"SIMPLE TRUSSES"

DESIGNS:

- START WITH A TRIANGLE TRUSS!
- ADD TWO MEMBERS TO EACH TRUSS TRAIS!)

EXAMPLE:



6.2 METHOD OF JOINTS

- REASONING:

ENTIRE TRUSS IS IN EQUILIBRIUM
 ↳ EACH JOINT MUST BE IN EQUILIBRIUM!

► PLANE (2D) TRUSS: COPLANAR & CONCURRENT FORCE SYSTEM, i.e.,
 $\sum M = 0$ / IS AUTOMATICALLY SATISFIED FOR EACH JOINT.

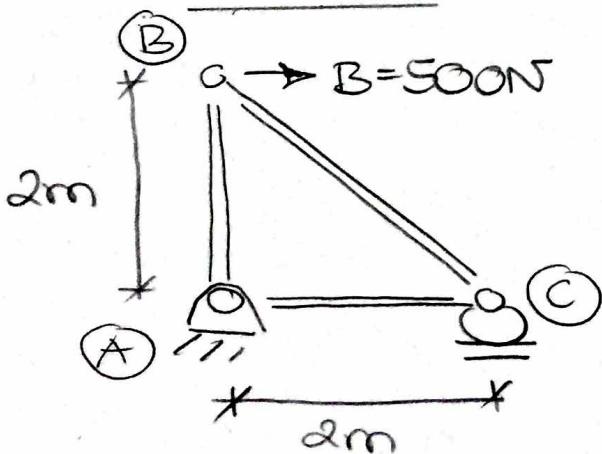
HINT: ALWAYS ASSUME THAT A FORCE IN A MEMBER IS IN TENSION (POSITIVE)
 COMPRESSION (NEGATIVE)

FREE BODY DIAGRAM

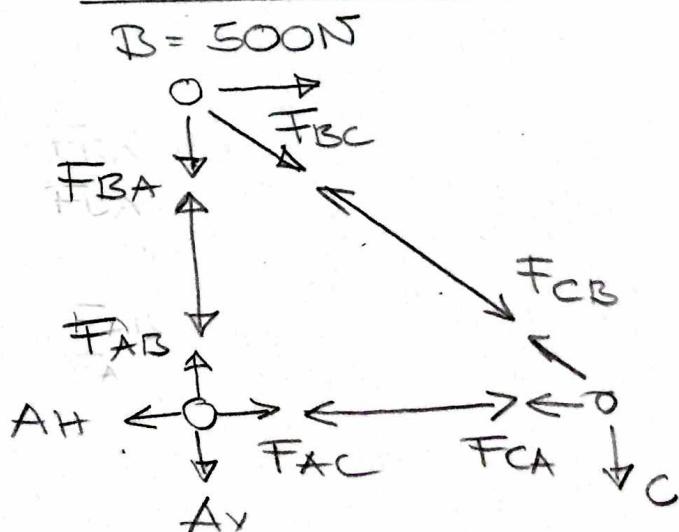
FOR EACH JOINT & EACH MEMBER!

- EXAMPLE 6.1

SYSTEM



FREE BODY Diagram



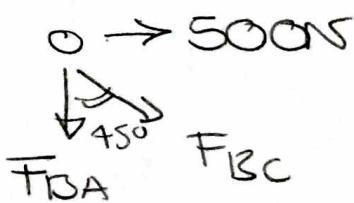
(Signs are different from the book)

→ START smart!

3 forces @ C, 4 forces @ A, 2 forces @ B

→ start @ B?

1) Joint B:



$$\uparrow \sum F_x = 0: +500N - F_{BC} \cdot \sin 45^\circ = 0$$

$$F_{BC} = \frac{500N}{\sqrt{2}} = \underline{\underline{707.1 \text{ N}}}$$

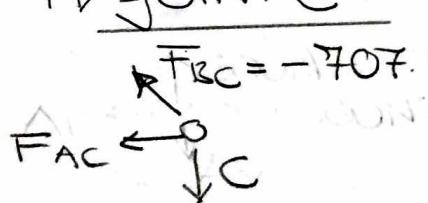
↑ compression

$$\uparrow \sum F_y = 0: -F_{BA} - F_{BC} \cos 45^\circ = 0$$

$$F_{BA} = -F_{BC} \cdot \frac{1}{2}\sqrt{2} = \underline{\underline{+500 \text{ N}}}$$

↑ tension

1) Joint C:



$$\uparrow F_{BC} = -707.1 \text{ N} \quad \uparrow \sum F_x = 0: -F_{AC} - [-707.1 \text{ N} \cdot \cos 45^\circ] = 0$$

$$F_{AC} = +707.1 \text{ N} \cdot \frac{1}{2}\sqrt{2} = \underline{\underline{+500 \text{ N}}}$$

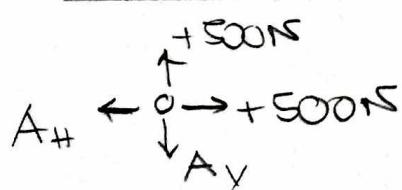
↑ tension

$$\uparrow \sum F_y = 0: -C + [-707.1 \text{ N} \cdot \sin 45^\circ] = 0$$

$$C = -707.1 \text{ N} \cdot \frac{1}{2}\sqrt{2} = \underline{\underline{-500 \text{ N}}}$$

↑ compression

1) Joint A:



$$\uparrow \sum F_x = 0: -A_H + 500N = 0$$

$$A_H = \underline{\underline{+500 \text{ N}}}$$

↑ tension

$$\uparrow \sum F_y = 0: -A_V + 500N = 0$$

$$A_V = \underline{\underline{+500 \text{ N}}}$$

↑ tension



CHECK

ID JS EACH NODE ON EQUILIBRIUM? E.G. GRAPHIC BY VECTOR ADDITION

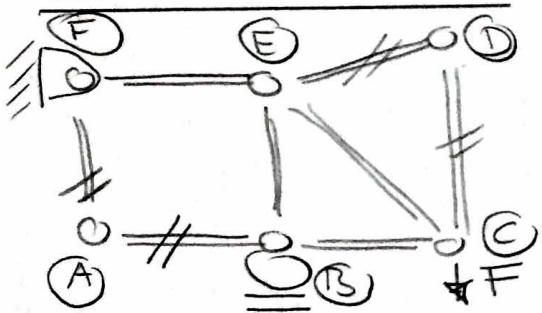
ID JS SYSTEM ON EQUILIBRIUM?
 $\rightarrow \sum F_x = 0; \sum F_y = 0; \sum M = 0$

6.3 ZERO FORCE MEMBERS

ID IDENTIFY MEMBERS THAT SUPPORT NO LOAD BY INSPECTION.

important

EXAMPLE 6-11

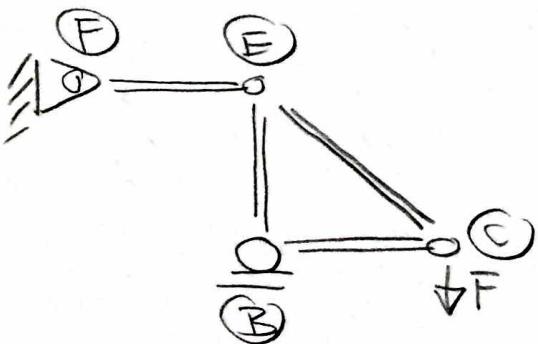


$$@A \rightarrow \sum F_x = 0 \rightarrow F_{AB} = 0$$

$$\uparrow \sum F_y = 0 \rightarrow F_{AF} = 0$$

$$@D \rightarrow \sum F_x = 0 \rightarrow F_{DE} = 0$$

$$\uparrow \sum F_y = 0 \rightarrow F_{DF} = 0$$



\rightarrow joints with only 2 members & no external forces or supports are "ZERO-FORCE MEMBERS".