

# Arch314

# **STRUCTURES I**

Fall 2025  
Recitation

FACULTY: Prof. Peter von Bülow  
Mohsen Vatandoost

# Arch314: STRUCTURES I

## Welcome to Recitation session 09/05

Introduction

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Office hours:

By appointment

Please feel free to ask questions.

# Arch314: STRUCTURES I

## Welcome to the Recitation session 09/05

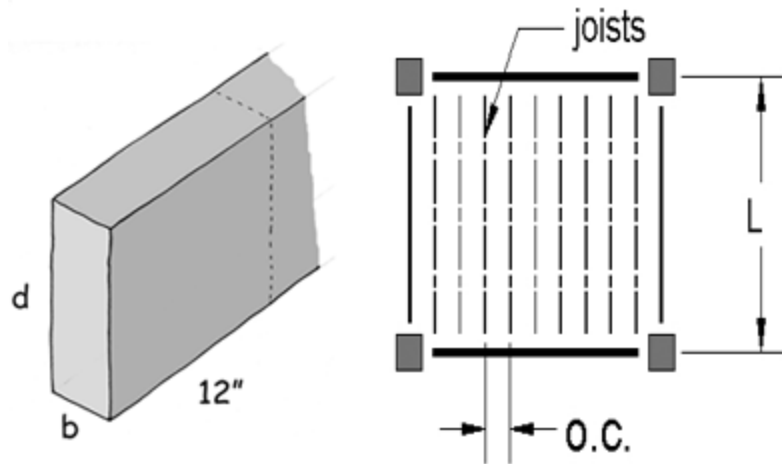
### Outline:

- Quick Recap
- Provide the solution for the assignments (Homework 1, and 2)
- Answering students' questions
- Recitation lab: Adding Forces

Please feel free to ask questions.

# Provide the solution for the assignment- HW1

- Problem:



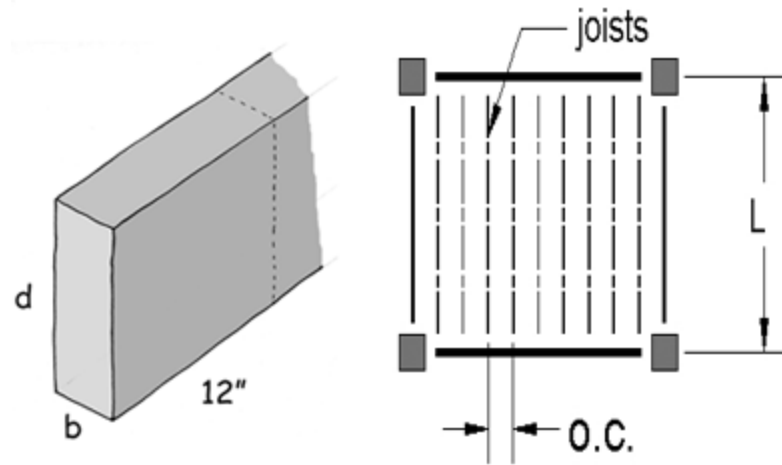
## 1. Dead Load Calculation

For the given member cross-section and length, find the DL in PLF of the joist member, total pounds of the member, and PSF DL of the joist on the floor.

DATASET: 2	-1-	-3-
Width, $b$	1.5 IN	
Depth, $d$	13.25 IN	
Length, $L$	11 FT	
On center spacing	16 IN	
Species class	Western Hemlock	
Density	30 PCF	

# Provide the solution for the assignment- HW1

- Problem:

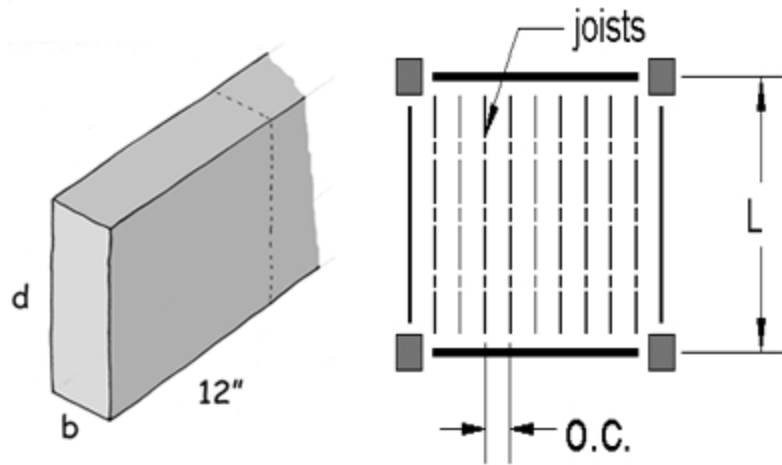


#	Question	Your Response
1	The cross-sectional area: A	<input type="text"/> IN <sup>2</sup>
2	Dead load of joist section	<input type="text"/> PLF
3	Dead load of whole joist member	<input type="text"/> LBS
4	Dead load of joists on floor	<input type="text"/> PSF

Cross-sectional area:  
 $= b \times d$   
 $= 1.5 \times 13.25$   
 $= 19.875 \text{ IN}^2$

# Provide the solution for the assignment- HW1

- Problem:



#	Question	Your Response
1	The cross-sectional area: A	<input type="text"/> IN <sup>2</sup>
2	Dead load of joist section	<input type="text"/> PLF
3	Dead load of whole joist member	<input type="text"/> LBS
4	Dead load of joists on floor	<input type="text"/> PSF

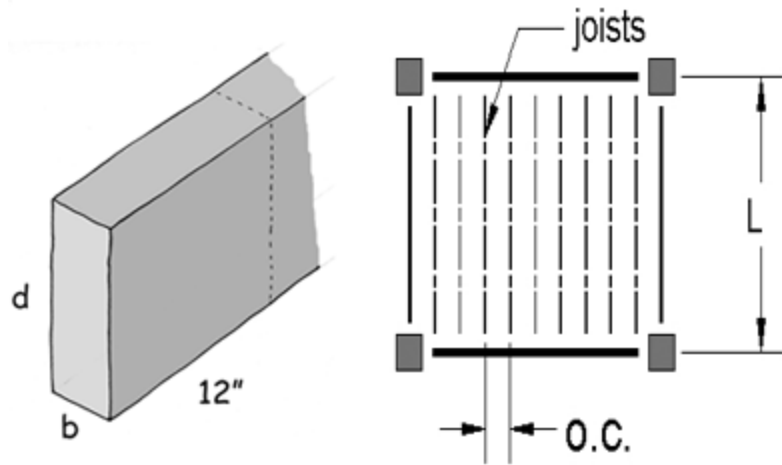
Density = 30 PCF  
Western Hemlock weight 30 Pounds per Cubic Ft

Dead load of Joist section:  
Cross-sectional area = 19.875 IN<sup>2</sup>  
(Convert Inch to ft) = 19.875 \* 1/12 \* 1/12  
= 0.1380 ft<sup>2</sup>

Volume of Joist :  
= Cross-sectional x L (per unite length)= 0.1380 ft<sup>3</sup>  
= 30 x 0.1380 = 4.1406 Pounds Linear foot

# Provide the solution for the assignment- HW1

- Problem:



#	Question	Your Response
1	The cross-sectional area: A	<input type="text"/> IN <sup>2</sup>
2	Dead load of joist section	<input type="text"/> PLF
3	Dead load of whole joist member	<input type="text"/> LBS
4	Dead load of joists on floor	<input type="text"/> PSF

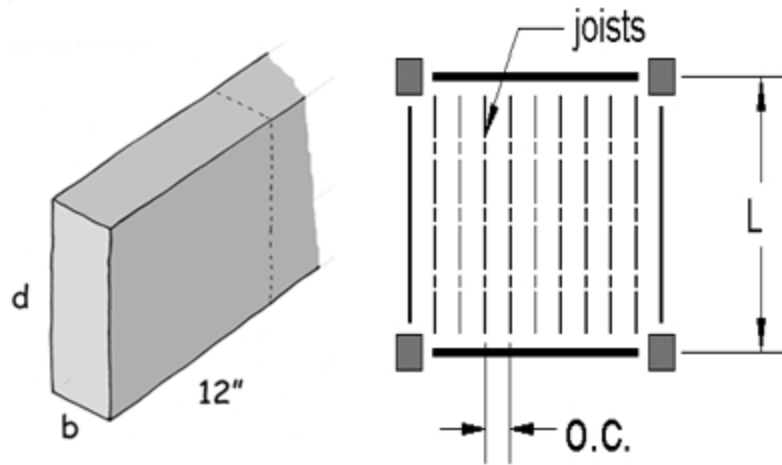
Density = 30 PCF  
Western Hemlock weight 30 Pounds per Cubic Ft

We have calculated the weight of joist for each foot length:  
4.1406 Pounds Linear foot

Dead load of whole Joist member:  
= 4.1406 x Length of the Joist  
= 4.1406 x 11  
= 45.5466 LBS

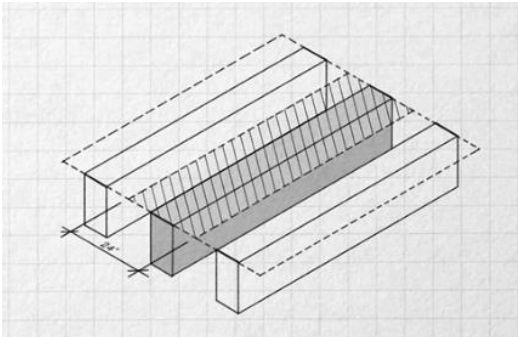
# Provide the solution for the assignment- HW1

- Problem:



#	Question	Your Response
1	The cross-sectional area: A	<input type="text"/> IN <sup>2</sup>
2	Dead load of joist section	<input type="text"/> PLF
3	Dead load of whole joist member	<input type="text"/> LBS
4	Dead load of joists on floor	<input type="text"/> PSF

On Center Spacing = 16 IN

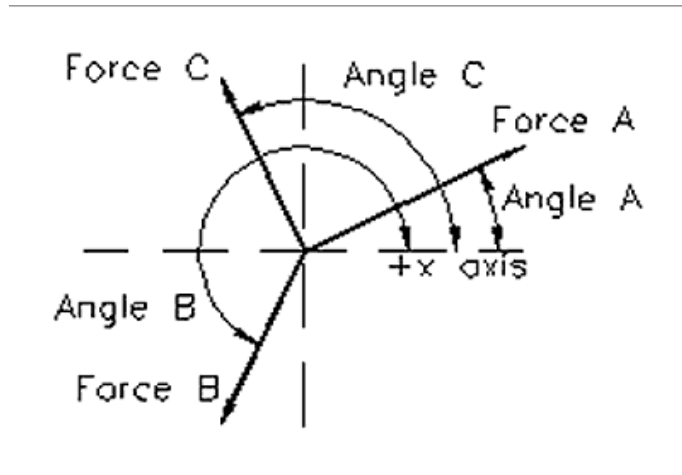


Dead load of joist on floor:

$$\text{Surface} = (16/12) \times \text{Joint Length}$$
$$= (16/12) \times 11 = 14.67$$
  
$$\text{DL (surface)} = \text{DL (weight)} / \text{A (O. C. Surface)}$$
$$= 45.5466 / 14.67 = 3.1047 \text{ PSF}$$

(Pound per square foot)

# Provide the solution for the assignment – HW2

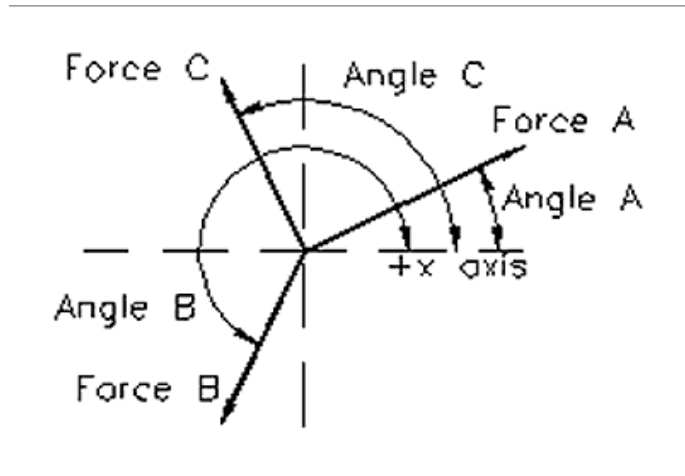


## • Problem:

DATASET: 1	
Force A	37 LBS
Angle A	39 DEGREES
Force B	64 LBS
Angle B	150 DEGREES
Force C	86 LBS
Angle C	334 DEGREES

#	Question	Your Response	Correct Answer
1	Horizontal component of Force A (+ to right: - to left)	<input type="text"/> LBS	<input type="button" value="SUBMIT"/>
2	Vertical component of Force A (+ upward: - downward)	<input type="text"/> LBS	<input type="button" value="SUBMIT"/>
3	Horizontal component of Force B (+ to right: - to left)	<input type="text"/> LBS	<input type="button" value="SUBMIT"/>
4	Vertical component of Force B (+ upward: - downward)	<input type="text"/> LBS	<input type="button" value="SUBMIT"/>
5	Horizontal component of Force C (+ to right: - to left)	<input type="text"/> LBS	<input type="button" value="SUBMIT"/>
6	Vertical component of Force C (+ upward: - downward)	<input type="text"/> LBS	<input type="button" value="SUBMIT"/>
7	Sum of horizontal components (+ to right: - to left)	<input type="text"/> LBS	<input type="button" value="SUBMIT"/>
8	Sum of vertical components (+ upward: - downward)	<input type="text"/> LBS	<input type="button" value="SUBMIT"/>
9	Resultant of Forces A + B + C (absolute value)	<input type="text"/> LBS	<input type="button" value="SUBMIT"/>
10	Angle of the Resultant in DEGREES from + x axis counterclockwise	<input type="text"/> DEGREES	<input type="button" value="SUBMIT"/>

# Provide the solution for the assignment- HW2



- Solution:

DATASET: 1	-2-	-3-
Force A	37 LBS	
Angle A	39 DEGREES	
Force B	64 LBS	
Angle B	150 DEGREES	
Force C	86 LBS	
Angle C	334 DEGREES	

$$\begin{cases} (F_A)_x = F_A \cos(A) = (37)(\cos 39) = 28.75 \\ (F_A)_y = F_A \sin(A) = (37)(\sin 39) = 23.285 \end{cases}$$

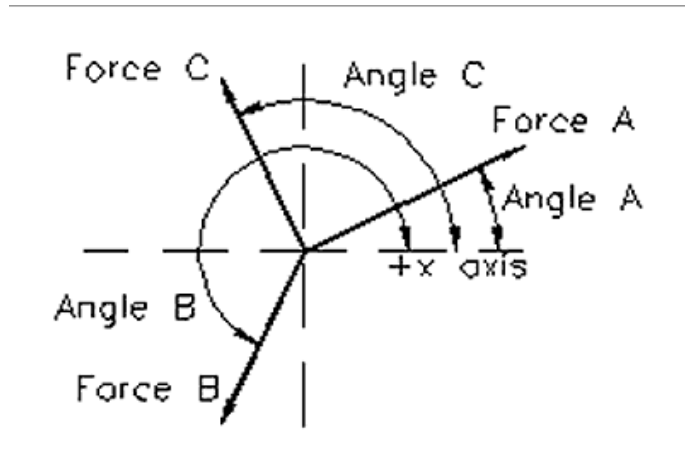
$$\begin{cases} (F_B)_x = F_B \cos(150) = -55.425 \\ (F_B)_y = F_B \sin(150) = 32 \end{cases}$$

$$\begin{cases} (F_C)_x = F_C \cos(334) = 77.29 \\ (F_C)_y = F_C \sin(334) = -37.69 \end{cases}$$

$$\begin{aligned} \sum F_x &= (F_A)_x + (F_B)_x + (F_C)_x \\ &= 28.75 - 55.425 + 77.29 \\ &= \boxed{50.615} \end{aligned}$$

$$\begin{aligned} \sum F_y &= (F_A)_y + (F_B)_y + (F_C)_y \\ &= 23.285 + 32 - 37.69 \\ &= \boxed{17.595} \end{aligned}$$

# Provide the solution for the assignment- HW2

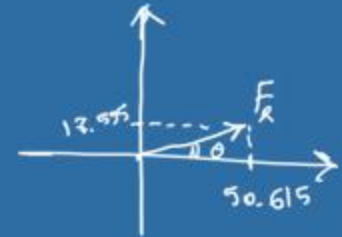


- Solution:

$$F_R = \sqrt{F_x^2 + F_y^2}$$

$$= \sqrt{50.615^2 + 17.595^2}$$

$$= \boxed{53.58}$$



$$\tan \theta = \frac{F_x}{F_y} \longrightarrow \theta = \tan^{-1} \left( \frac{F_x}{F_y} \right)$$

$$= \tan^{-1} \left( \frac{50.615}{17.595} \right)$$

$$= \boxed{19.92}$$

DATASET: 1

-2-

-3-

Force A	37 LBS
Angle A	39 DEGREES
Force B	64 LBS
Angle B	150 DEGREES
Force C	86 LBS
Angle C	334 DEGREES

# Lab: Adding Forces

## Adding Forces

### Description

This project is intended to give a sense how forces combine in a system of equilibrium. A selection of 3 force equilibrium systems are modeled both physically and graphically to verify hand calculations.

### Goals

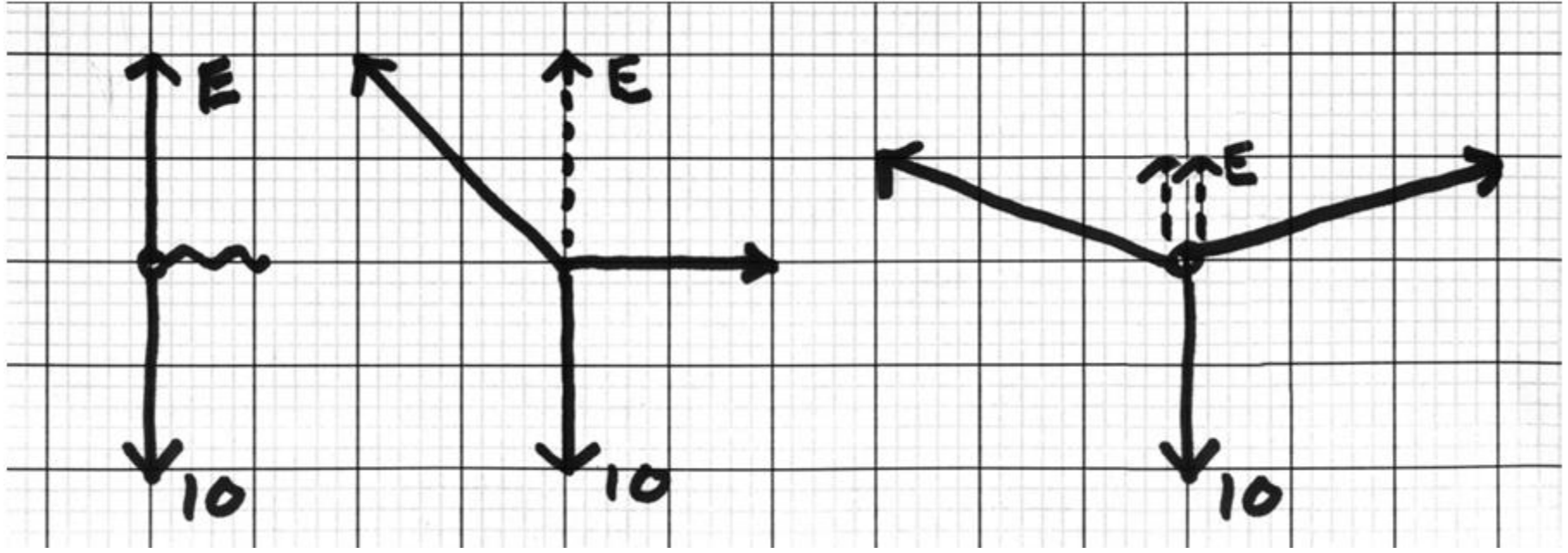
- To model two component forces of an equilibrant in tension using a physical model.
- To show the vector addition of the same 2 forces to find the resultant
- To make hand calculations of the same vector addition.

# Lab: Adding Forces

## Procedure

1. Using a piece of string with some weight tied to the middle; hold the two string ends at  $0^\circ$  and  $90^\circ$  (horizontal and vertical). Observe that the horizontal is slack (no force in the string). Your hand on the vertical string is the equilibrant force to the force of gravity acting on the weight.
2. Move the vertical string so one string is at  $45^\circ$  and the other at  $0^\circ$  (horizontal).
3. Make a scaled sketch of equilibrant force (opposite to the weight) and its 2 component forces (the two strings in your hands). Scale the *force* not the string. Assume the weight to be 10 units. Scale the forces on the graph paper and estimate the force magnitude of each of the two component forces.
4. Use either trigonometry or similar triangles to calculate the forces in the strings. Compare your results with the graphic result.
5. Try another variation like the third figure below.
6. Try to pull the 2 strings horizontal (don't break the string). Observe that there tends to be a small sag in the string even when pulled fairly taut.

# Lab: Adding Forces



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# Any question?

Please feel free to ask questions.