TAUBMAN COLLEGE
ARCHITECTURE & URBAN PLANNING
UNIVERSITY OF MICHIGAN

Arch314
STRUCTURES I

Fall 2024
Recitation

FACULTY: Prof. Peter von Bülow
Mohsen Vatandoost

Arch314: STRUCTURES I

Welcome to Recitation session 09/06

Introduction

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Office hours:

By appointment

Please feel free to ask questions.

Arch314: STRUCTURES I

Welcome to Recitation session 09/06

Outline:

- Quick Recap
- Provide the solution for the assignment **(Topic Quiz 1 + Homework 1,and 3)**
- Answering student's questions
- Recitation lab: Adding Forces

Please feel free to ask questions.

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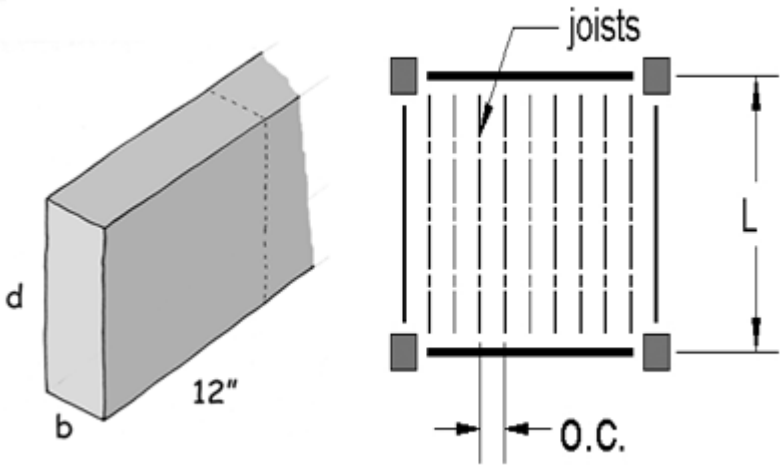
Contact: Mohsenv@umich.edu

Provide the solution for the assignment- HW1



- **Problem:**

1. Dead Load Calculation

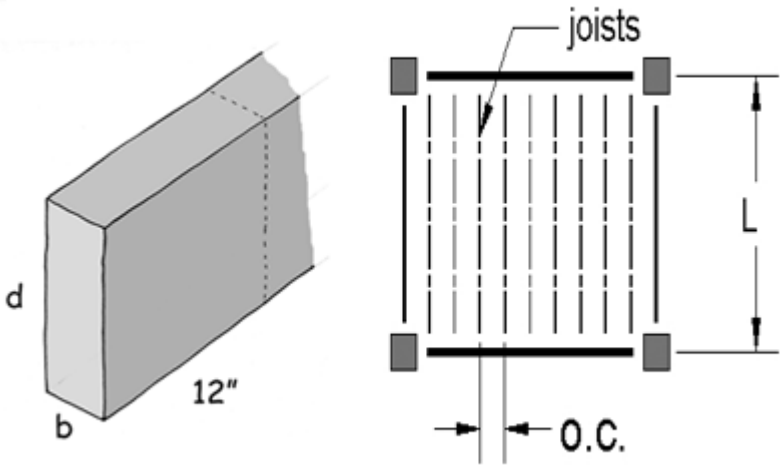
For the given member cross-section and length, find the DL in PLF of the joist member, total pounds of the member, and PSF DL of the joist on the floor.

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:

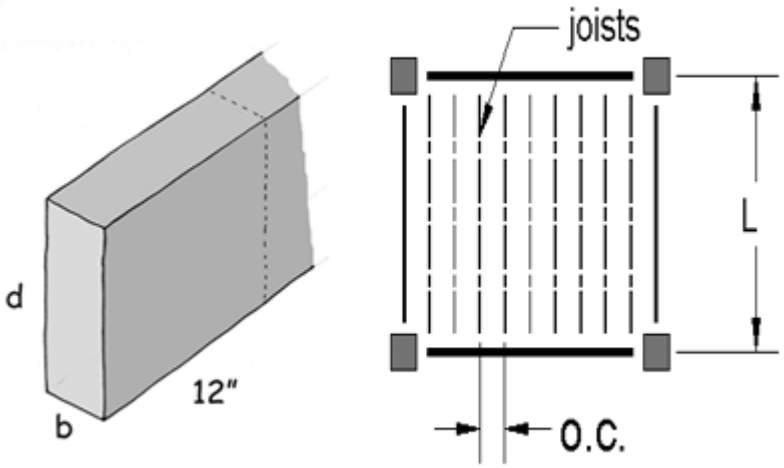


#	Question	Your Response
1	The cross-sectional area: A	IN^2
2	Dead load of joist section	PLF
3	Dead load of whole joist member	LBS
4	Dead load of joists on floor	PSF

Cross-sectional area:
= b x d
= 1.5 x 13.25
= 19.875 IN^2

Provide the solution for the assignment- HW1

- Problem:



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1	The cross-sectional area: A	IN^2
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3	Dead load of whole joist member	LBS
4	Dead load of joists on floor	PSF

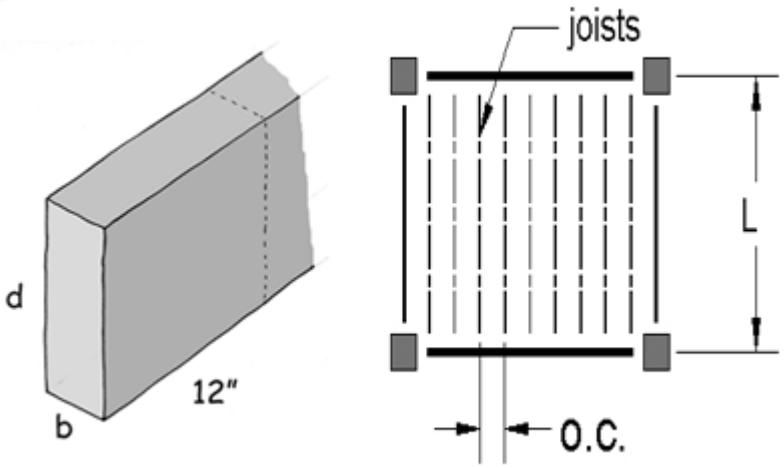
Density = 30 PCF
Western Hemlock weight 30 Pounds per Cubic Ft

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

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

Provide the solution for the assignment- HW1

- Problem:



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2	Dead load of joist section	PLF
3	Dead load of whole joist member	LBS
4	Dead load of joists on floor	PSF

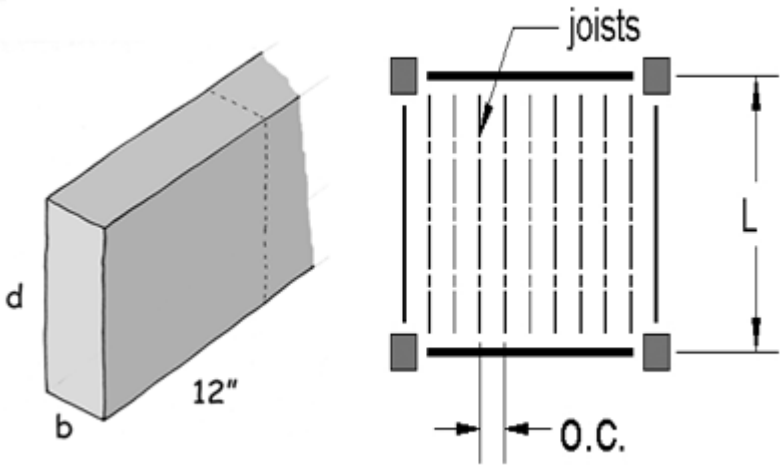
Density = 30 PCF
Western Hemlock weight 30 Pounds per Cubic Ft

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:



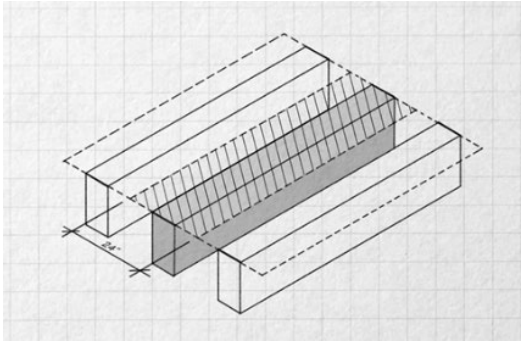
#	Question	Your Response
1	The cross-sectional area: A	IN^2
2	Dead load of joist section	PLF
3	Dead load of whole joist member	LBS
4	Dead load of joists on floor	PSF

On Center Spacing = 16 IN

Dead load of joist on floor:

Surface = (16/12) x Joint Length
= (16/12) x 11 = 14.67

DL (surface) = DL(weight) / A (O. C. Surface)
= 45.5466 / 14.67 = 3.1047 PSF
(Pound per square foot)



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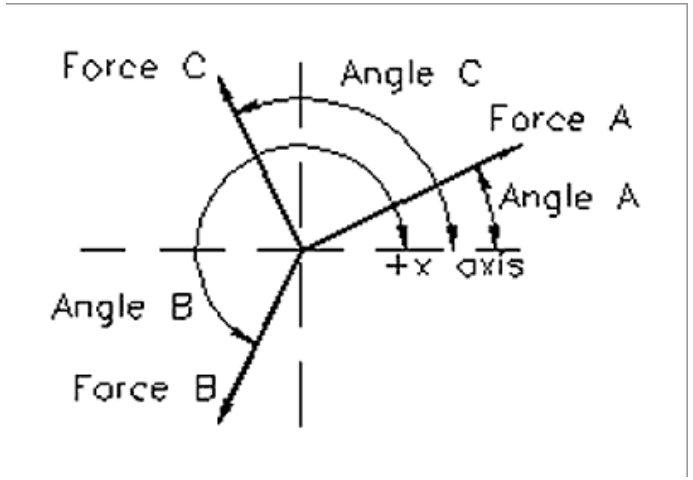
Provide the solution for the assignment – HW2



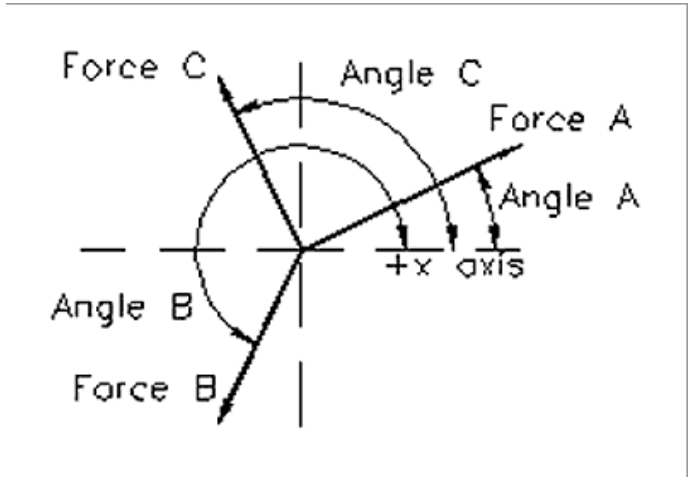
- **Problem:**

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

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

Provide the solution for the assignment- HW2



DATASET: 1	-2-	-3-
Force A		37 LBS
Angle A		39 DEGREES
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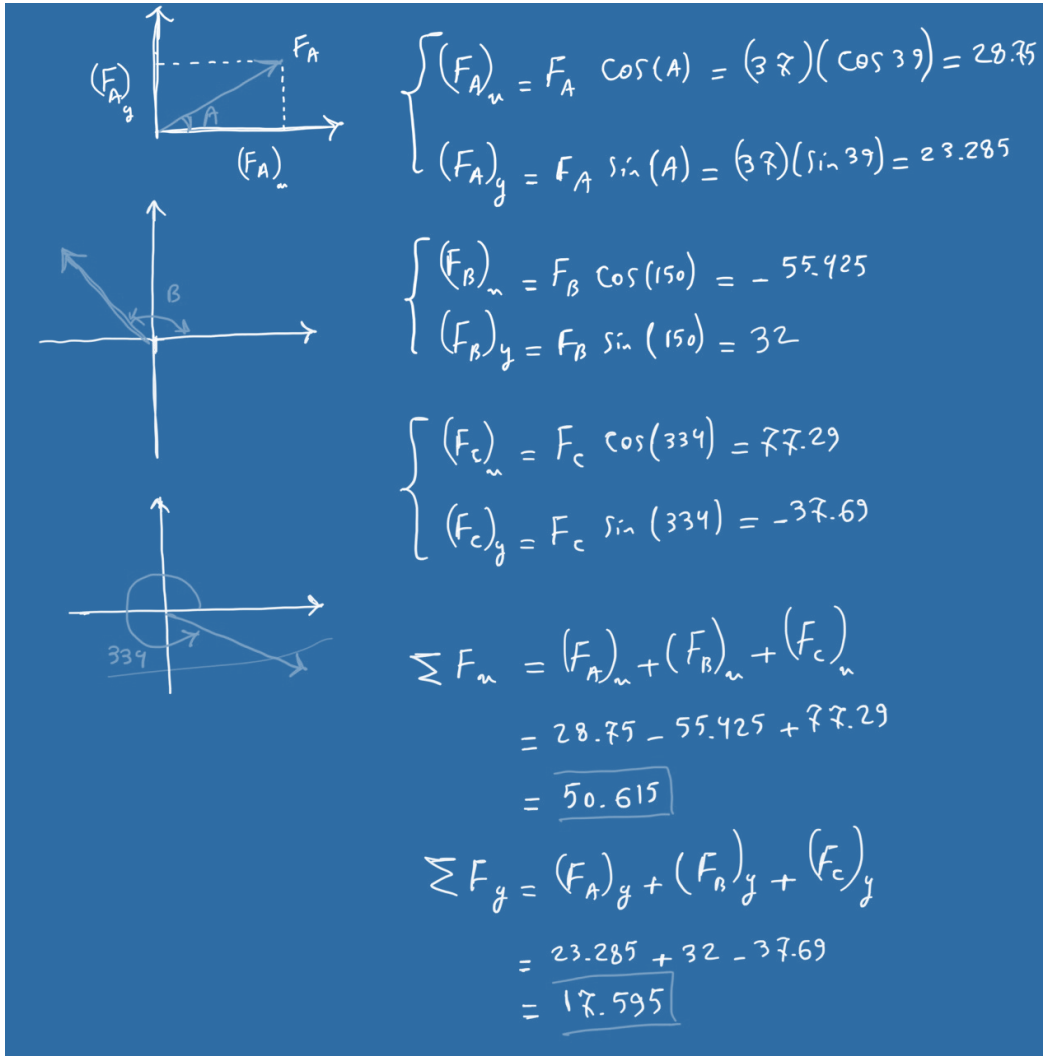
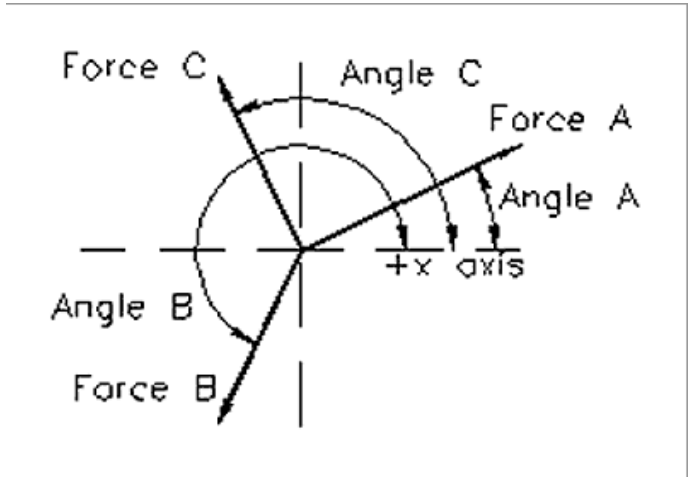
- Solution:



Provide the solution for the assignment- HW2



DATASET: 1 -2- -3-

Force A	37 LBS
Angle A	39 DEGREES
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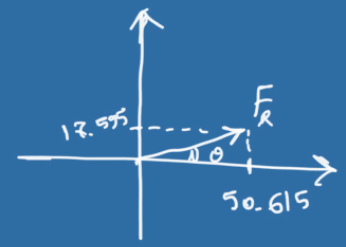
Force C	86 LBS
Angle C	334 DEGREES

- Solution:

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

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

$$= \boxed{53.58}$$



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

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

$$= \boxed{19.92}$$

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

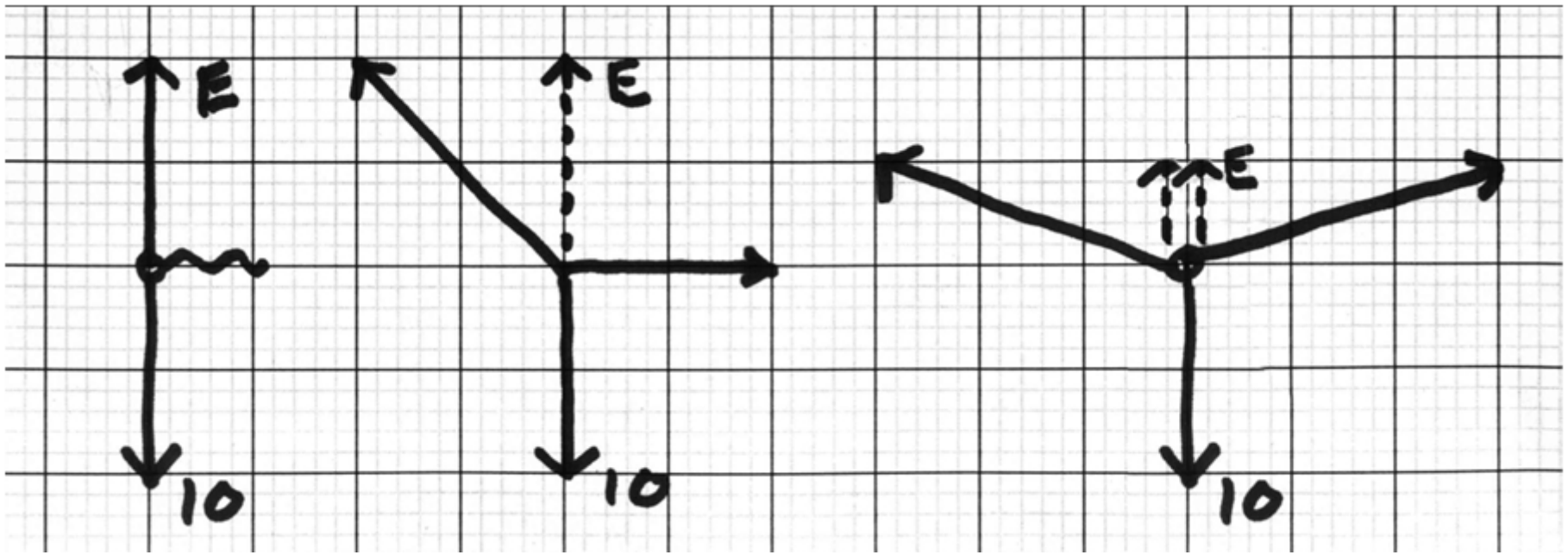
To model two component forces of an equilibrant in tension using a physical model.
To show the vector addition of the same 2 forces to find the resultant
To make hand calculations of the same vector addition.

Lab: Adding Forces

Procedure

1. Using a piece of string with some weight tied to the middle; hold the two string ends at 0° and 90° (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° and the other at 0° (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 taught.

Lab: Adding Forces



Any question?

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