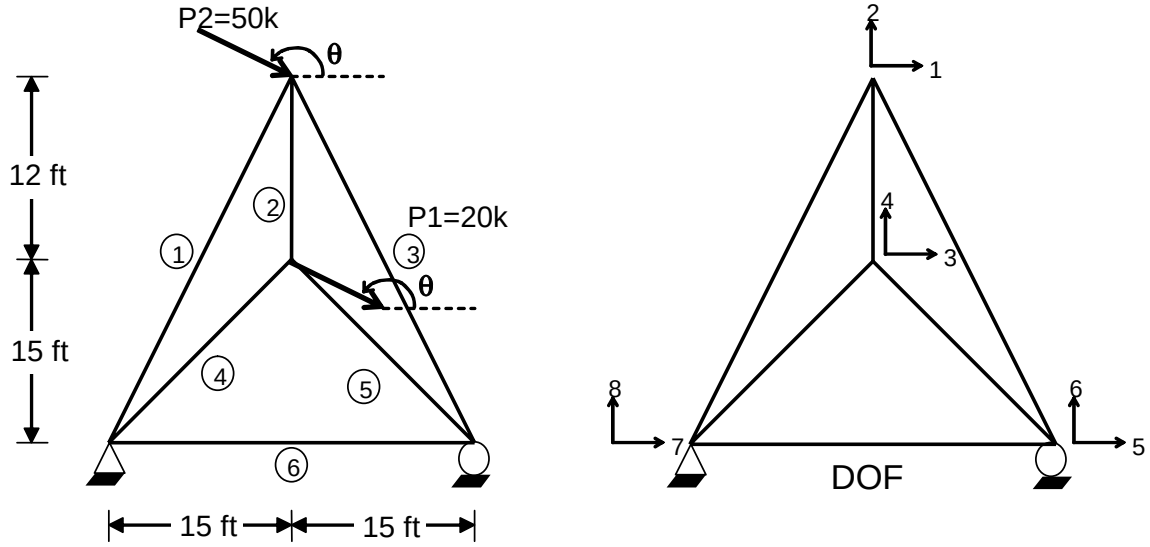
CEE 379 **Problem Set 7** **Autumn 2007**

(Due Nov. 2nd, in class or 4:30 PM in 233 More)

Problem 1. Consider the same truss (shown in the figures below) that you considered in Problem Set 4. For each member, the elastic modulus, E = 29,000 ksi. the cross-sectional area, A = 8 in.^{2} and the yield stress is 50 ksi.

USING EXCEL, develop a spreadsheet to automatically complete this problem and the next one. The equations should be dynamic, such that updating the member properties, jont locations and applied forces should automatically lead to the updating of the end displacements and member forces.

For each problem, submit the printout of a neat spreadsheet output, in which major results are clearly identified.



a) Compute the element stiffness matrix, k, for each of the six truss members.

b) Express the equations of equilibrium at the free kinematic DOF in terms of the applied external loads, the member properties and the displacements at the free kinematic DOF. (i.e., $Q_k = K_{11}D_u$)

c) For θ = 135 degrees, compute the unknown joint displacements, and sketch the deflected structure.

d) For θ = 135 degrees, compute the element forces at the end of each truss member. Then, show the member axial forces on a neat drawing of the structure.

e) Compute the axial stress in each member. ($\sigma = P/A$). Compare this value with the yield stress? Which members have yielded, if any?

Problem 2.

Repeat all of Problem 1, but assume that the top node (DOF #1 and 2) is initially located 6 ft above the location shown in the sketch. The other nodes are initially located in the same location as shown on the sketch. If the original spreadsheet was written correctly, this problem should take only a few minutes to complete.

Problem 3. Consider again the original truss geometry shown in the sketches above. Assume that the load at the top joint (DOF #1 and #2) remains the same, but now, assume that imposed displacements of 0.05 in. to the right, 0.04 inches downward and 0.03 inches to the right are imposed at DOF #3, #4 and #5.

a) For $\theta = 135$ degrees, compute the unknown joint displacements, and sketch the deflected structure.

b) For $\theta = 135$ degrees, compute the element forces at the end of each truss member. Then, show the member axial forces on a neat drawing of the structure.

c) Compute the axial stress in each member. ($\sigma = P/A$). Compare this value with the yield stress? Which members have yielded, if any?

You may solve this problem by modifying the spreadsheet from Problem 1, or by taking the key results from Problem 1 and computing the answer with paper and pencil.

YOU MAY WORK ALONE OR IN GROUPS OF 2 ON THIS PROBLEM SET.

PLEASE NEATLY WRITE THE NAMES OF BOTH GROUP MEMBERS ON THE FRONT PAGE OF THE ASSIGNMENT.