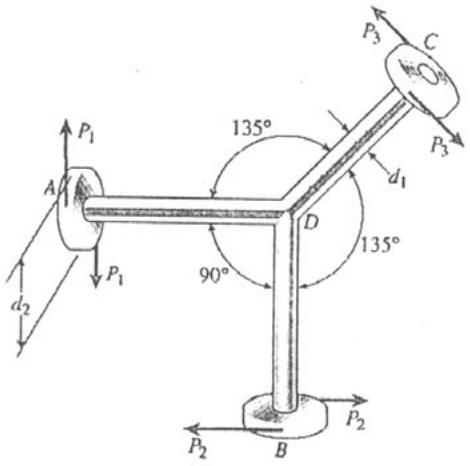
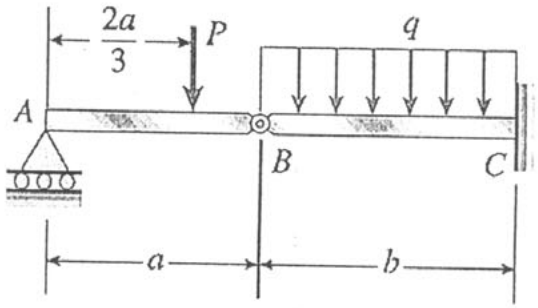
1. (20%) Three identical circular disks A, B, and C are welded to the ends of three identical solid circular bars shown below. The bars lie in a common plane and the disks lie in the planes perpendicular to the axes of the bars. The bars are welded at their intersection D to form a rigid connection. Each bar has diameter $d_1 = 10$ mm and each disk has diameter $d_2 = 75$ mm. Forces P_1, P_2, and P_3 create torques action on disk A, B, and C, respectively. If $P_1 = 100$N, what is the maximum shear stress τ_{max} in any of the three bars?

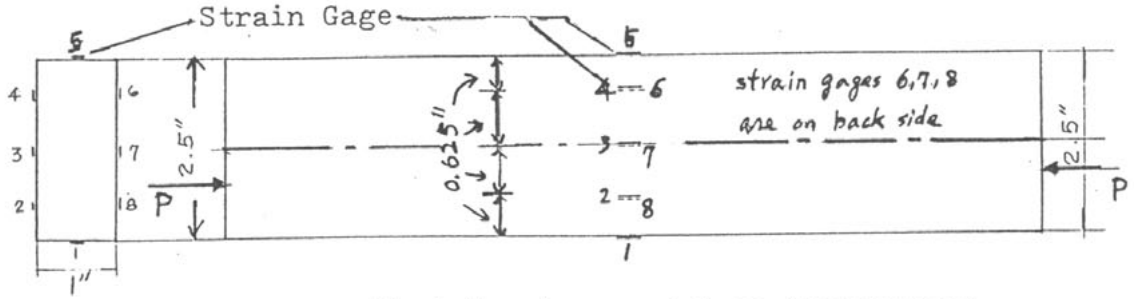


2. A compound beam ABC has a roller support at A, and internal hinge at B, and a fixed support at C. Segment AB has length $a = 15$ in. and segment BC has length $b = 20$ in. A concentrated load $P = 900$ lb acts at distance $2a/3$ from support A and a uniform load of intensity $q = 50$ lb/in acts between points B and C. Let beam flexural rigidity $EI = 10\times10^6$ lb-in^2. (a) (10%) Draw shear and bending moment diagram of the beam ABC. (b) (20%) Find deflection δ_B at the hinge B and angle of rotation θ_A at support A.



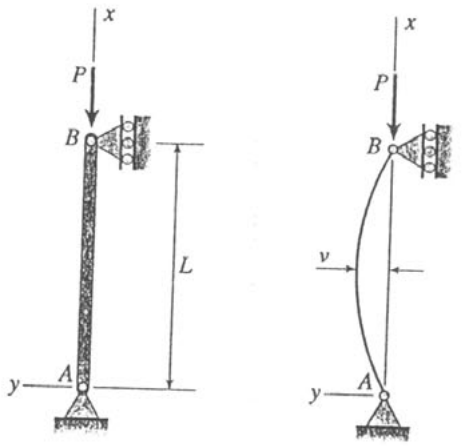
(背面仍有題目,請繼續作答)

3. A rectangular column, made of aluminum (Young's modulus E = 10.5 x 10^6 psi), is subjected to a compressive force P as shown in the figure below. Eight strain gages are mounted on a cross section near center portion of the column. Under the load P, the reading of the eight strain gages are: -344 x 10^{-6}; -247 x 10^{-6}; -153 x 10^{-6}; -58 x 10^{-6}; -39 x 10^{-6}; -55 x 10^{-6}; -152 x 10^{-6} and –246 x 10^{-6}, respectively. What is the magnitude of the compressive load P? (10%) And where (i.e., the eccentricity e) is the load P applied? (15%)



Test Specimen and Gage Arrengement

4. A simply supported beam, with length L and bending rigidity EI as shown below, is subjected to a compressive force P through its longitudinal axis. Derive the differential equation which governs the buckling of the column.(5%) Obtain the Euler's buckling load from the above equation (10%) and discuss the stability characteristics of the column. (10%)



(a) (b)