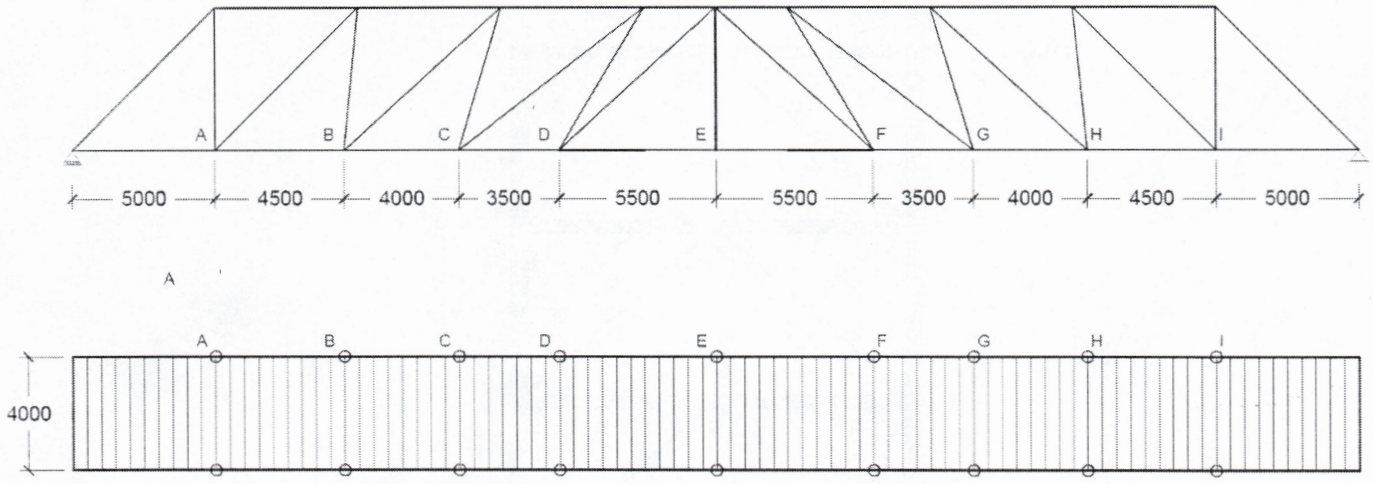
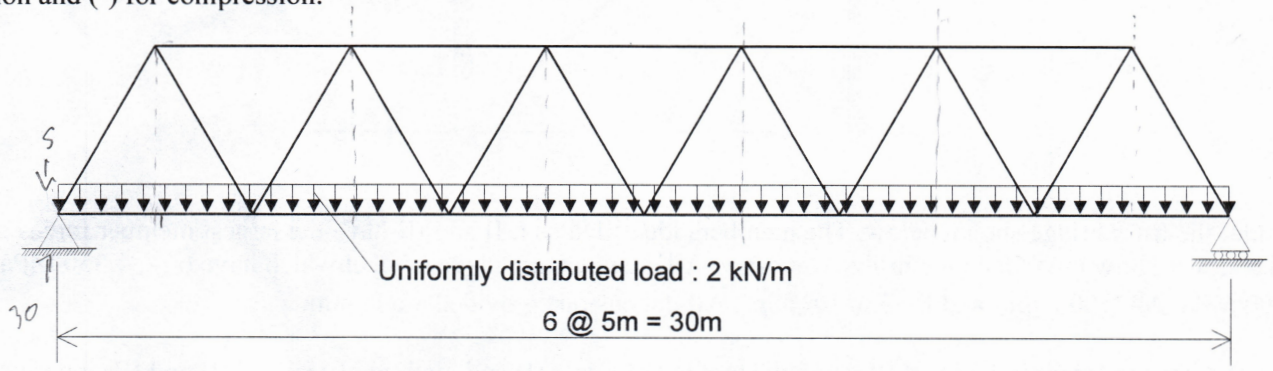
CIV 102F Problem Set #5 – October 10 and 11, 2019

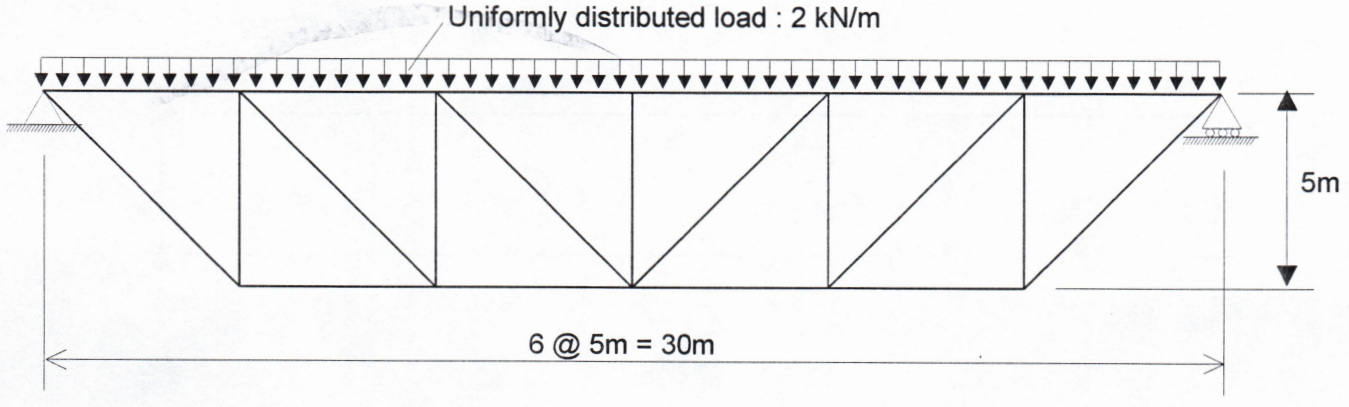
1. The figure shown below shows a truss bridge from elevation view (top), and plan view (bottom). Calculate the joint loads at joints A to I if the bridge was carrying a uniformly distributed load of w = 8.5 kPa applied to the full deck. All dimensions are in mm.



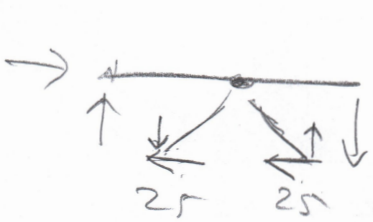
2. Calculate the joint loads and solve for the forces in the members of the Warren truss shown below. All members have the same length. Write the calculated member forces on a diagram you draw for your submission. Use (+) for tension and (-) for compression.

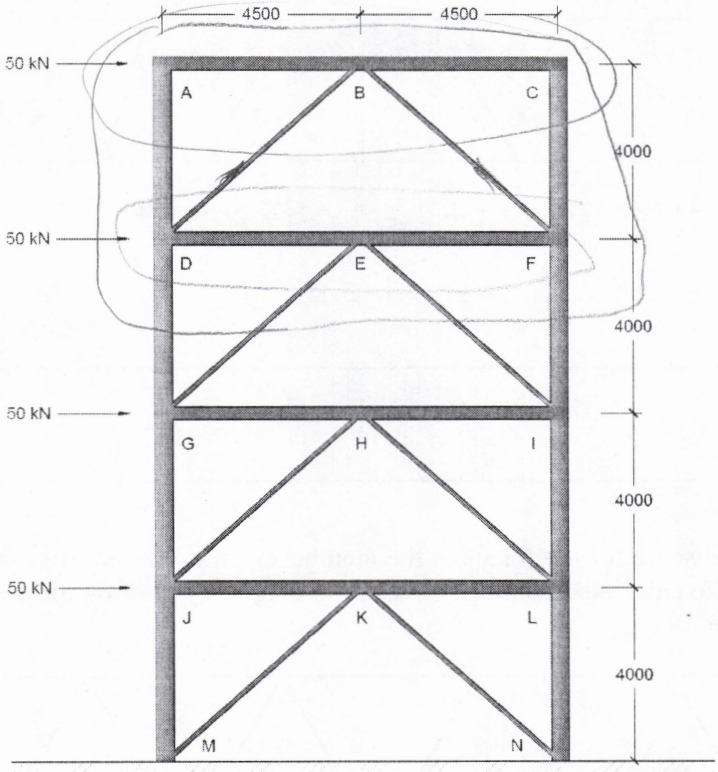


3. Calculate the joint loads and solve for the forces in the members of the inverted Pratt truss shown below. Write the calculated member forces on a diagram you draw for your submission. Use (+) for tension and (-) for compression.



4. The figure shown below is an elevation of a building which uses chevron braces to resist lateral loads caused by high winds and earthquakes. Calculate the forces in all the beams (horizontal members), columns (vertical members) and braces (diagonal members) caused by the horizontal forces. Note that all members are pin-connected, and the supports at M and N are pins. When solving using the method of joints, start at joint "A" and work down the building. All dimensions are in mm.





5. Consider the truss bridge shown below. The members identified as I, II and III have the largest member forces and will hence govern how much load the bridge can carry. All members are made of steel which have σ_{yield} = 350 MPa, E = 200,000 MPa, A = 2000 mm^2 and I = 5.6×10^6 mm^4. All dimensions provided are in mm.

a. Solve for the forces in I, II and III using the method of joints (I) and method of sections (II and III) in terms of P.

b. Calculate the value of P which would cause the bridge to fail. Failure may occur if the member stress exceeds the yield strength (in both tension or compression), or if a member in compression buckles. Recall that the force which causes buckling in a compression member is calculated as:

$$P_{crit} = \frac{\pi^2 EI}{L^2}$$