CIV102F Assignment # 5 – October 14, 2020

Due Wednesday October 21, 2020 at 23:59 Toronto time

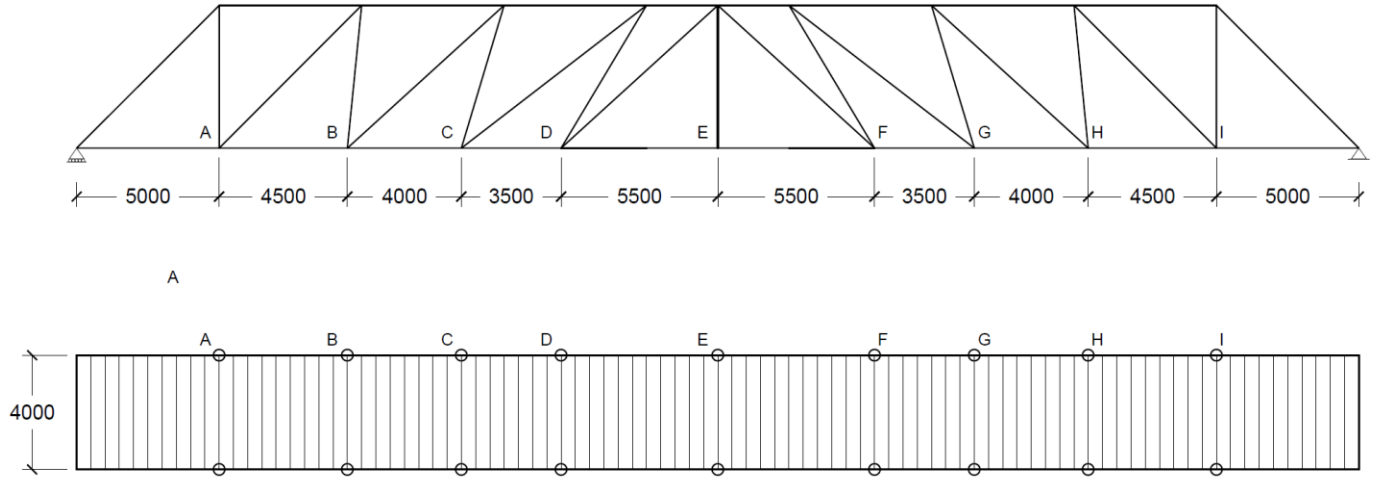
General Instructions

- There are four questions on this assignment. All questions must be attempted; however, only one question will be graded.
- Submissions which are incomplete and do not contain a serious attempt to solve each question will receive a grade of 0.
- Intermediate steps must be provided to explain how you arrived at your final answer. Receiving full marks requires both the correct process and answer.
- All final answers must be reported using slide-rule precision (ie, four significant figures if the first digit is a "1", three otherwise), and engineering notation for very large or very small quantities.
- Submissions must be prepared neatly and be formatted using the requirements discussed in the course syllabus. Marks will be deducted for poor presentation of work.

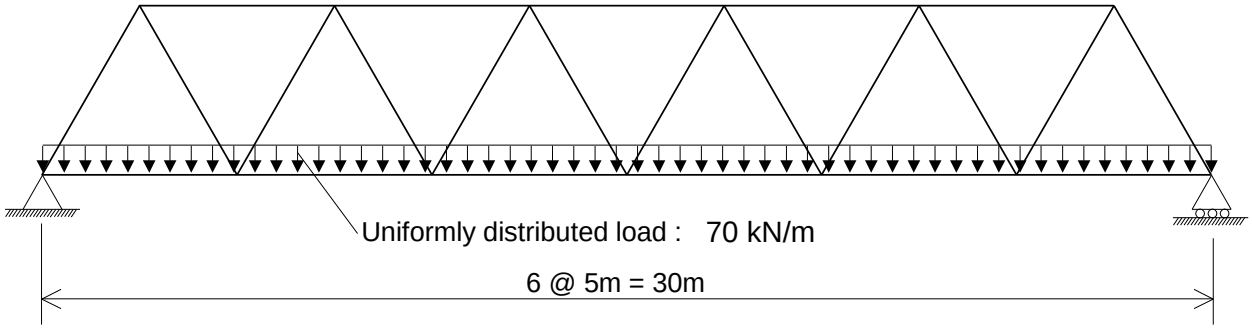
Assignment-Specific Instructions

- Final answers **must** be provided in a neat sketch of each structure with the member forces written in. Tension members should be indicated as (+) and compression members should be indicated as (-)

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 = 9.2 kPa applied to the full deck. All dimensions are in mm.

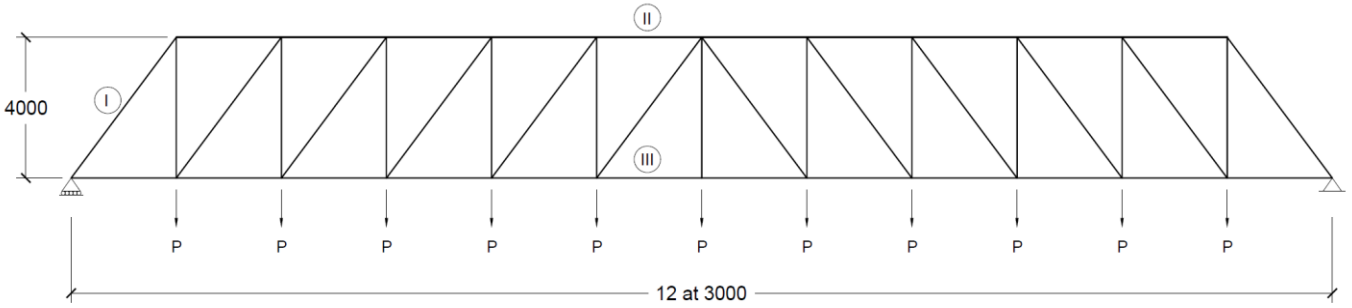


2. Calculate the joint loads and solve for the forces in the members of the Warren truss shown below. All members have the same length. Select the lightest square HSS which can be used for all of the truss members. Use E = 200,000 MPa and σ_y = 350 MPa.

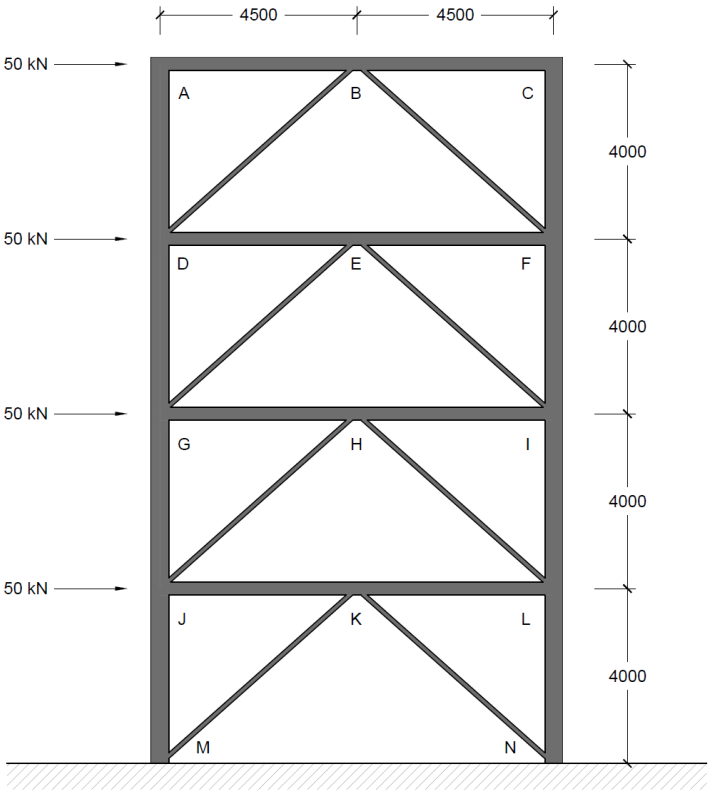


3. Consider the truss bridge shown below. The members identified as I, II and III have the largest member forces and will hence govern how much load the bridge can carry. All members are made of steel which have σ_{yield} = 350 MPa, E = 200,000 MPa, A = 2000 mm^2 and I = 5.6×10^6 mm^4. All dimensions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



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. All dimensions are in mm. Select the lightest square HSS which can be used for all diagonal brace members. Use E = 200,000 MPa and σ_y = 350 MPa.



Hint: When solving using the method of joints, start at joint "A" and work down the building. Do not start by solving the reaction forces. Remember that the method of joints lets you solve for 2 unknown forces at a location of interest.