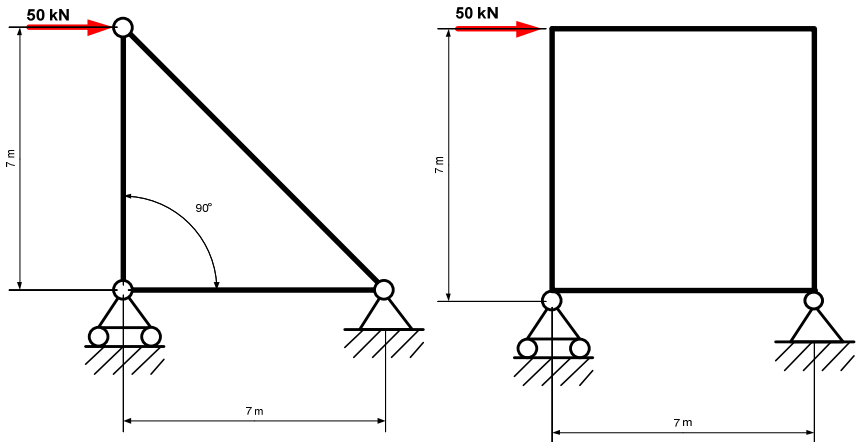
Problem 1

Two structures depicted below have prismatic steel members of identical constant cross section and material. The bases and vertical members are 7 m long.

a) Draw a load path diagram for each of the structures shown below.
b) Draw a free-body diagram for every member of the structures and calculate the base reactions of both structures.
c) Sketch the displaced and deflected shape for each of the structures. Do not use any structural analysis programme, just follow your judgment.
d) Which structure is a stiffer structure? Explain why?
e) Compute the member forces, stresses, and deflections of all members in the first structure.

(Note: all joints marked with a small circle are "pin" connections and do not transfer bending moments. The structure to the left below has all members pin ended, while the one to the right below is a frame supported on pinned foundations.)



Problem 2

A new type of composite beam is being tested. The following table shows the compressive strength of the columns as tested as well as the loads survey in the planned applications. Please note this is an exercise. In the real case many more samples would be needed.

Find the

a) 5th percentile of the beam resistance and 95th percentile of the loads.
b) Global safety factor of the beam.
c) Safety index of the beam when used in the planned application.
d) Is the beam safe to use in a typical building structure to be designed according to our current codes?

bending resistance of samples (kNm)	load samples (kNm)
501	310
604	350
656	220
550	500
206	375
301	440
508	540
494	370
658	331
666	445
777	429
---	349

Problem 3

Study the postings on the webpage (www.sigi.ca/engineering/steel_design.html). Write a one page summary in structured point form, highlighting the characteristics of limit states design and description of factored loads and load combinations.

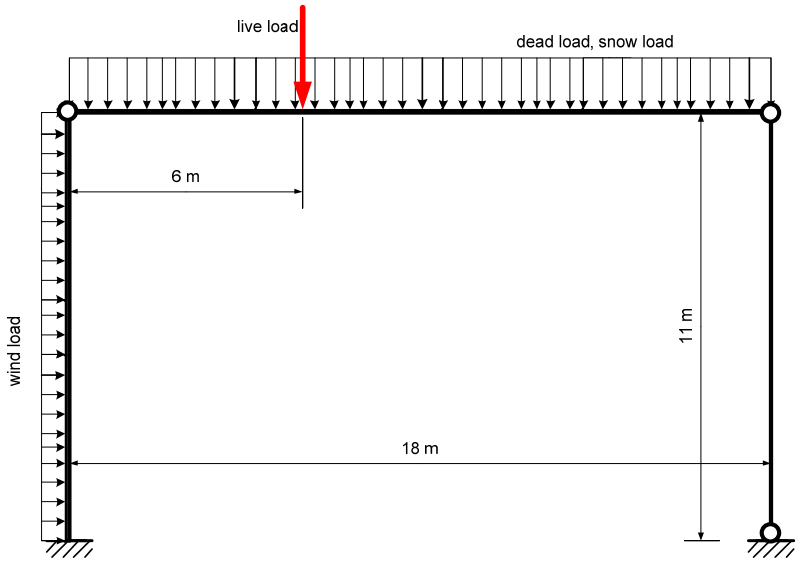
Problem 4

A structure of high importance experiences the following notional loads (= value without importance factors):

type	dead	live	wind	snow
total load in kN	**25**	**30**	**15**	**10**

a) Find all load combinations for the ultimate limit state.

b) What load case gives the maximum deflection for the roof beam, assuming columns and beam have the same cross section and material?



Problem 5

Read or work through the following links at the webpage:

http://www.sigi.ca/engineering/steel_design.html

List of links:

Introduction to Steel and Timber Design.pdf
Analysis Tools
Load Evaluation.xlsm
Engineering Structures.pdf
Design Flowchart.pdf
Specifications.pdf
LSD CSA.pdf
LSD Scope.pdf
LSD Typical.pdf
Guide to HSC.pdf
Changes_to_HSC_10th_ed.pdf (with permission of Andrew Metten, P.Eng.)
Designing with Steel.pdf
AISC Basic Design Values.pdf
Gimme_Ten_1.pdf
Example_Loads.pdf
Load_Cases.pdf
Loading_Tables.pdf
Lateral Load.avi
Lateral Seismic.avi
Lateral System.avi
Some Steel History.pdf
Steel Making in Pictures
Shapes in Pictures
Steel Materials and Properties.pdf

Problem 6

If you own a Handbook of Steel Construction 9th Edition, see Andrew Metten's Changes_to_HSC_10th_ed.pdf and make notes and corrections in your book. Borrow a 10th Edition from a class mate and update your 9th Edition accordingly. Assignments and exams assume that you have access to the last version of the Handbook.

Problem 7 (please hand this page in together with your other solutions).

Limit states that are concerned with safety are called:

ultimate limit states	[_]
serviceability limit states	[_]
endurance limit states	[_]
allowable limit states	[_]

Who publishes the American standards equivalent to the CAN/CSA standards for steel qualities:

Canadian Standards Association (CSA)	[_]
American Standards Association (ASA)	[_]
American Society for Testing and Materials (ASTM)	[_]

The member forces must be computed considering:

all load cases	[_]
only the load cases with highest values when added	[_]
without stress factors	[_]
the 5^{th} and 95^{th} percentile	[_]

Dead loads are computed from the:

mass of the material	[_]
volume and yield strength of the members	[_]
total mass of individual members	[_]
total volume of individual members	[_]

A live load must always be a:

moving load	[_]
moving of fixed load	[_]
load that change in magnitude	[_]
vibrating load	[_]

In order to meet a desired design goal, one uses:

Common sense	[_]
Older guys' opinions	[_]
Engineering sciences	[_]

If you can reduce costs of a design by 50%, how much can one sacrifice on the performance:

90%	[_]
50%	[_]
10%	[_]

Which important factors must be considered in the design process:

Materials	[_]
Manufacturability	[_]
Number of members in the design team	[_]

Limit States Design is:

Typical safety requirement for engineering structures	[_]
Jurisdictional requirement	[_]

Shipping of large steel structures is easier to facilitate with:

Big ships	[_]
Modular construction	[_]
When being close to the airport	[_]

Typical design cycles include:

Repetition of steps	[_]
Reversal of steps	[_]
Stepped developments	[_]

A specified deflection limit is a(n):

Ultimate load	[_]
Useful parameter to observe	[_]
Functional specification	[_]

Steel arches typically span economically:

20 – 60 m	[_]
20 – 60 ft	[_]
60 - 180 ft	[_]

Free Body Diagramme and Load Path are:

The same	[_]
Useful tools to understand structural behaviour	[_]
Necessary to design a structural system	[_]