QUESTION 1

A) In this figure we can see the support reactions on a fixed beam with some given loading. This diagram is generated in staad pro by specifying all the load and support conditions.

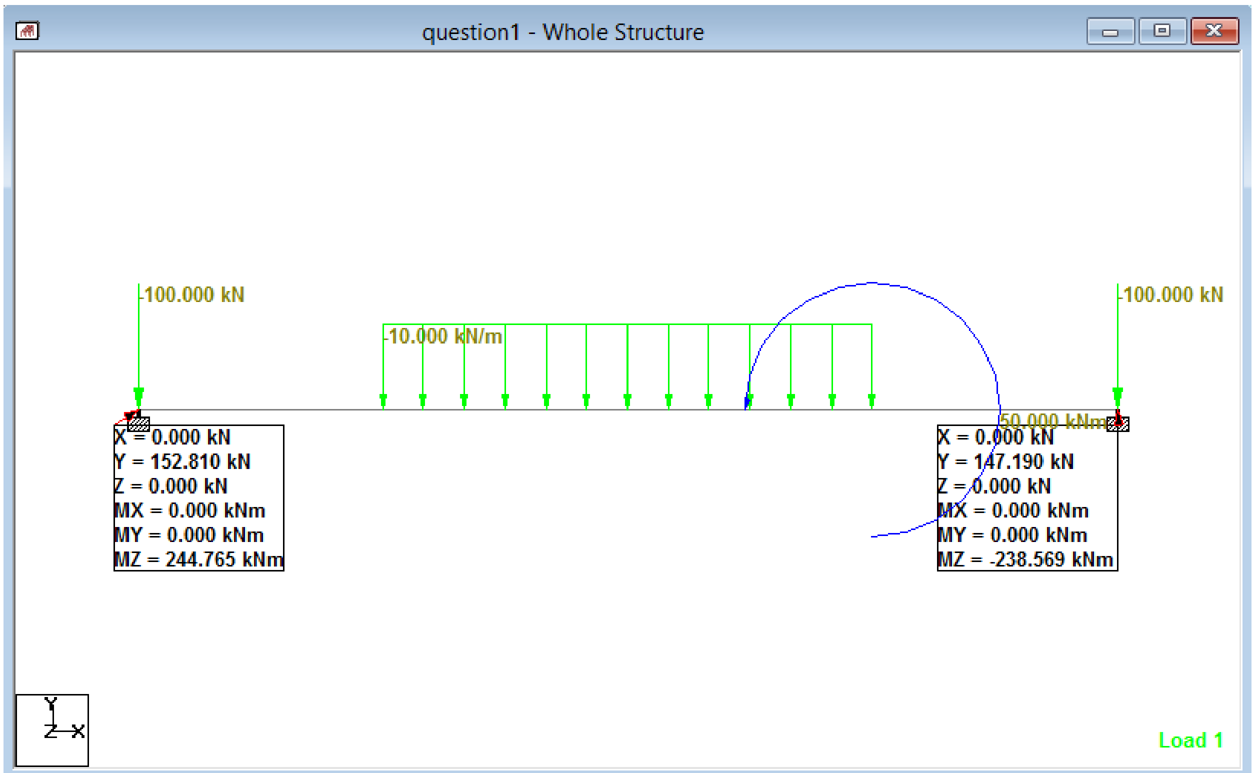


FIG 1

Figure 2 shows the bending moment diagram of the same beam in red color and shear force diagram in blue color.

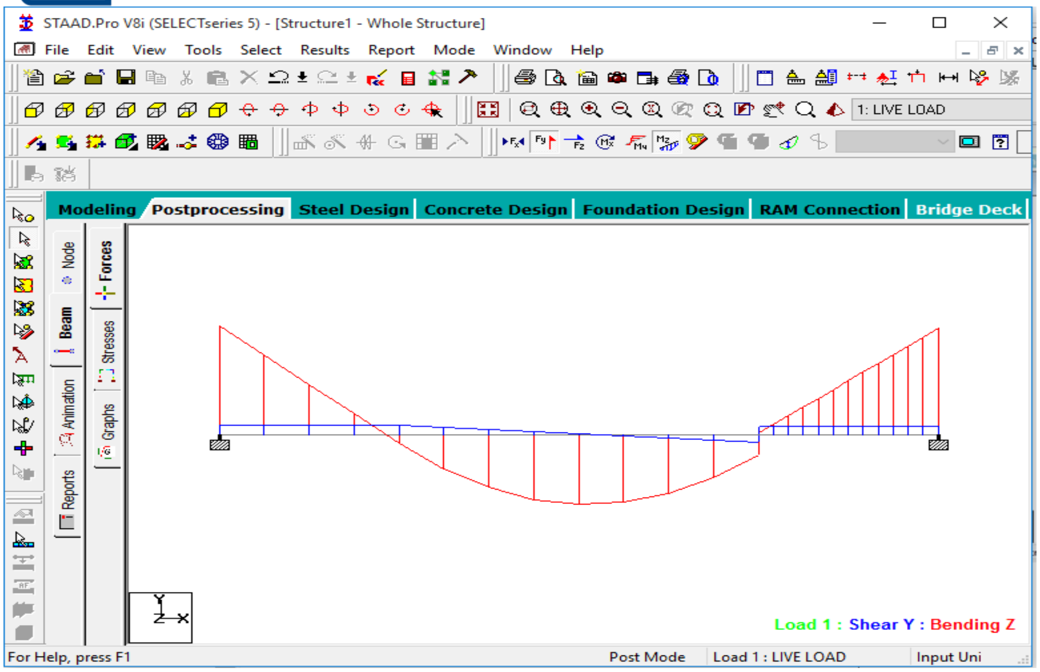


FIG 2

QUESTION 2

a) Figure 1 show the member forces calculated with the help of mdsolids.The analysis done by the student was wrong.The correct member forces are as follows:-

AB=33kN (Tension)

AG=47.67kN (compression)

CD=33kN(Tension)

BH=0

JE=42kN(Tension)

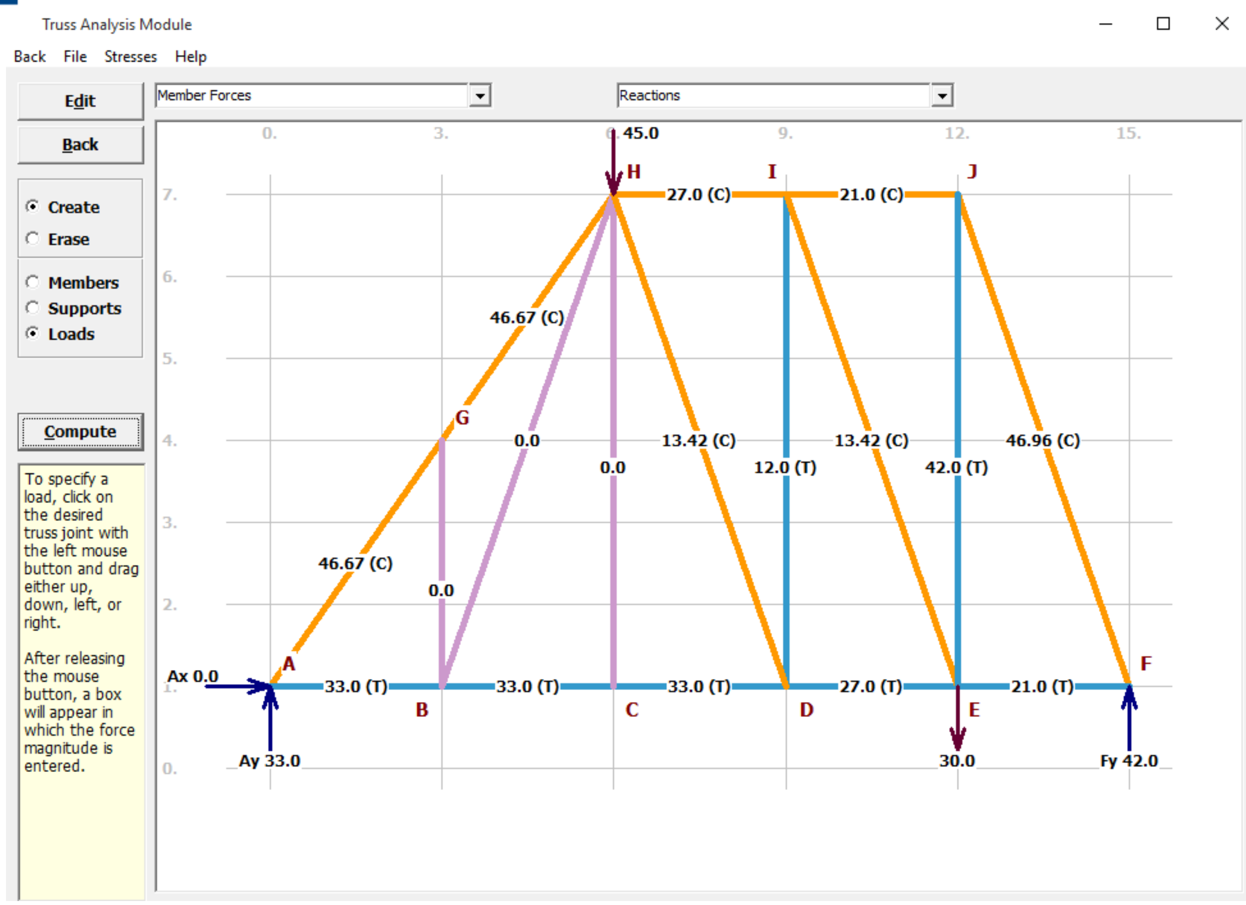


Figure 1

b)As we can see,the member forces in the element BH,CH,BG is equal to zero which can be calculated with the help of zero force condition without using the method of section or method of joint.

As per the zero force condition, if three members form a truss joint for which two of the members are collinear, the third member is a zero-force member provided no external force or support reaction is applied to the joint.

Therefore it is not necessary to calculate the member forces in these element by joint or section method.

Figure 2

c)

The method which can be used to determine the member forces in HI,HC,HD is method of joint.Due to the application of load at joint G and I the member forces get changed in almost every member.The result is shown in figure 1.

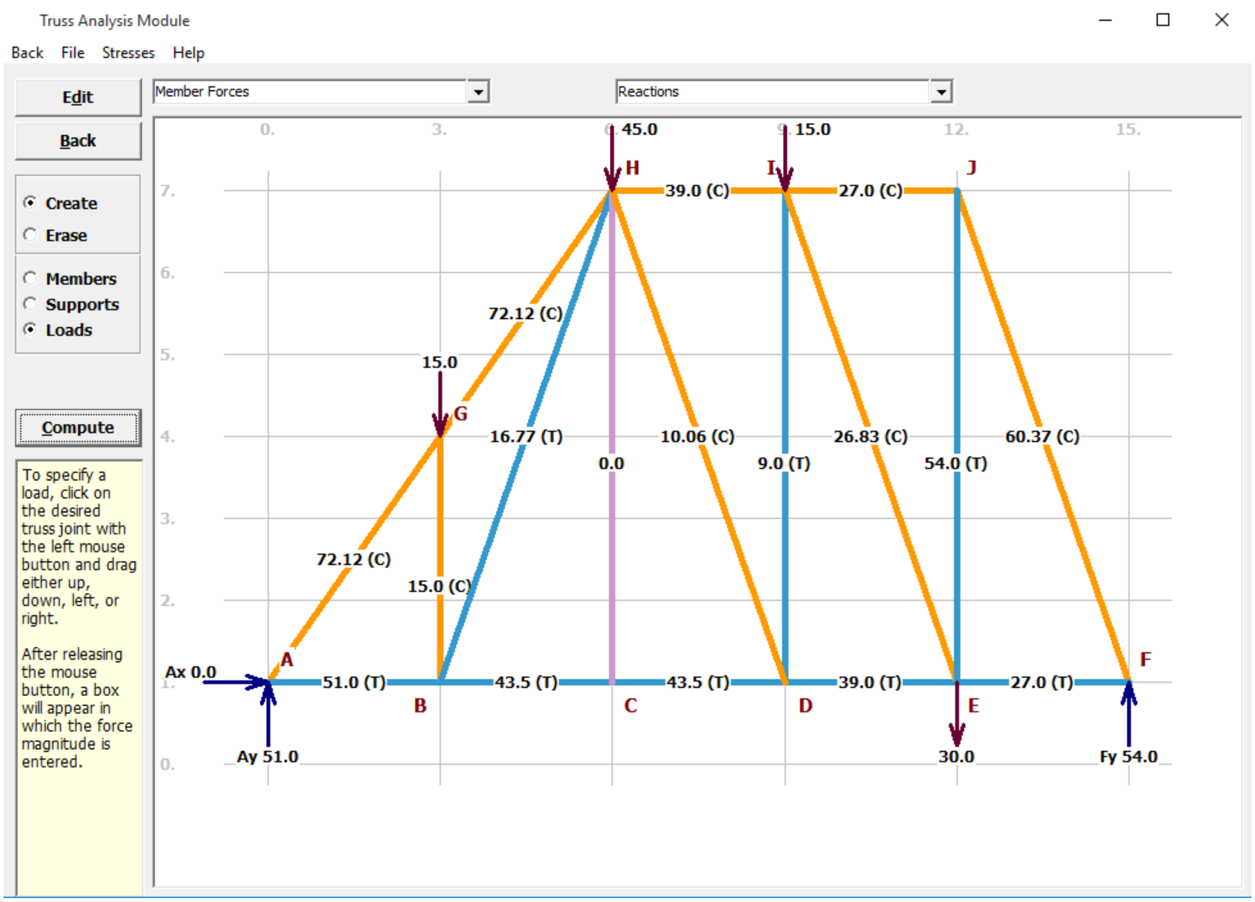
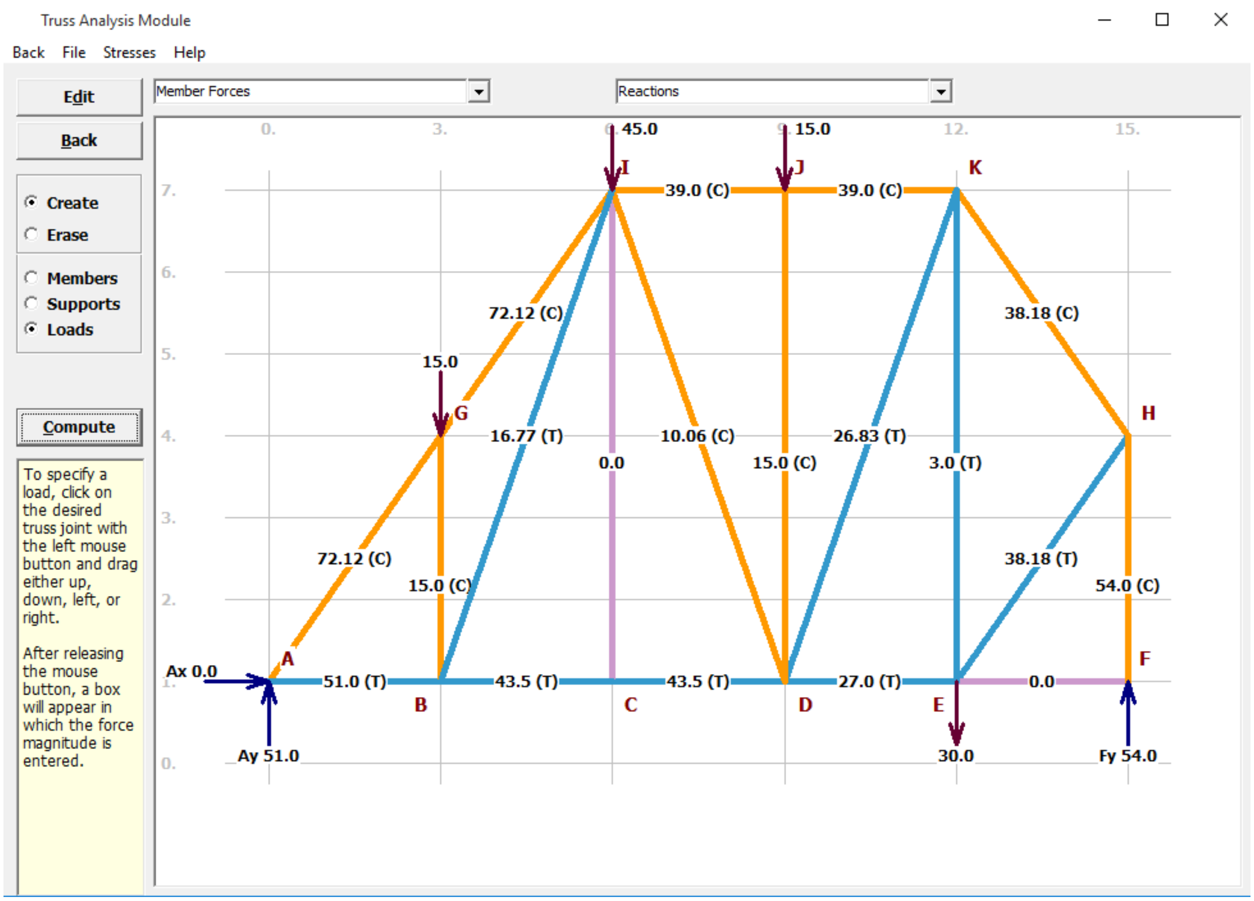


Figure 1

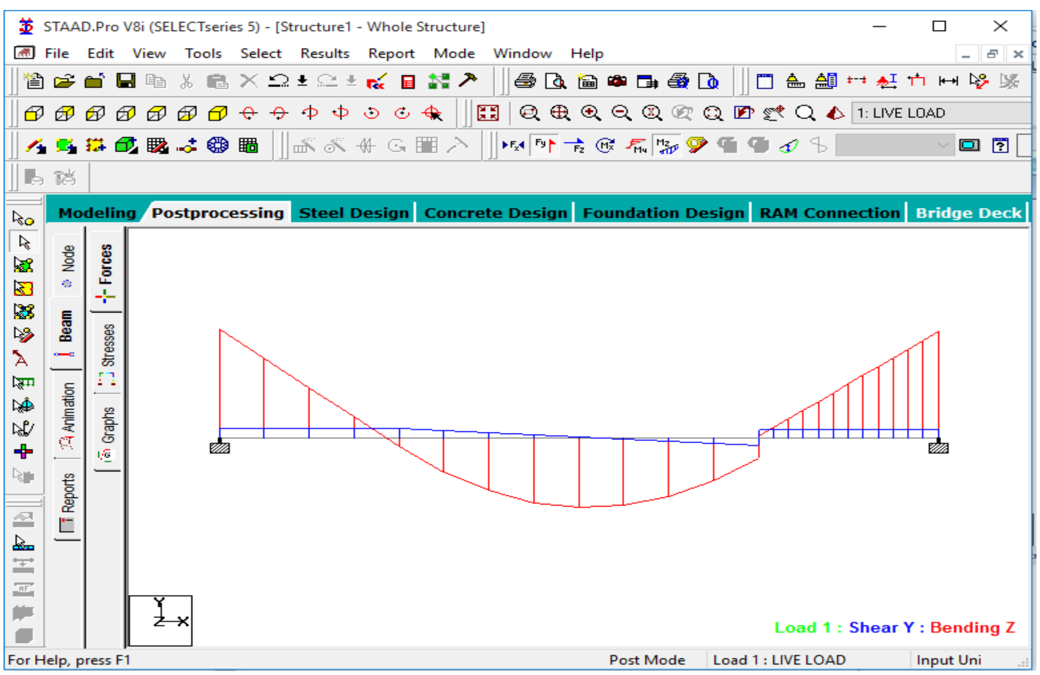
d) The manual method which is used to determine the element force would be section method since in method of joint the number of unknown member forces can’t be more than 2 at any joint. But when we add a member between D and J the number of unknown at joint J will become more than 2,which will make the method of joint not applicable.

e) Figure shown below shows the modified truss with all the member forces caculated in mdsolids software.



QUESTION 3

a) The Shear force diagram will not change as the shear force diagram depend on load and support conditions only, but the actual shear force resisted by the member will change as it depends on various parameters of the member as well on the external loading and support condition.
The shear force is the unbalance transverse force at a section of the beam when moving either from left or from right side.It is the algebraic sum of the vertical forces at any section of a beam to the right or to the left of the section. And The shear force diagram is one which shows the variation of shear force along the length of the beam. The parameters such as area of cross-section, young's modulus of elasticity, moment of inertia of the member etc if changed will only lead to change in the shear force resistance and not in shear force diagram.



b) The reaction in the cantilever beam will increases because in this case all the vertical loads has to be balanced by a single support. And the shear force diagram will also gets changed because the support condition has changed.

But If we vary young's modulus along the length, the shear force diagram will not show any changes because the shear force diagram depends only on the load and support conditions.

Figure 1 shows the cantilever beam made in staad pro with all the support reactions. And figure 2 shows the shear force diagram of the cantilever beam.

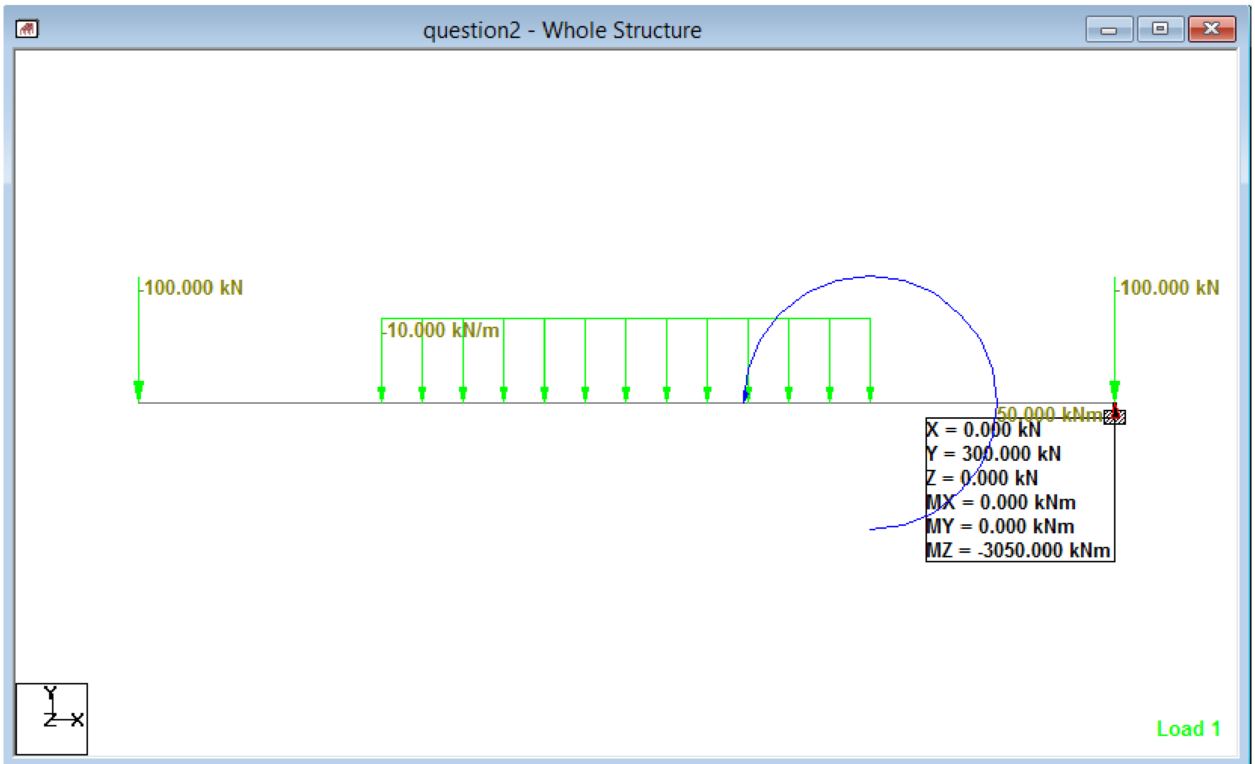


Figure 1

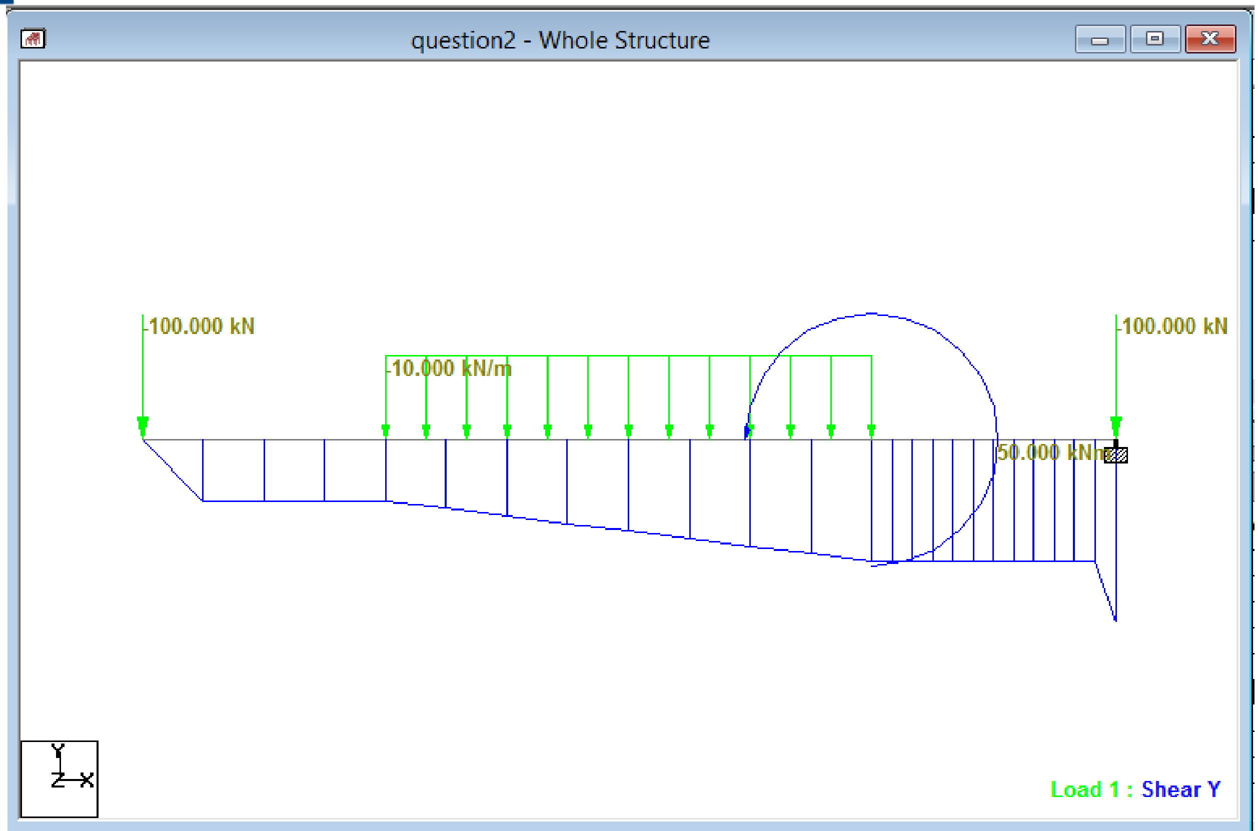


Figure 2

QUESTION 4

a)The bending moment diagram will not show any changes as the bending moment diagram also depends only on load and support condition just like shear force diagram. But the actual moment of resistance of the member will change as it does depends on the area and young's modulus of elasticity and other member parameters. Bending moment is the algebraic sum of the moments of all the forces acting to the right or left of the section. And similarly the bending moment diagram is one which shows the variation of bending moment along the length of the beam.The parameters such as area of cross-section, young's modulus of elasticity, moment of inertia of the member etc if changed will only lead to change in the moment of resistance and not in bending moment diagram.

b) Figure 2 shows a bending moment diagram of a cantilever beam made in staad pro with previous loading condition.The bending moment diagram will also gets changed similarly like shear force diagram because of the change in the support conditions. The value of bending moment at the fixed end will increase and is shown in figure 1 and will be greater than the value of bending moment came in question 1.

But If we vary young's modulus along the length, the bending moment diagram will not show any changes because the bending moment diagram depends only on the load and support conditions.

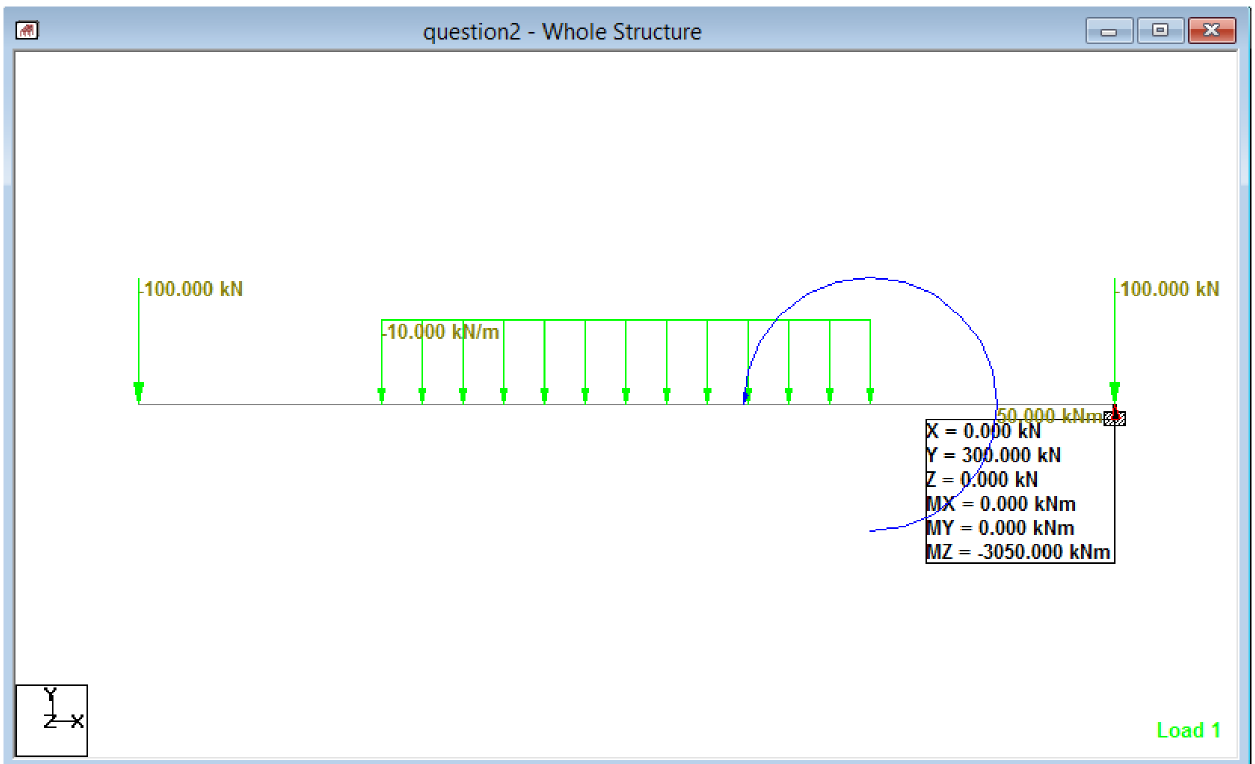


Figure 1

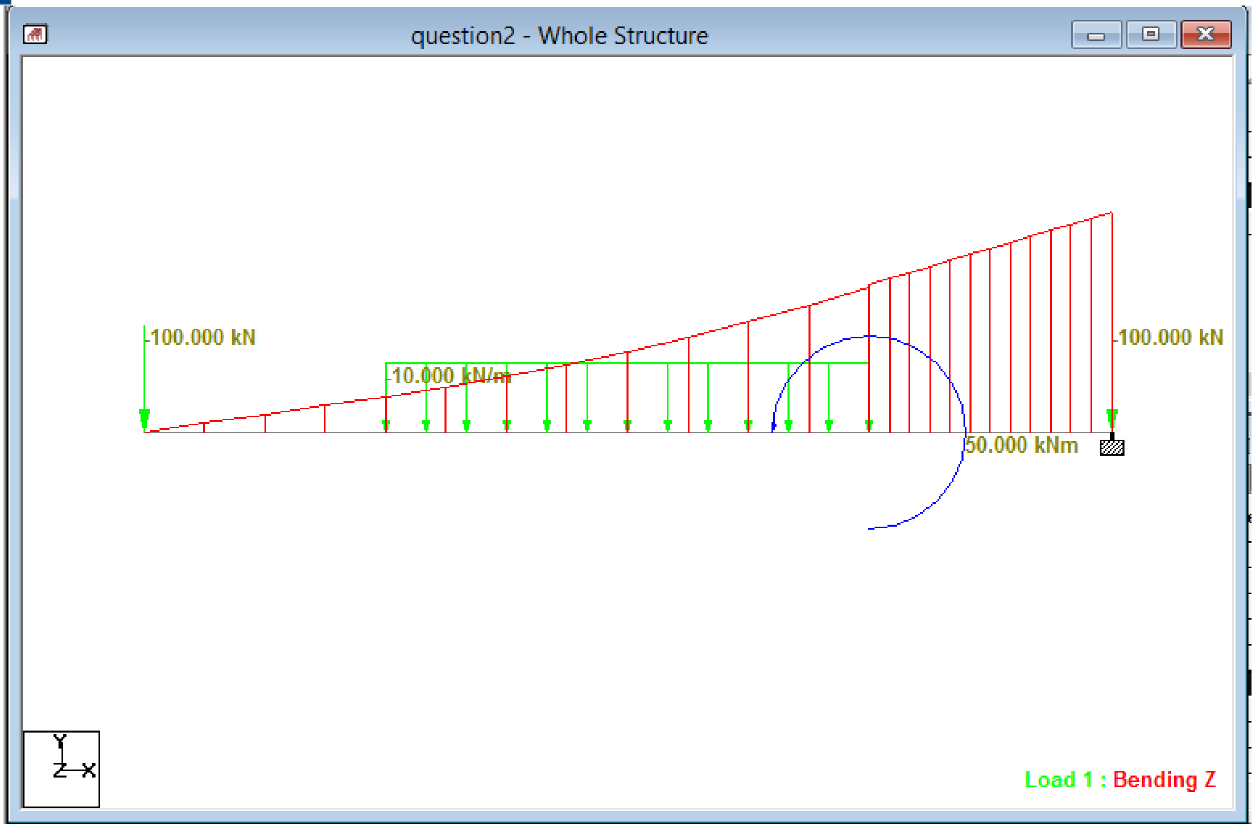

question2 - Whole Structure
100.000 kN
10.000 kN/m
100.000 kN
50.000 kNm
Y
Z
X
Load 1 : Bending Z

Figure 2

Question 7

a) Figure 1 shows the value of normal stress and shear stress produced in a bar of thickness 50mm, width 25mm and pin of diameter 45mm when the bar and pin configuration is pulled with a tensile force of 100kN.

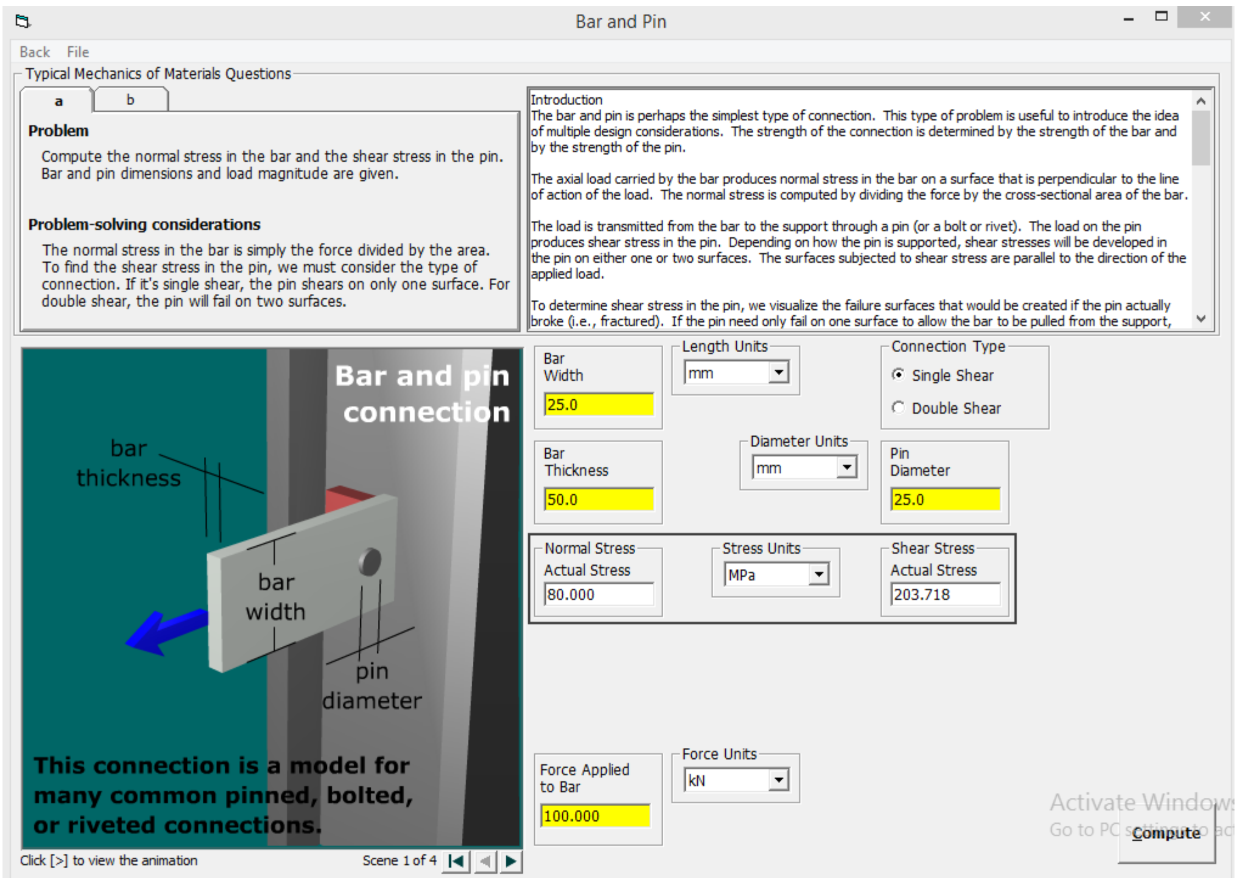
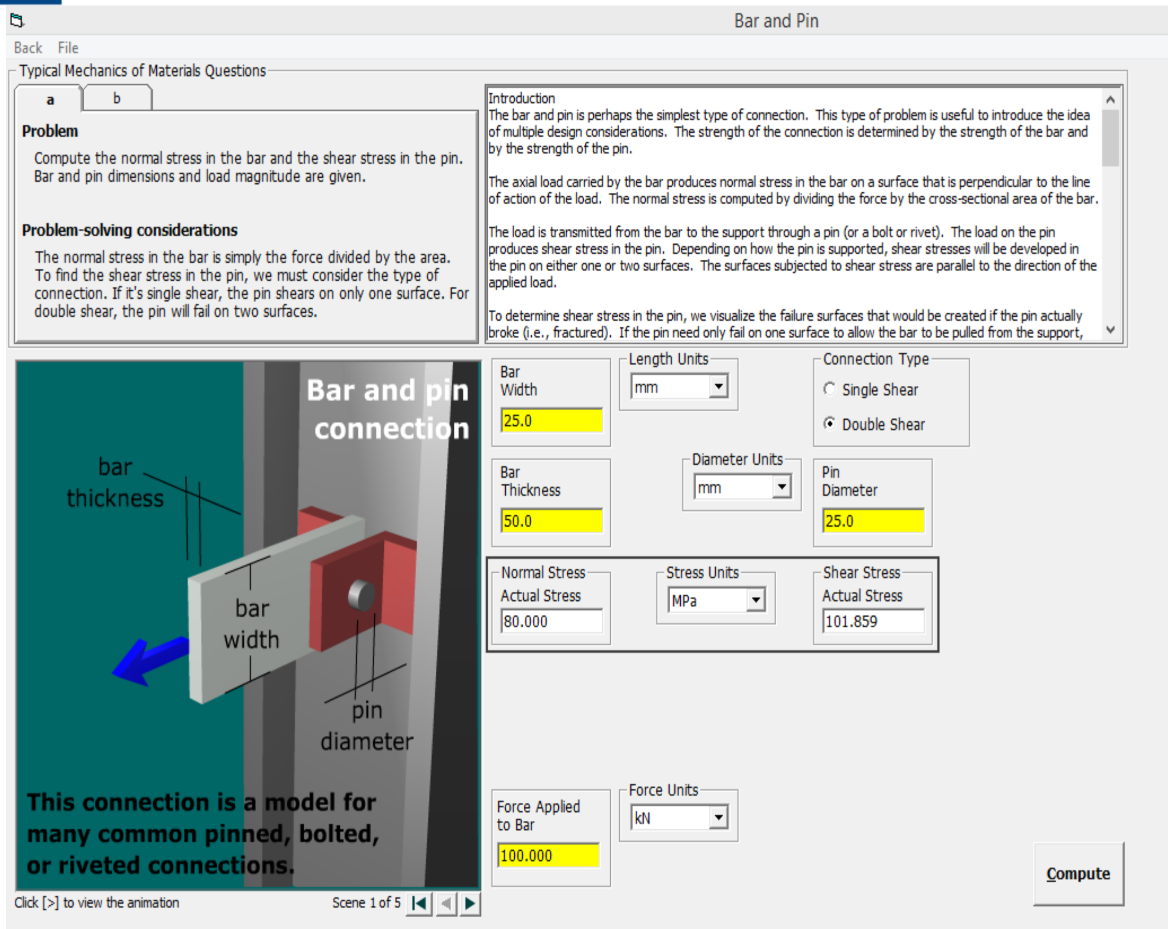


Figure 1

b)when the concept of double shear is introduced the shear stress in the pin will get reduced to half because in the case of double shear the number of shear plane will become 2.So now the total tensile force will be balanced equally by 2 shear plane. In single shear case the number of shear plane is equal to 1.Therefore total tensile force is taken by single only one shear plane.


Bar and Pin
Back File
Typical Mechanics of Materials Questions
a
b
Problem
Compute the normal stress in the bar and the shear stress in the pin. Bar and pin dimensions and load magnitude are given.
Problem-solving considerations
The normal stress in the bar is simply the force divided by the area. To find the shear stress in the pin, we must consider the type of connection. If it's single shear, the pin shears on only one surface. For double shear, the pin will fail on two surfaces.
Introduction
The bar and pin is perhaps the simplest type of connection. This type of problem is useful to introduce the idea of multiple design considerations. The strength of the connection is determined by the strength of the bar and by the strength of the pin.
The axial load carried by the bar produces normal stress in the bar on a surface that is perpendicular to the line of action of the load. The normal stress is computed by dividing the force by the cross-sectional area of the bar.
The load is transmitted from the bar to the support through a pin (or a bolt or rivet). The load on the pin produces shear stress in the pin. Depending on how the pin is supported, shear stresses will be developed in the pin on either one or two surfaces. The surfaces subjected to shear stress are parallel to the direction of the applied load.
To determine shear stress in the pin, we visualize the failure surfaces that would be created if the pin actually broke (i.e., fractured). If the pin need only fail on one surface to allow the bar to be pulled from the support,
Bar and pin connection
bar thickness
bar width
pin diameter
This connection is a model for many common pinned, bolted, or riveted connections.
Click [>] to view the animation
Scene 1 of 5
Bar Width
25.0
Length Units
mm
Connection Type
Single Shear
Double Shear
Bar Thickness
50.0
Diameter Units
mm
Pin Diameter
25.0
Normal Stress
Actual Stress
80.000
Stress Units
MPa
Shear Stress
Actual Stress
101.859
Force Applied to Bar
100.000
Force Units
kN
Compute