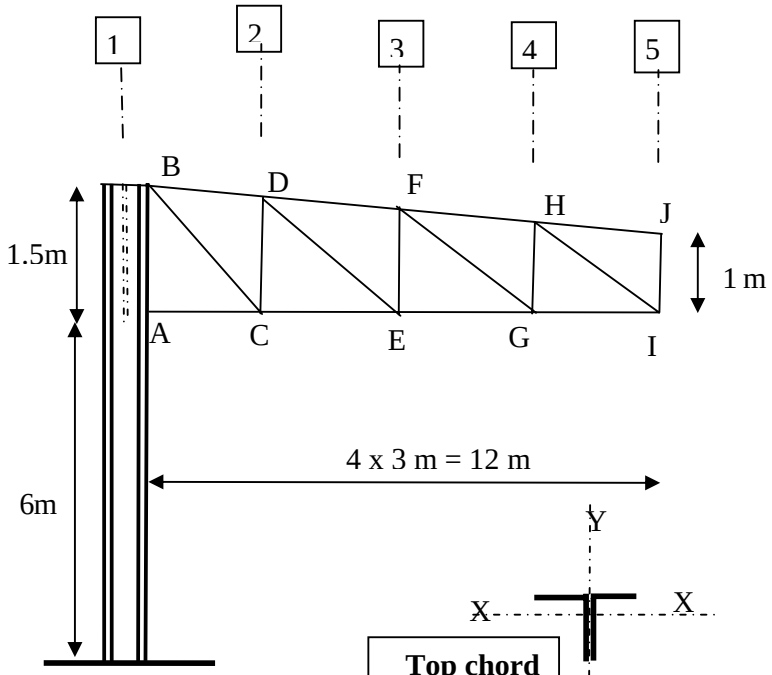
Name in Arabic :	**Lecture time :**
Number:	

KING SAUD UNIVERSITY	**STEEL STRUCTURES : CE 473**
COLLEGE OF ENGINEERING	**SECOND SEMESTER, 1425/1426 H**
CIVIL ENGINEERING DEPARTMENT	**TIME : 90 min**

SECOND MID TERM EXAM

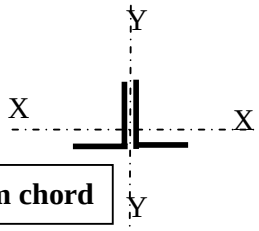
Answer all problems in the provided spaces

Problem 1:
The shown cantilever steel roof truss has a vertical bracing at axis (1) between A & B, all members are composed from double angles back to back with a guest plate thickness 9 mm



Top chord

1- What is the buckling length KL_x and KL_y for the member AC, For the following cases:



Bottom chord

	KL_X	KL_Y
Vertical bracing is only at axis 1		
Vertical bracing is placed at axis 1 and axis 5		
Vertical bracing is placed at axis 1, axis 3 and axis 5		

2- If member BD has a tension force = 200 kN and is bolted at end B with A325 M14 as **bearing type connection** and welded at end D with 4 mm fillet welds;

a- Which end will govern the design of the member?

b- Design the member BD as double equal angles back to back, if A36 steel is used, and determine the number of required bolts and their spacing.

Assume: BEARING TYPE CONNECTION, bolt diameter= 14mm, standard holes, U =0.80, F_{ub} = 620 MPa, F_{vb}= 400 MPa, and take angles thickness < 6 mm
(No need to recalculate U & check for block shear rupture in angles and guest plate)

Number of bolts	
Spacing of bolts (s) (mm)	
Edge distance Le (mm)	
Size of equal angles	

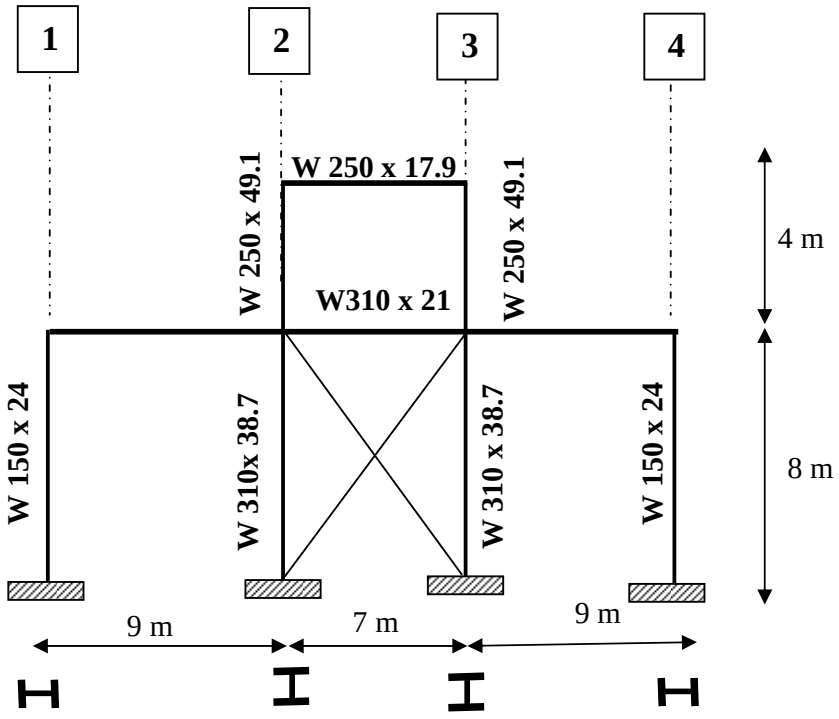
3- If the buckling length of member AC, KL_x= 3.0 m and Kl_y = 6.0 m, and the compression force is 150 kN, Use the LRFD tables to find the lightest double angles for the following two cases:

	Section size	weight	ϕP_n from (KL_x)	ϕP_n from (KL_y)	ϕP_n
Double equal angles back to Back					
Double unequal angles with short legs back to back					

Which section size do you prefer?

Problem 2 :

All members of the shown frame Are A36 steel. The frame is laterally braced in plane between axis (2) and (3) at the ground floor, and is laterally braced outside plane at columns ends at first and second floor level. All columns are fixed at base.



Obtain the required inertia for the following W shapes;

W 310x38.7 , I =

W 250 x 49.1 , I =

W 310 x 21, I =

W 250 x 17.9, I =

a- Determine the buckling length KL_x and KL_y for column on axis 2 at ground floor, (W 310x38.7)

b- Determine the buckling length KL_x and KL_y for column on axis 2 at first floor, (W 250 x 49.1)

c- Determine the factored compression resistance of column on axis 2 at ground floor, (W 310x38.7), if KL_x = 6 m and Kl_y = 5 m

d- **FROM LRFD TABLES,** determine the factored compression resistance of column on axis 2, at first floor (W 250 x 49.1), if KL_x= 4 m and KL_Y = 5 m