Theory of structure

Stability and Determinacy of Structures
L2

Assistant Lecturer
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Stability and Determinacy of Frames

1- Open frames

$r < C+3$, unstable

$r = C+3$, determinate if stable

$r > C+3$, indeterminate if stable

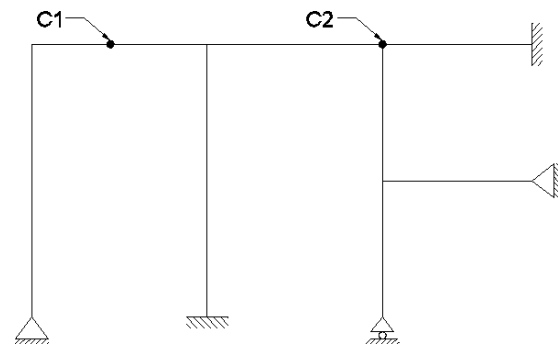Ex1:- Find the stability and determinacy of frame below

$C_1 = m-1$, $C_1 = 2-1 = 1$

$C_2 = m-1$, $C_2 = 3-1 = 2$

$C = C_1+C_2$, $C = 3$

$r = 11$

$C+3 = 6$

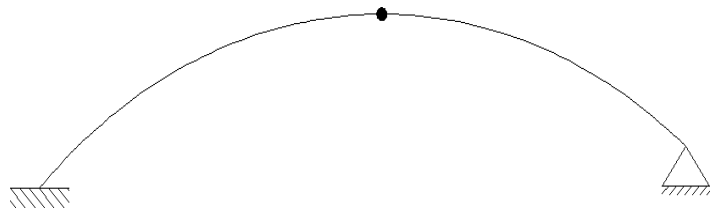$r > C+3$, the frame is stable& indeterminate 5th degree.

Ex2:-

r = 5

C = 2-1 = 1

r > C+3, the frame is stable & indeterminate 1st degree.
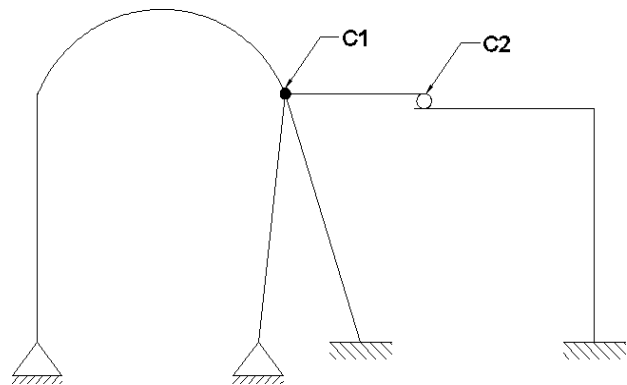
Ex3:-

$C_1 = m-1$, $C_1 = 4-1 = 3$

$C_2 = 2$

$C = C_1+C_2$, C = 5

r = 10

C+3 = 8

r > C+3, the frame is stable & indeterminate 2nd degree.

Ex4:-

r = 6
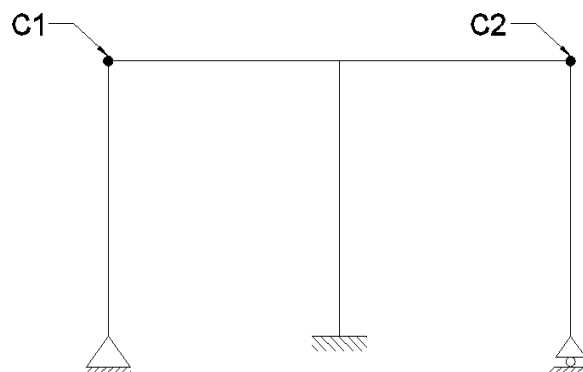
C = 2

r > C+3

The frame is unstable because of internal geometric instability

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2- Closed Frames:-

$3b+r < 3j+c$, unstable
$3b+r = 3j+c$, determinate if stable
$3b+r > 3j+c$, indeterminate if stable

Where,
$3b+r$ = unknown
$3j+c$ = equations
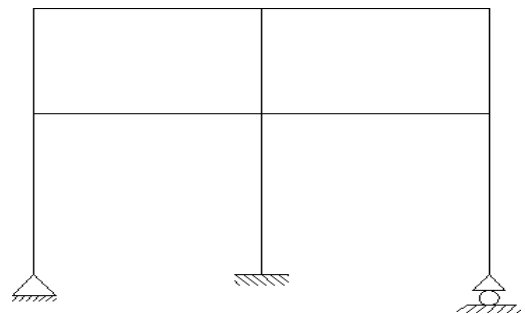b = No. of members
r = No. of reactionsj
= No. of joints

Ex1:-

$b = 10$
$r = 6$
$j = 9$
$3b+r = 36$
$3j+c = 27$
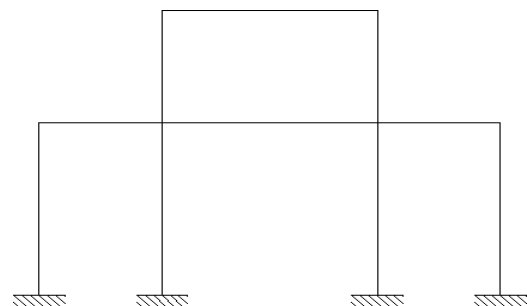$3b+r > 3j+c$, stable & indeterminate 9th degree

Ex2:-

$b = 10$
$r = 12$
$j = 10$
$3b+r = 42$
$3j+c = 30$
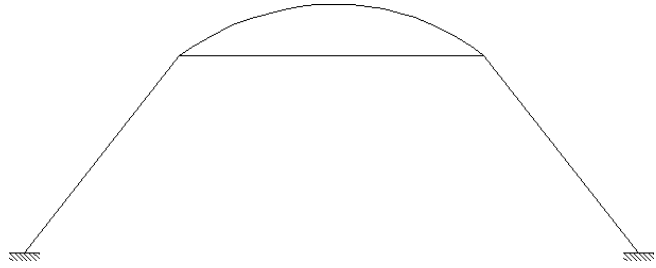$3b+r > 3j+c$, stable & indeterminate 12th degree

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Ex3:-

b = 4

r = 6

j = 4

c = 0

3b+r = 18

3j+c = 12

3b+r > 3j+c, stable & indeterminate 6th degree

Ex4:-

b = 9

r = 5

j = 7

c = m-1 => c = 1

3b+r = 32

3j+c = 22

3b+r > 3j+c, stable & indeterminate 10th degree
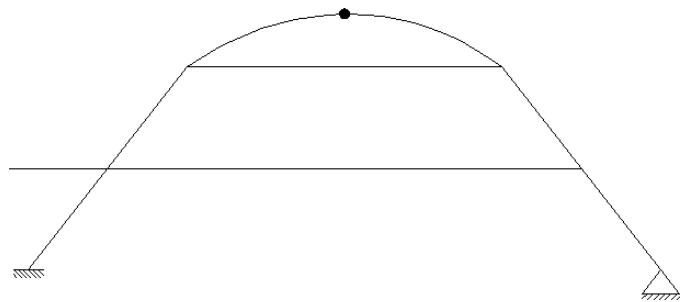
Ex5:-

b = 10

r = 9

j = 9

c = m-1 => c = 4-1=> c = 3

3b+r = 39
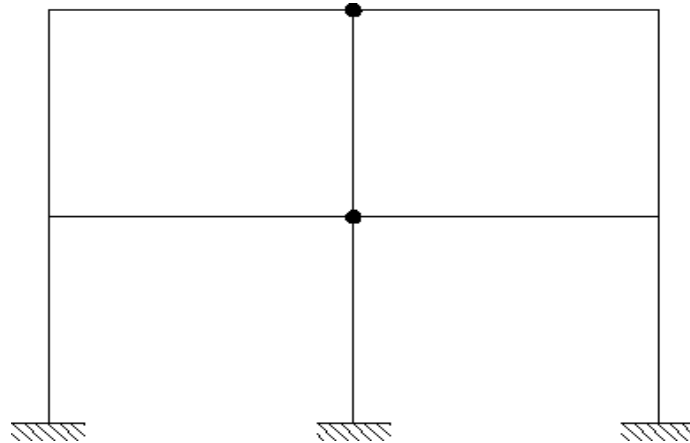
3j+c = 30

3b+r > 3j+c, stable & indeterminate 9th degree
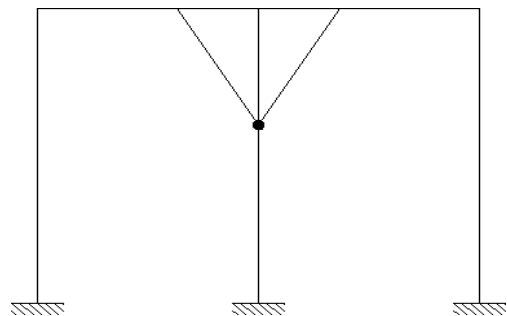
مالحظة:- اذا جاء ال   internal hinge   في بداية او نهاية الضلع فيحسب منه (j& c) اما
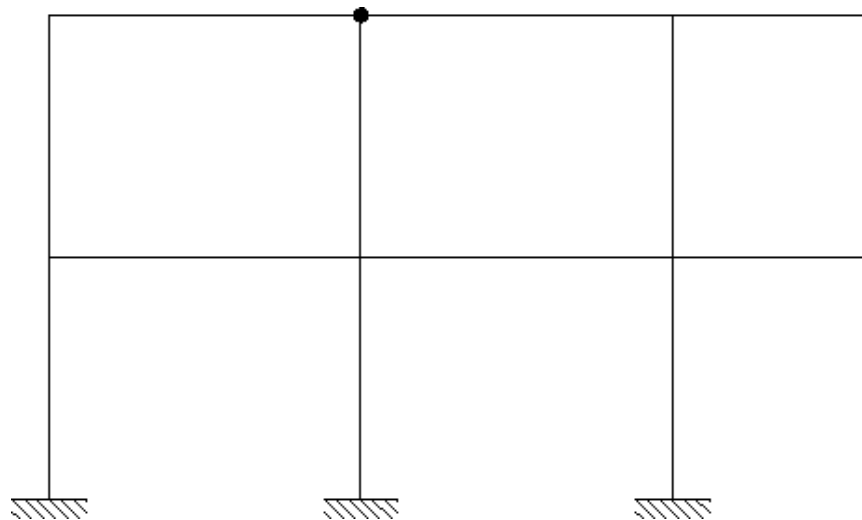
اذا جاء في داخل الضلع فيحسب منة c   فقط

Home work:

H.W1: Find the stability and determinacy of frame below

H.W2: Find the stability and determinacy of frame below

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Stability and Determinacy of Composite Structure

Unknowns	Equations
1- Each truss member give one unknown	1- each member carry moment give (3 equations)
2- reactions	2- each joint connect truss members only give (2 equations)
3- each joint connect member carry moment give unknown in these equation (2*(m-1))	

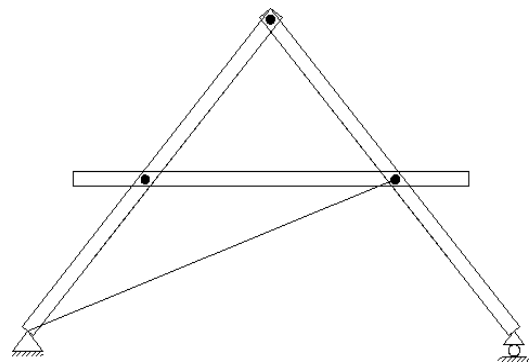Ex1:- Find the stability and determinacy of composite structure as shown below.

Solution:

Equations

$(3*3) + 0 = 9$

Unknowns

$1+3+ (3*(2(2-1))) = 10$

Unknowns > Equations, Stable & indeterminate 1st degree

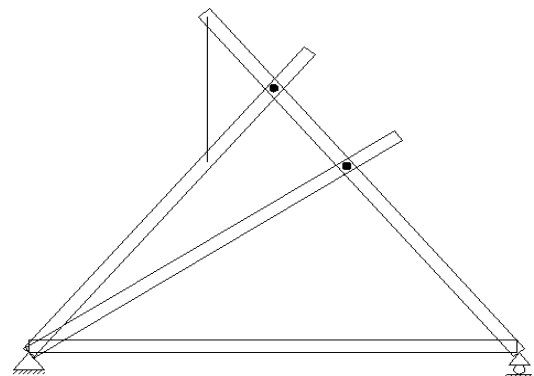Ex2:- Find the stability and determinacy of composite structure as shown below.

Solution:

Equations

$(4*3) + 0 = 12$

Unknowns

$1+3+ (3*(2(2-1))) + (2(3-1)) = 14$

Unknowns > Equations, Stable & indeterminate 2nd degree

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Ex3:- Find the stability and determinacy of composite structure as shown below.
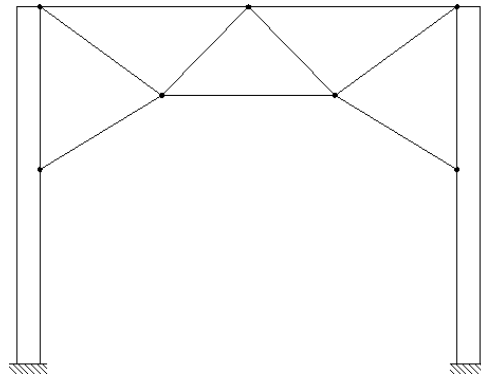
Solution:

Equations

$(2*3) + (3*2) = 12$

Unknowns

$9+6+0 = 15$

Unknowns > Equations, Stable & indeterminate 2nd degree

Ex4:- Find the stability and determinacy of composite structure as shown below.
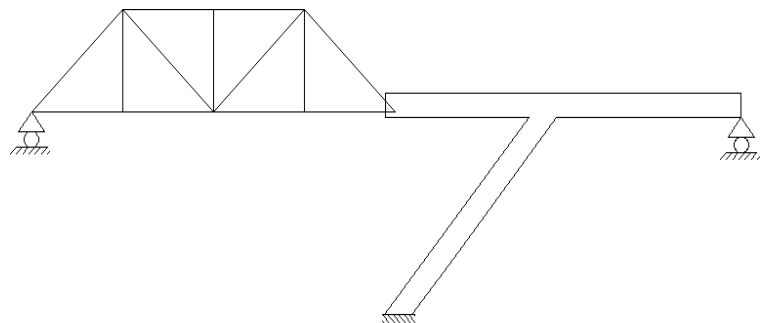
Solution:

Equations

$(1*3) + (7*2) = 17$

Unknowns

$13+5+0 = 18$

Unknowns > Equations, Stable & indeterminate 1st degree

H.w: Find the stability and determinacy of composite structure as shown below.

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