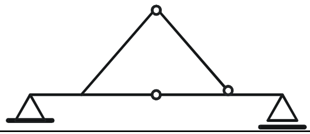
MINISTERUL EDUCATIEI CERCETARII SI TINERETULUI
UNIVERSITATEA TEHNICA "GH. ASACHI" IASI
FACULTATEA DE CONSTRUCTII

Bd. Prof. dr. Dimitrie Mangeron 43, cod 700050 ,IASI, tel: (0232)278683*, 254638, fax: (0232)233368

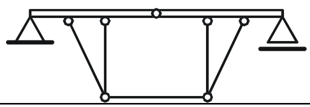
STRUCTURAL STATICS

1. Which is the right value of “n” (the static indeterminacy degree) for the shown structure?



a. n = 0 (statically determined) b. n = -1 (mechanism) c. n = 1 (hyperstatic)

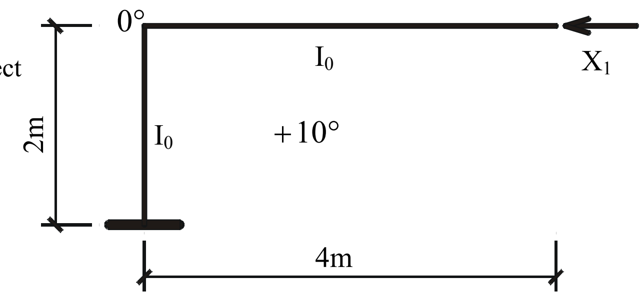
2. Which is the right value of “n” (the static indeterminacy degree) for the shown structure?:



a. n = 1 (hyperstatic) b. n = 0 (statically determined) c. n = -1 (mechanism)

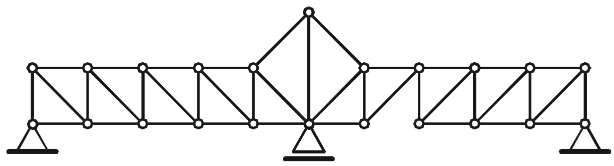
3. For the shown primary system, let specify the correct value of the free term Δ_{1t} if: $\alpha_t = 10^{-5} {}^\circ C^{-1}$

$I_0 = \frac{40x100^3}{12}, cm^4$



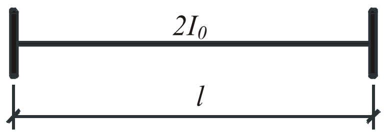
a. $\Delta_{1t} = -20 \cdot 10^{-5}$ b. $\Delta_{1t} = 0$ c. $\Delta_{1t} = 20 \cdot 10^{-5}$

4. Which is the right value of “n” (the static indeterminacy degree) for the shown structure?



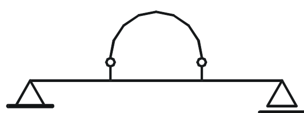
a. n = -1 (mechanism) b. n = 0 (statically determined) c. n = 1 (hyperstatic)

5. For the shown beam with constant cross section (moment of inertia of the corss-section - $2I_0$), having rigid links at both ends, the reduced stiffness matrix, in local coordinates, is:



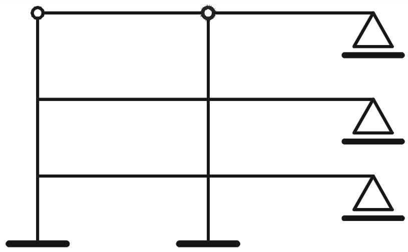
a. $[k]_{ij} = \frac{4 \cdot E \cdot I_0}{l} \cdot \begin{bmatrix} 1 & 0,5 \\ 0,5 & 1 \end{bmatrix}$ b. $[k]_{ij} = \frac{4 \cdot E \cdot I_0}{l} \cdot \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$ c. $[k]_{ij} = \frac{4 \cdot E \cdot I_0}{l} \cdot \begin{bmatrix} 4 & 2 \\ 2 & 4 \end{bmatrix}$)

6. Which is the right value of “n” (the static indeterminacy degree) for the shown structure?



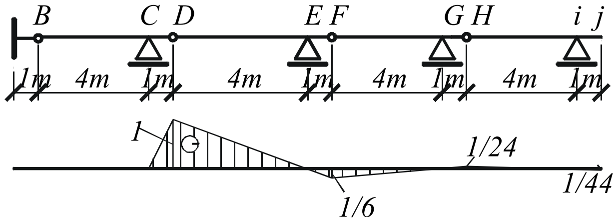
a. n = -1 (mechanism) b. n = 0 (statically determined) c. n = 1 (hyperstatic)

7. Let specify the correct value of the elastic-kinematic degree of indeterminacy „*Z*” for the shown structure (axial deformations of the beams are neglected):



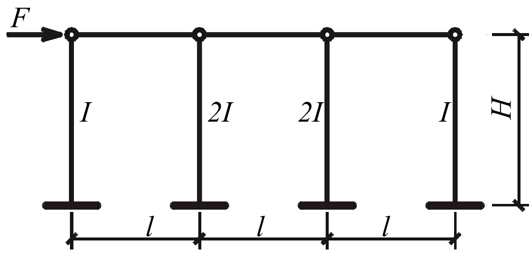
a. Z = 9 b. Z = 7 c. Z = 4

8. Let specify for which internal effort the shown influence line has been drawn.:



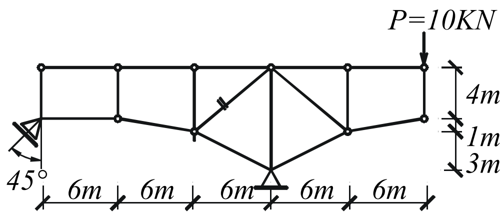
a. V_C b. M_C c. M_E

9. Let specify which is the most efficient method to solve the following structure:



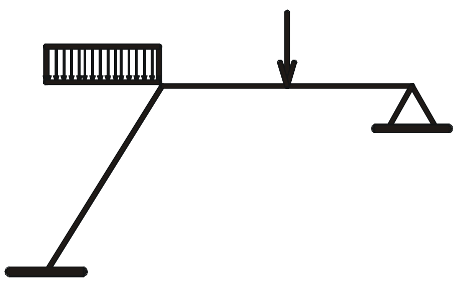
a. forces method b. displacement method c. anyone

10. Let specify which is the correct value of the axial effort in the indicated beam of the shown truss system:

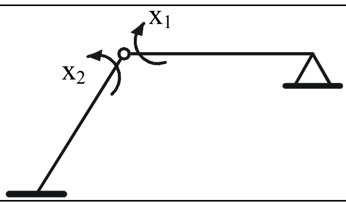


a. N = -1,06 KN b. N = 2,31 KN c. N = 1,06 KN

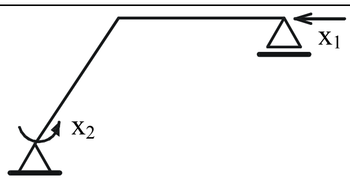
11. Which is the correct primary system if the structure must be solved using the forces method:



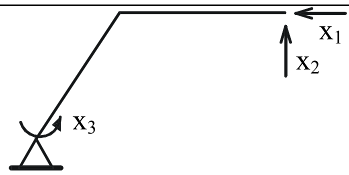
a.



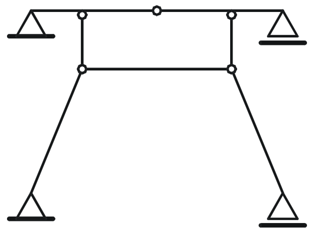
b.



c.

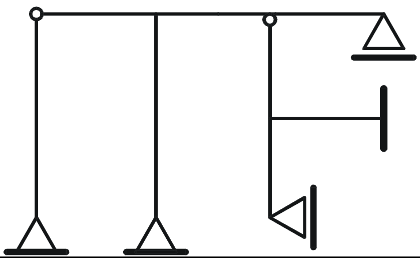


12. Which is the right value of “n” (the static indeterminacy degree) for the shown structure?



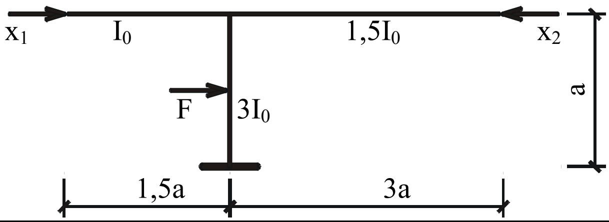
a. n = 1 (hyperstatic) b. n = 0 (statically determined) c. n = -1 (mechanism)

13. Let specify the correct value of the elastic-kinematic degree of indeterminacy „Z” for the shown structure (axial deformations of the beams are neglected):



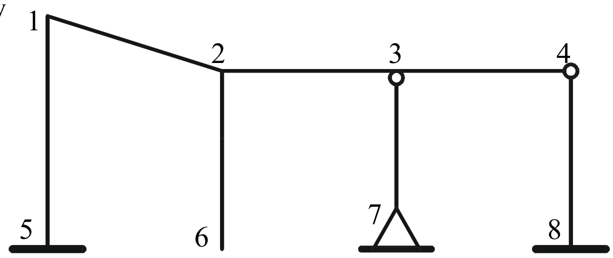
a. Z = 5 b. Z = 6 c. Z = 4

14. Let specify which relationship is between the unknowns coefficients in the forces method for the shown primary system:

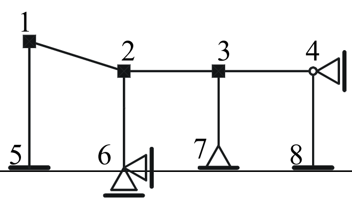


a. $\begin{cases}\delta_{11} \neq \delta_{22} \\ \delta_{12} = \delta_{21}\end{cases}$ b. $\begin{cases}\delta_{11} = -\delta_{12} \\ \delta_{22} = \delta_{12}\end{cases}$ c. $\{\delta_{11} = \delta_{22} = -\delta_{12} = -\delta_{21}$

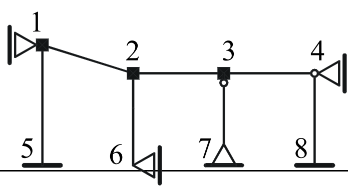
15. Let indicate the correct primary system, geometrically determined, for the shown structure :



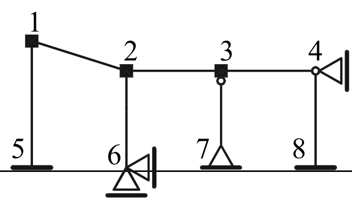
a.



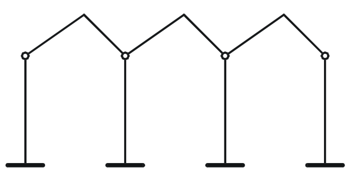
b.



c.



16. Which is the right value of “n” (the static indeterminacy degree) for the shown structure?



a. n = 3 (hyperstatic) b. n = 0 (statically determined) c. n = -1 (mechanism)

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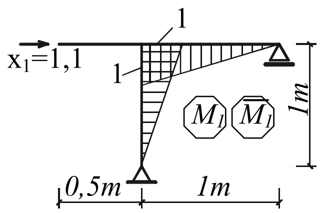
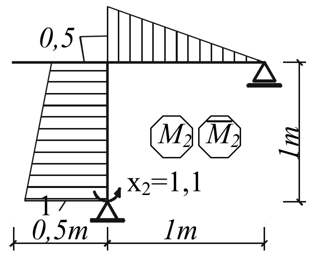
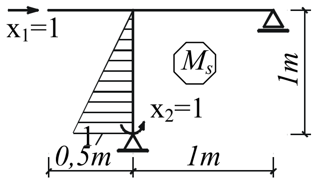
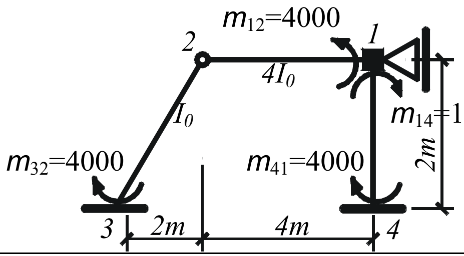
17. Let indicate which of the following bending moment diagrams M_1, M_2 sau M_s is the wrong one:

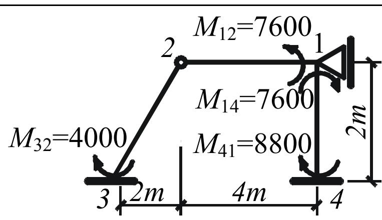
a.


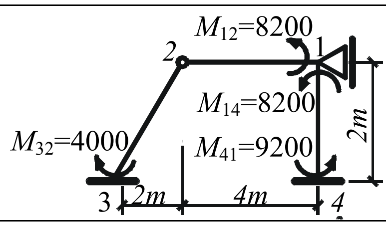
b.


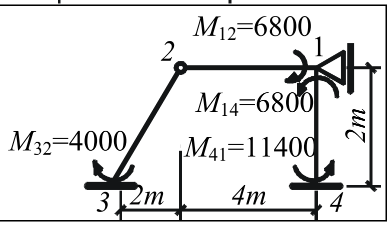
c.


18. Knowing the fixed-ends moments m_{ij} let indicate which are correct bending moments after the distribution and carry-over operation has been done (Cross method):

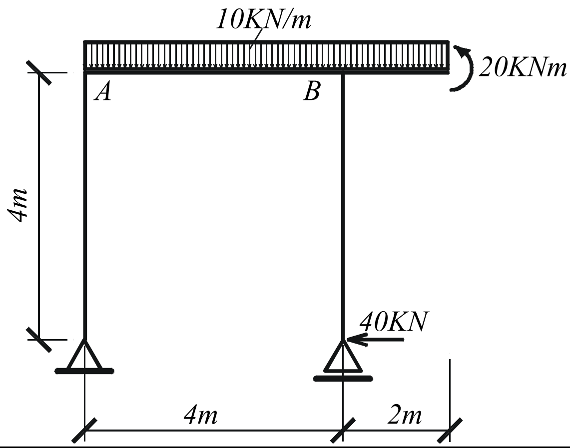


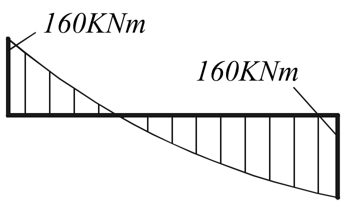
a.


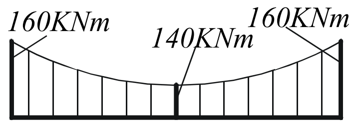
b.


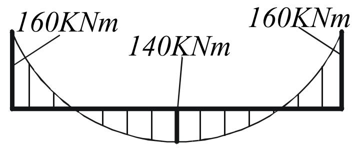
c.


19. For the shown structure, let indicate which is the right bending moment diagram for beam AB:



a.


b.


c.


20. If in the following elastic equilibrium equations system:

(1) $\delta_{11} \cdot x_1 + \delta_{12} \cdot x_2 + \delta_{13} \cdot x_3 + \Delta_{1p} = 0$

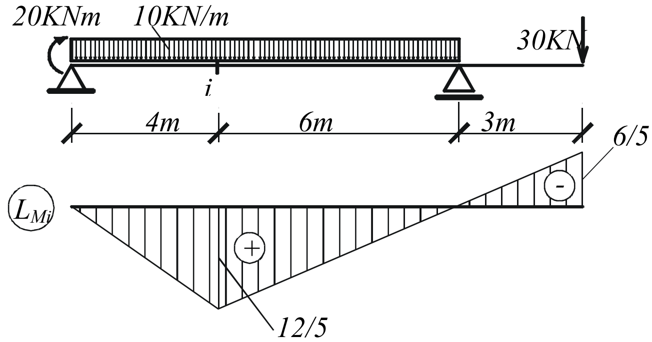
(2) $\delta_{21} \cdot x_1 + \delta_{22} \cdot x_2 + \delta_{23} \cdot x_3 + \Delta_{2p} = 0$

(3) $\delta_{31} \cdot x_1 + \delta_{32} \cdot x_2 + \delta_{33} \cdot x_3 + \Delta_{3p} = 0$

the coefficients of equations (1) and (2) are right values (it checks), and those of equation (3) didn't check, then:

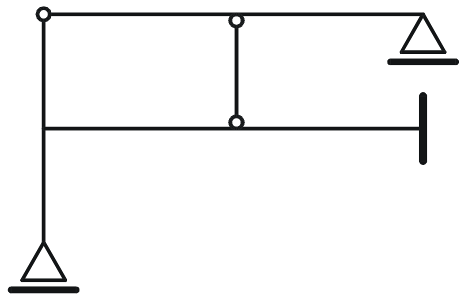
a. the coefficient δ_{31} is wrong
b. the coefficient δ_{32} is wrong
c. the coefficient δ_{33} is wrong

21. Let specify which one of the indicated values is the right bending moment M_i of the shown beam, knowing the corresponding influence line:



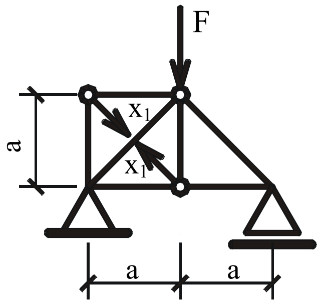
a.	M_i = - 48 KNm	b.	M_i = 72 KNm	c.	M_i = 96 KNm

22. Let specify the correct value of the elastic-kinematic degree of indeterminacy „Z" for the shown structure (axial deformations of the beams are neglected):



a.	Z = 4	b.	Z = 5	c.	Z = 6

23. For the shown primary system, let indicate the correct elastic equilibrium equation (EA = constant):

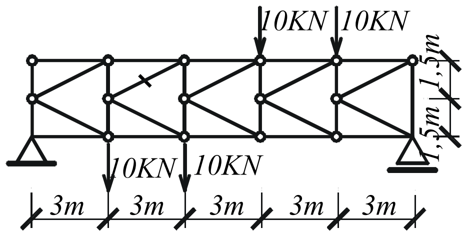


a. $(\delta_{11} + \frac{a \cdot \sqrt{2}}{EA}) \cdot x_1 + \Delta_{1p} = 0$

b. $(\delta_{11} - \frac{a \cdot \sqrt{2}}{EA}) \cdot x_1 = 0$

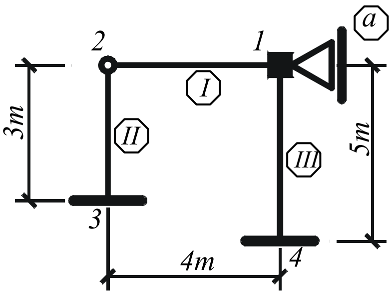
c. $\delta_{11} \cdot x_1 + \Delta_{1p} = \frac{a \cdot \sqrt{2}}{EA} \cdot x_1$

24. Let specify which is the correct value of the axial effort in the indicated beam of the shown truss system:



a.	N = 9,452 KN	b.	N = -11,186 KN	c.	N = -9,452 KN

25. Which is the correct transformation matrix [A] of the joint displacements into ends beam deformations for the shown structure:



a. $y_1=1 \quad y_a=1$

$$[A]=\begin{bmatrix} 1 & 0 \\ 0 & -0{,}333 \\ 1 & -0{,}2 \\ 0 & -0{,}2 \end{bmatrix} \begin{matrix} \theta_{14} \\ \theta_{41} \\ \theta_{14} \\ \theta_{41} \end{matrix}$$

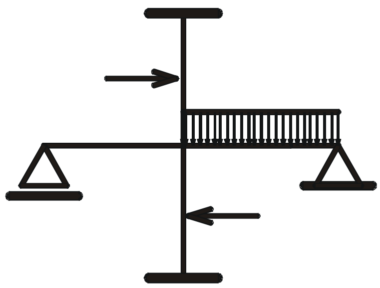
b. $y_1=1 \quad y_a=1$

$$[A]=\begin{bmatrix} 1{,}5 & -0{,}333 \\ 1{,}5 & 0{,}25 \\ 0 & 0 \\ 0 & 0{,}25 \end{bmatrix} \begin{matrix} \theta_{12} \\ \theta_{32} \\ \theta_{14} \\ \theta_{41} \end{matrix}$$

c. $y_1=1 \quad y_a=1$

$$[A]=\begin{bmatrix} 0 & 0 \\ 0 & 0{,}25 \\ 1 & -0{,}25 \\ 1 & 0 \end{bmatrix} \begin{matrix} \theta_{12} \\ \theta_{32} \\ \theta_{14} \\ \theta_{41} \end{matrix}$$

26. The primary system of which method is much more indicated to be used for the shown system?

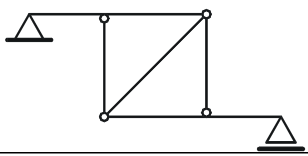


a. forces method

b. displacement method

c. both methods

27. Which is the right value of "n" (the static indeterminacy degree) for the shown structure?

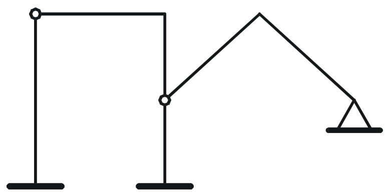


a. n = 0 (statically determined)

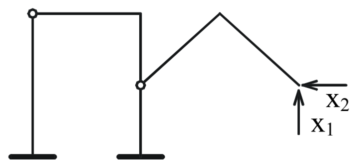
b. n = 1 (hyperstatic)

c. n = -1 (mechanism)

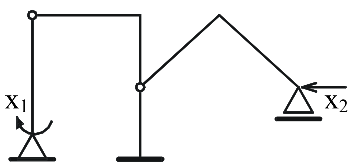
28. Which is the correct primary system if the structure must be solved using the forces method:



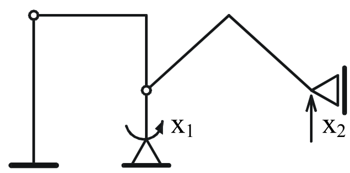
a.



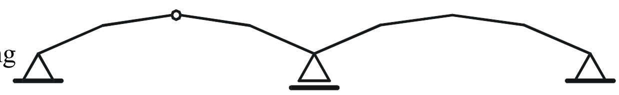
b.



c.



29. The degree of static indeterminacy of the following system is:

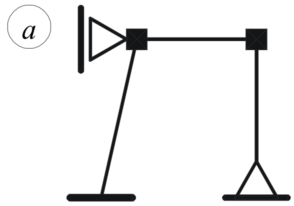


a. n = 0 (statically determined)

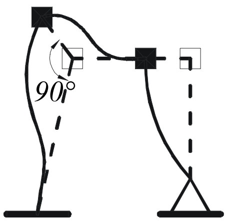
b. n = -1 (mechanism)

c. n = 1 (hyperstatic)

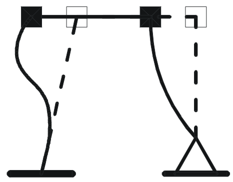
30. Which is the correct deformed shape for the elastic degree of freedom (a)?



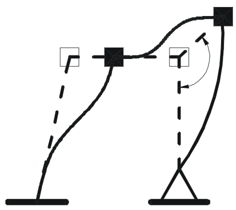
a.



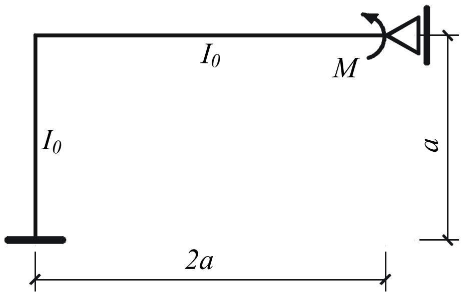
b.



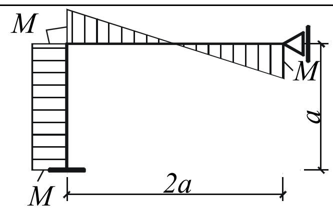
c.



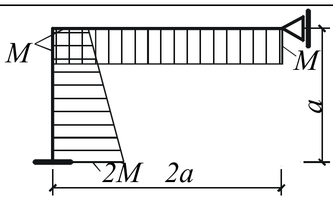
31. Using the elastic compatibility check condition, let indicate the correct bending moment diagram for the shown system:



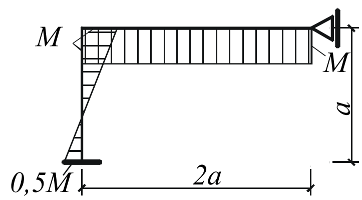
a.



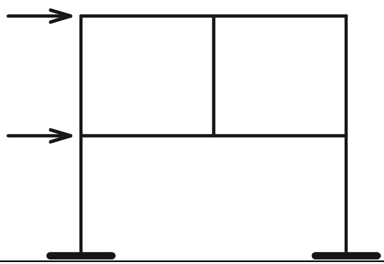
b.



c.

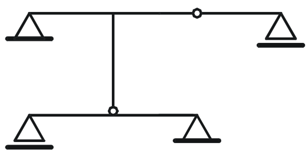


32. Let specify which is the most efficient method to solve the following structure:



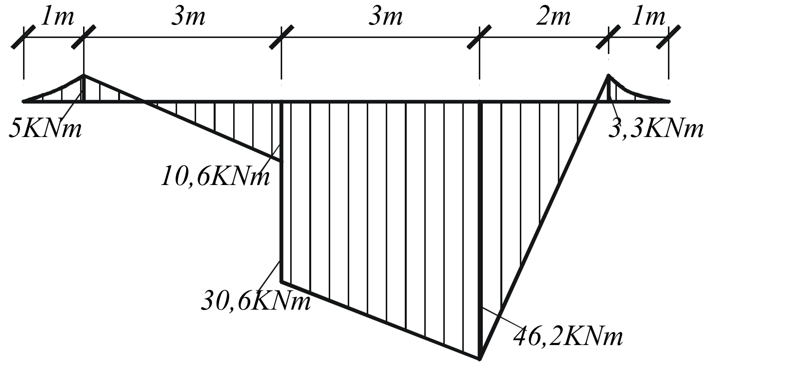
a.	forces method	b.	displacement method (analytical form)	c.	both methods

33. Which is the right value of "n" (the static indeterminacy degree) for the shown structure?

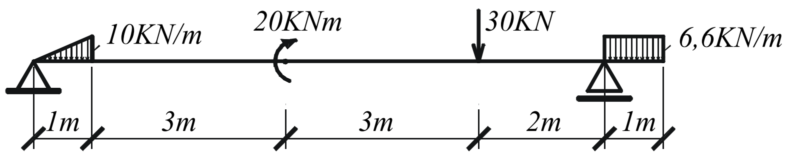


a.	n = -1 (mechanism)	b.	n = 1 (hyperstatic)	c.	n = 0 (statically determined)

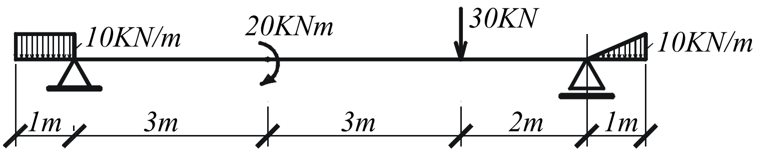
34. Let specify to which beam corresponds the shown bending moment diagram:



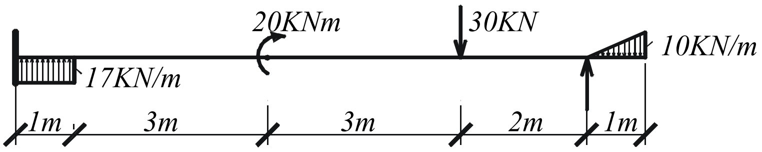
a.



b.

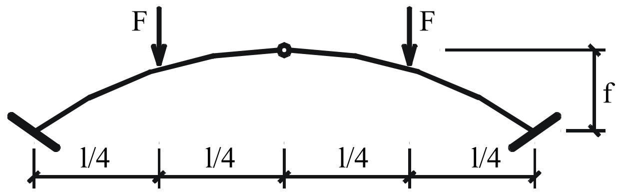


c.

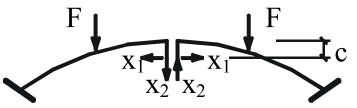


35. Which is the correct primary system for the following arch if the structure must be solved using the forces method:

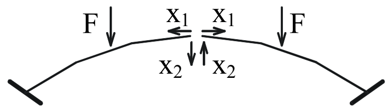
EI = constant



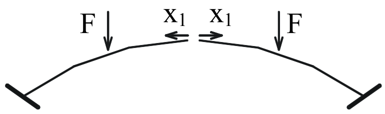
a.



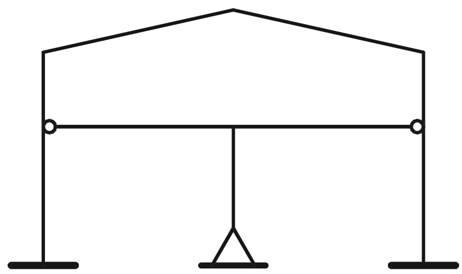
b.



c.



36. Let specify the correct value of the elastic-kinematic degree of indeterminacy „Z" for the shown structure (axial deformations of the beams are neglected):

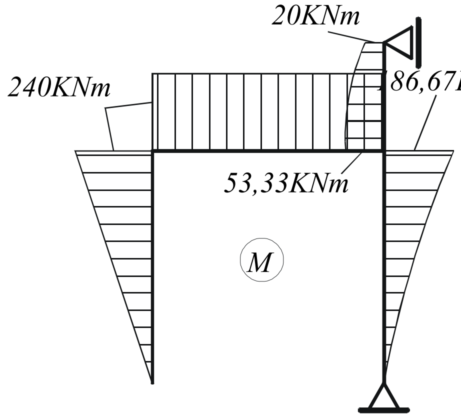


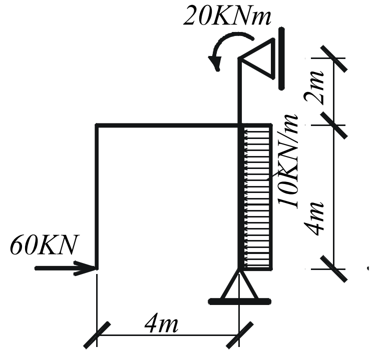
a. Z = 5

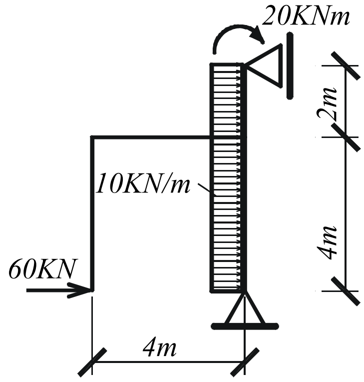
b. Z = 8

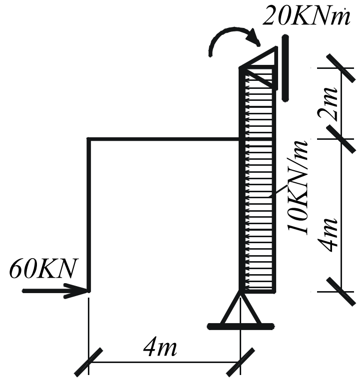
c. Z = 9

37. Let specify which is the corresponding load case for the shown bending moment diagram.



a.


b.


c.


38. How many meanings could have a coefficient „S_{ij}" from the displacements method equation system - the analytical form – with joint elastic displacements as unknowns:

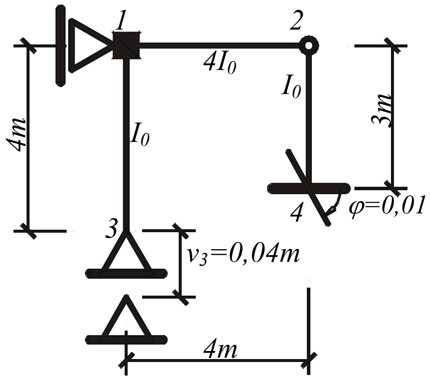
a. 2 meanings

b. 3 meanings

c. 4 meanings

39. Which are the correct fixed-end moments m_{ij} for the indicated settlements (moments toward beam):

$EI_0=10^5 KNm^2$

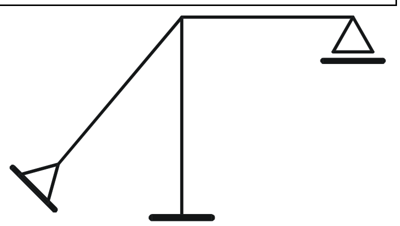


a. $\begin{cases} m_{12} = -2500\, KN \cdot m \\ m_{42} = 1000\, KN \cdot m \end{cases}$

b. $\begin{cases} m_{12} = 3000\, KN \cdot m \\ m_{42} = 1000\, KN \cdot m \end{cases}$

c. $\begin{cases} m_{12} = 3000\, KN \cdot m \\ m_{42} = -2500\, KN \cdot m \end{cases}$

40. Which is the degree of static indeterminacy for the shown system:

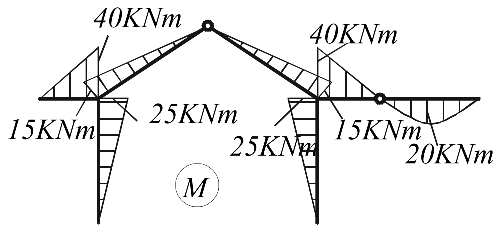


a. n = 4

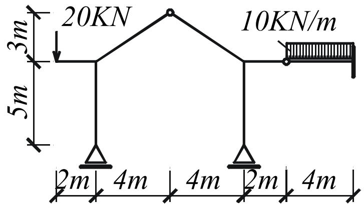
b. n = 3

c. n = 0 (statically determined)

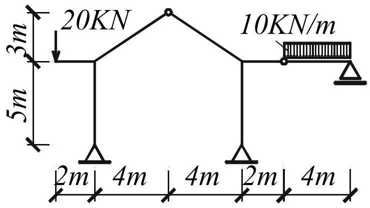
41. Which are the corresponding outward links for the shown bending moment diagram:



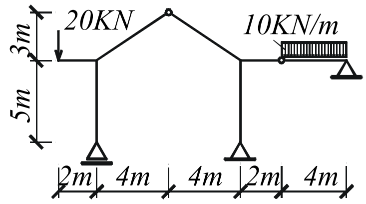
a.



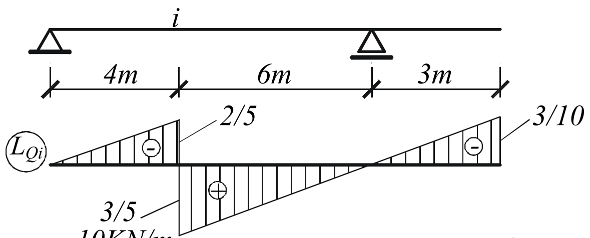
b.



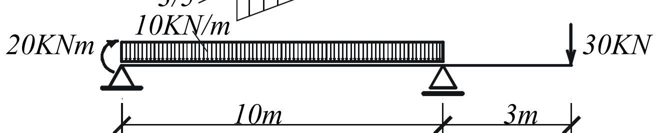
c.



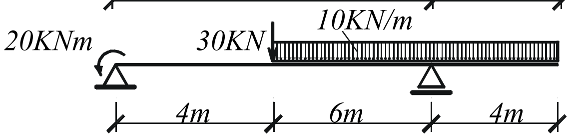
42. Knowing the shear force influence line of the „i” cross-section, let indicate for which load case Q_i=25 kN:



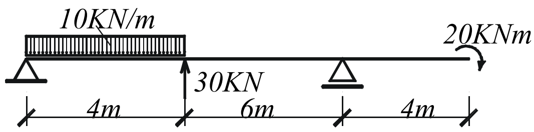
a.



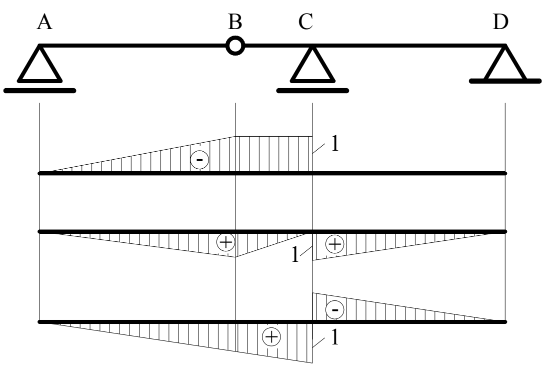
b.



c.



43. Which is the correct influence line for the shear force Q_c^{st} ?

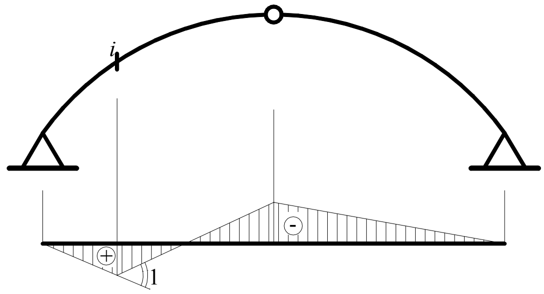


a.

b.

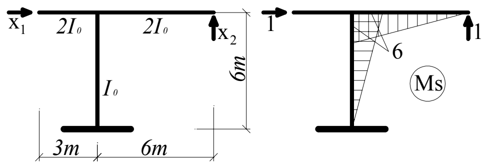
c.

44. For which internal effort of the „i" cross-section has been drawn the following influence line:



a. Q_i b. M_i c. N_i

45. Which is the correct coefficients group (forces method) for the shown primary system:



a. $\delta_{11} = \frac{72}{EI_0}$, $\delta_{12} = \delta_{21} = -\frac{108}{EI_0}$, $\delta_{22} = \frac{252}{EI_0}$

b. $\delta_{11} = \frac{72}{EI_0}$, $\delta_{12} = \delta_{21} = -\frac{108}{EI_0}$, $\delta_{22} = \frac{216}{EI_0}$

c. $\delta_{11} = \frac{86}{EI_0}$, $\delta_{12} = \delta_{21} = -\frac{108}{EI_0}$, $\delta_{22} = \frac{252}{EI_0}$

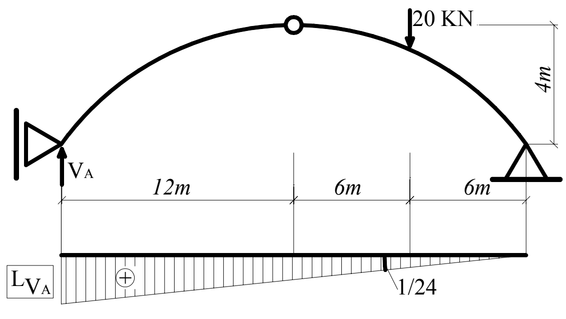
46. Which is the correct relationship for the thrust evaluation H for the double hinged arch:

a. $H = \dfrac{\int_0^l \frac{I_0}{I} \cdot M_p(x) \cdot y(x) \cdot ds}{\int_0^l \frac{I_0}{I} \cdot y^2(x) \cdot ds + i_0^2 \cdot l}$

b. $H = \dfrac{\int_0^l \frac{I_0}{I} \cdot M_p(x) \cdot y(x) \cdot ds}{\int_0^l \frac{I_0}{I} \cdot y^2(x) \cdot ds + i_0^2 \cdot l^2}$

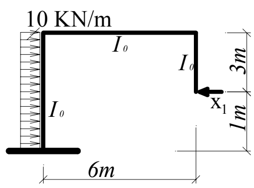
c. $H = \dfrac{\int_0^l \frac{I_0}{I} \cdot M_p(x) \cdot y(x) \cdot ds}{\int_0^l \frac{I_0}{I} \cdot y^2(x) \cdot ds + i_0 \cdot l^2}$

47. Knowing the vertical reactive force influence line V_A, let specify which is its correct value:



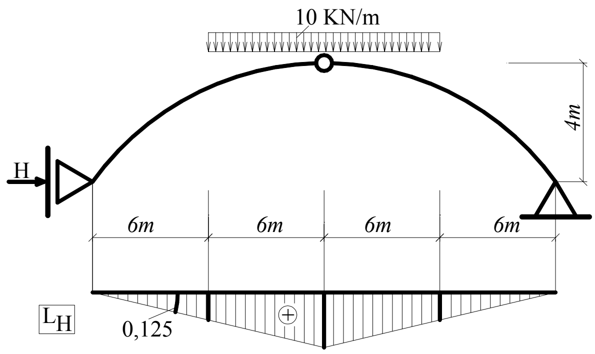
a. V_A=8.33 KN b. V_A=10 KN c. V_A=5 KN

48. Which is the correct value of the free term Δ_{1p} for the shown primary system:



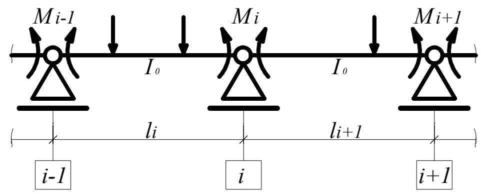
a. $\Delta_{1p} = 0$ b. $\Delta_{1p} = -\frac{10}{EI_0}$ c. $\Delta_{1p} = \frac{10}{EI_0}$

49. Knowing the thrust influence line H, let specify which is its correct value:



a.	H=160 KN	b.	H=135 KN	c.	H=140 KN

50. Which is the correct variant for the *three bending moment equation* (Clapeyron's relationship):

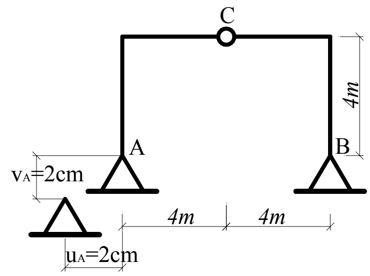


a. $\boxed{i}$ $l_i \cdot M_{i-1} - 2\cdot(l_i + l_{i+1})\cdot M_i + l_{i+1}\cdot M_{i+1} + m''_{i,i-1}\cdot l_i + m'_{i,i+1}\cdot l_{i+1} = 0$

b. $\boxed{i}$ $l_i \cdot M_{i-1} + 2\cdot(l_i + l_{i+1})\cdot M_i + l_{i+1}\cdot M_{i+1} + l_i \cdot m'_{i,i-1} + l_{i+1}\cdot m''_{i,i+1} = 0$

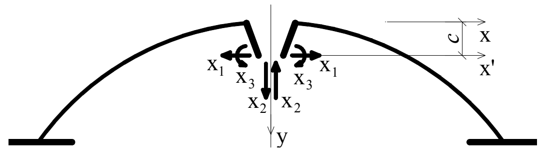
c. $\boxed{i}$ $l_i \cdot M_{i-1} + 2\cdot(l_i + l_{i+1})\cdot M_i + l_{i+1}\cdot M_{i+1} + l_i \cdot m''_{i,i-1} + l_{i+1}\cdot m'_{i,i+1} = 0$

51. Let specify the correct value of the vertical displacement v_c for the indicated settlements:



a.	v_c=2 cm	b.	v_c=0	c.	v_c=-2 cm

52. Let specify for which unknowns X_i *(i=1,2,3)* the following equation $X_i = -\dfrac{\int_0^l \frac{I_0}{I}\cdot M_p(x)\cdot x \cdot ds}{\int_0^l \frac{I_0}{I}\cdot x^2 \cdot ds}$ is the correct one:



a.	*i=1*	b.	*i=2*	c.	*i=3*

53. For which methods many different primary systems could be used:

a.	displacement method	b.	forces method	c.	both methods

54. Which is the correct definition of a flexibility δ_{ij} :

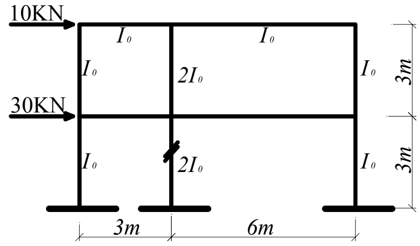
a. displacement (translation/rotation) produced on „*i*" direction by a unit force or bending moment applied on „*j*" direction

b. reactive force/moment developed on „*i*" direction caused by a unit translation/rotation on „*j*" direction

c. both

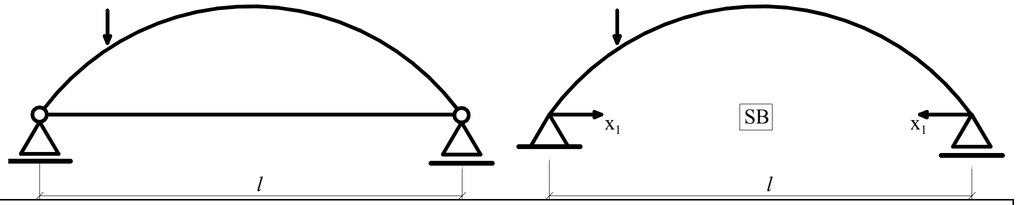
55.	Which is the correct definition of a stiffness K_{ij} :
a.	displacement (translation/rotation) produced on „i” direction by a unit force or bending moment applied on „j” direction
b.	reactive force/moment developed on „i” direction caused by a unit translation/rotation on „j” direction
c.	both

56. Using the simplified method, let find the correct value of the shear force in the indicated beam:



a.	$Q = 10\,KN$	b.	$Q = 15\,KN$	c.	$Q = 20\,KN$

57. Which is the correct elastic equilibrium equation for the following system considering the indicated primary system:



a.	$\delta_{11} \cdot X_1 + \Delta_{1p} = \dfrac{l}{EI_0} \cdot X_1$	b.	$\delta_{11} \cdot X_1 + \Delta_{1p} = -\dfrac{l}{E_t I_t} \cdot X_1$	c.	$\delta_{11} \cdot X_1 + \Delta_{1p} = -\dfrac{l}{E_t A_t} \cdot X_1$

58. Which is the correct relationship of the elastic center at symmetric structures:

a.	$c = \dfrac{\int_0^l \frac{I_0}{I} \cdot y(x) \cdot ds}{\int_0^l \frac{I_0}{I} \cdot ds}$	b.	$c = \dfrac{\sum_{i=1}^{n} W_i \cdot y_i}{\sum_{i=1}^{n} W_i}\ ; W_i = \dfrac{I_0}{I_i} \cdot \Delta S_i$	c.	both

59. Which is the correct relationship of the a coefficient L_{qr} from equilibrium equation using virtual work, to find the correction coefficients in the displacement method – the distribution and carry over bending moments method in 2 steps:

a.	$L_{qr} = \sum \pm (M_{ij}^{q} + M_{ji}^{q}) \cdot \psi_{ij}^{r}$	b.	$L_{qr} = \sum \pm (M_{ij}^{r} + M_{ji}^{r}) \cdot \psi_{ij}^{q}$	c.	both

60 Which is the correct relationship of final beam-ends moments for the structures with displaced joints, loaded by the joint concentrated forces - the distribution and carry over bending moments method in 2 steps:

a.	$M_{ij} = M_{ij}^{I} + \sum_{r=1}^{m} M_{ij}^{r} \cdot X_r$	b.	$M_{ij} = \sum_{r=1}^{m} M_{ij}^{r} \cdot X_r$	c.	$M_{ij} = M_{ij}^{I}$

61. Which is the correct relationship of final beam-ends moments for the structures with fixed joints, loaded by different settlements - the distribution and carry over bending moments method in 2 steps:

a.	$M_{ij} = M_{ij}^{I} + \sum_{r=1}^{m} M_{ij}^{r} \cdot X_r$	b.	$M_{ij} = \sum_{r=1}^{m} M_{ij}^{r} \cdot X_r$	c.	$M_{ij} = M_{ij}^{I}$

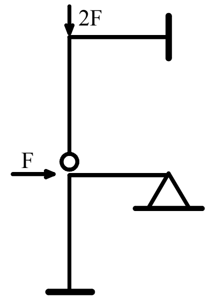
62. Which is the most efficient method to solve the hyperstatic arches:

a.	displacement method	b.	forces method	c.	anyone

63 Which is the most practical method to solve the hyperstatic trusses with rigid joints:

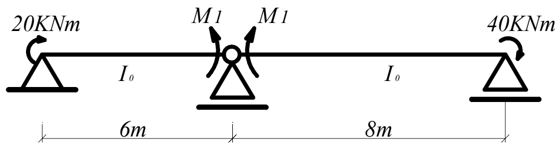
a. displacement method b. forces method c. both methods

64. Which method is the most indicated to solve the following structure:



a. forces method b. displacement method (analytical form) c. none

65. For the shown primary system, let indicate which is the correct three bending moment equation:



a. $6 \cdot 20 + 2 \cdot (6+8) \cdot M_1 + 8 \cdot (-40) = 0$ b. $0 + 14 \cdot M_1 + 240 = 0$ c. $20 + 8 \cdot M_1 - 40 = 0$

66. Which is the correct compatibility condition of the deformed shape for a hyperstatic structure subjected to a temperature nonuniform variation:

a. $\sum_0^l \frac{M^f \cdot \overline{M}_i}{EI} \cdot dx = \Delta_{it}$ b. $\sum_0^l \frac{M^f \cdot \overline{M}_i}{EI} \cdot dx = 0$ c. $\sum_0^l \frac{M^f \cdot \overline{M}_i}{EI} \cdot dx = -\Delta_{it}$

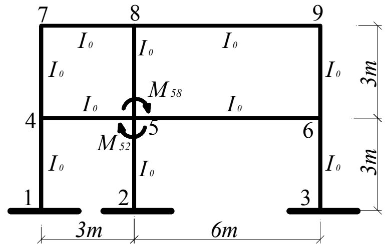
67. Which is the correct compatibility condition of the deformed shape for a hyperstatic structure subjected to different settlements:

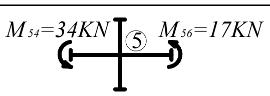
a. $\sum_0^l \frac{M^f \cdot \overline{M}_i}{EI} \cdot dx = 0$ b. $\sum_0^l \frac{M^f \cdot \overline{M}_i}{EI} \cdot dx = \sum \overline{R}_{ki} \cdot \Delta_k^{ced}$ c. $\sum_0^l \frac{M^f \cdot \overline{M}_i}{EI} \cdot dx = -\sum \overline{R}_{ki} \cdot \Delta_k^{ced}$

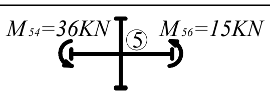
68. Which is the correct compatibility condition of the deformed shape for a hyperstatic structure subjected to external loads:

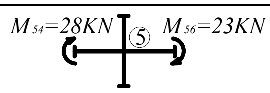
a. $\sum_0^l \frac{M^f \cdot \overline{M}_i}{EI} \cdot dx = -\Delta_{ip}$ b. $\sum_0^l \frac{M^f \cdot \overline{M}_i}{EI} \cdot dx = \Delta_{ip}$ c. $\sum_0^l \frac{M^f \cdot \overline{M}_i}{EI} \cdot dx = 0$

69. Knowing the following bending moments $M_{52} = 30KN \cdot m$, $M_{58} = 21KN \cdot m$ and using the simplified method, let indicate which are the correct values of the bending moments M_{54} şi M_{56}:

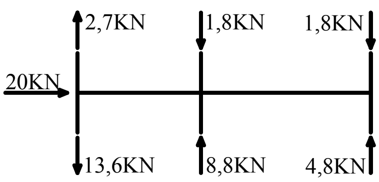


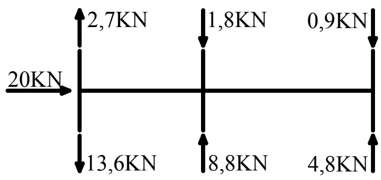
a. 

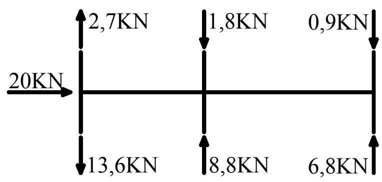
b. 

c. 

70. In which one of the following cases the axial efforts in the columns have the correct indicated magnitude:

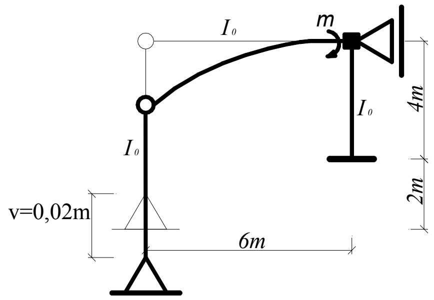
a. 

b. 

c. 

71. Which is the correct value of the fixed-end moment for the indicated settlement:

$EI_0 = 2 \cdot 10^7 \ daN \cdot m^2$



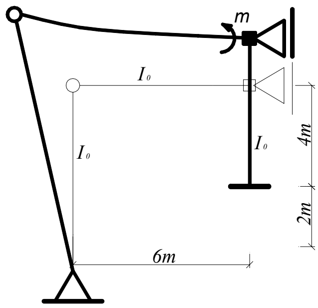
a.	m=12968,33 daN·m	b.	m=33333,33 daN·m	c.	m=27777,78 daN·m

72. Which is the correct value of the fixed-end moment for the indicated uniform temperature variation:

$t_m = 30^\circ C$

$\alpha_t = 10^{-5\circ} C^{-1}$

$EI_0 = 2 \cdot 10^7 \ daN \cdot m^2$



a.	m =2500 daN·m	b.	m =3000 daN·m	c.	m =1000 daN·m

73. Knowing:
- the quasi-diagonal stiffness matrix [$\diagdown k \diagdown$]
- the transformation matrix (displacements into deformations) [A]
- the stiffness matrix of the structure [K_S]
- the joint reduced load vector on their displacement direction (rotations and translations) $\{P\}$
- the fixed-end moments vector{ m }

Let indicate which are the main steps and the correct relationships to solve a hyperstatic structure using the displacement method in a matrix form:

a.
- joint displacement vector $\{D\} = [K_S]^{-1} \cdot \{P\}$
- beam-ends deformation vector (rotations) $\{d\} = [A] \cdot \{D\}$
- internal efforts vector (bending moments) of the beam ends $\{S\}=[\diagdown k \diagdown] \cdot \{d\}+\{m\}$

b.
- joint displacement vector $\{D\} = -[K_S] \cdot \{P\}$
- beam-ends deformation vector (rotations) $\{d\} = -[A]^T \cdot \{D\}$
- internal efforts vector (bending moments) of the beam ends $\{S\}=[\diagdown k \diagdown] \cdot \{d\}$

c.
- joint displacement vector $\{D\} = -[K_S]^{-1} \cdot \{P\}$
- beam-ends deformation vector (rotations) $\{d\} = -[A] \cdot \{D\}$
- internal efforts vector (bending moments) of the beam ends $\{S\}=\{m\}+ [\diagdown k \diagdown]^{-1} \cdot \{d\}$

74. Let indicate which is the correct variant of the reciprocity theorem in the displacement method:

a.	$\delta_{ij}^{(P_j=1)} = \delta_{ji}^{(M_i=1)}$	b.	$\delta_{ij}^{(P_j=1)} = \delta_{ji}^{(P_i=1)}$	c.	both

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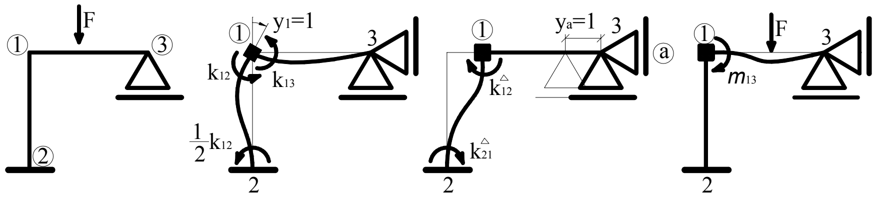
75. Which of the reciprocity theorem for the reactive forces is the correct one:

a. $s_{ij}^{(y_j=1)} = s_{ji}^{(\theta_i=1)}$ b. $s_{ij}^{(\theta_j=1)} = s_{ji}^{(\theta_i=1)}$ c. both

76. Knowing the displacement of joint *1*, y_1 *and* y_a, let indicate which are the correct relationships for the beam ends bending moments:

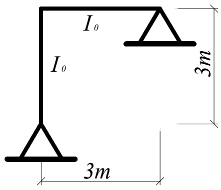


a.
$M_{13} = -k_{13} \cdot y_1 + m_{13}$
$M_{12} = -k_{12} \cdot y_1 + \bar{k}_{12}^{\Delta} \cdot y_a$
$M_{21} = 0$

b.
$M_{13} = -k_{13} \cdot y_1 + m_{13}$
$M_{12} = -k_{12} \cdot y_1 + \bar{k}_{12}^{\Delta} \cdot y_a$
$M_{21} = -\frac{1}{2} \cdot k_{12} \cdot y_1$

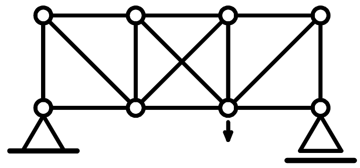
c.
$M_{13} = -k_{13} \cdot y_1 + m_{13}$
$M_{12} = -k_{12} \cdot y_1 + \bar{k}_{12}^{\Delta} \cdot y_a$
$M_{12} = -\frac{1}{2} \cdot k_{12} \cdot y_1 + \bar{k}_{21}^{\Delta} \cdot y_a$

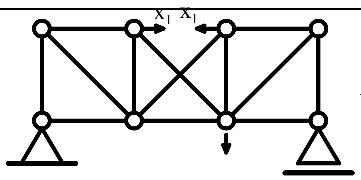
77. Which is the correct stiffness matrix $[K_S]$ for the shown structure:

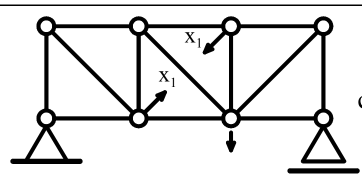


a. $[K_S] = EI_0 \cdot [2]$ b. $[K_S] = \begin{bmatrix} 1 & 0,5 \\ 0,5 & 1 \end{bmatrix}$ c. $[K_S] = \begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$

78.
Which is the correct primary system for the shown truss system:

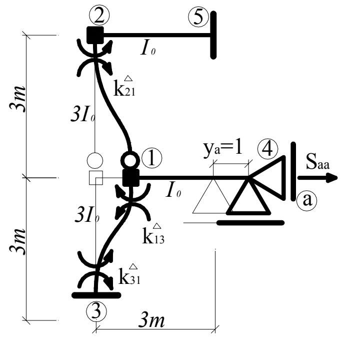


a.


b.


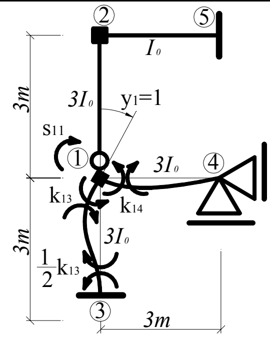
c. both

79. Which is the correct value of the coefficient s_{2a} of the static equations system in displacement method:



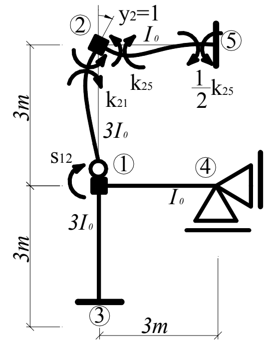
a. $s_{aa} = \frac{4}{3} \cdot EI_0$ b. $s_{aa} = EI_0$ c. $s_{aa} = \frac{5}{3} \cdot EI_0$

80. Which is the correct value of the coefficient s_{11} of the static equations system in displacement method:



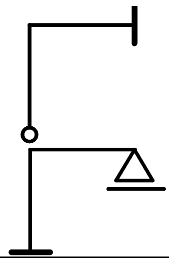
a.	$s_{11} = 5 \cdot EI_0$	b.	$s_{11} = \frac{7}{3} \cdot EI_0$	c.	$s_{11} = 7 \cdot EI_0$

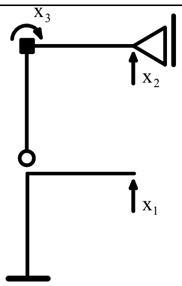
81. Which is the correct value of the coefficient s_{12} of the static equations system in displacement method:

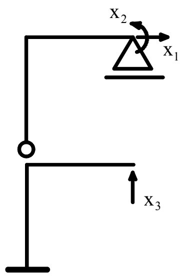


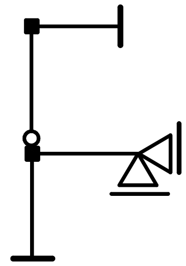
a.	$s_{12} = \frac{1}{3} \cdot EI_0$	b.	$s_{12} = 0$	c.	$s_{12} = -EI_0$

82. Which is the correct primary system if the forces method must to be applied:

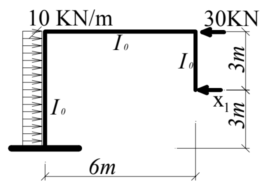


a. 

b. 

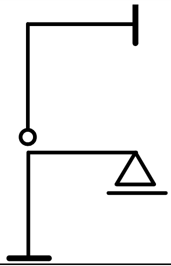
c. 

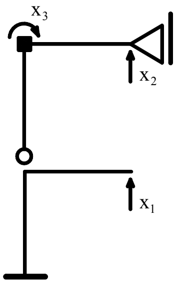
83. Which is the correct value of the free term Δ_{1p} for the shown primary system:

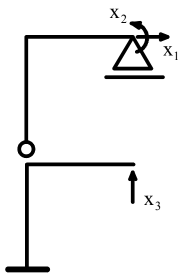


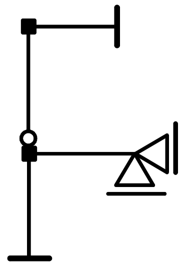
a.	$\Delta_{1p} = -\frac{120}{EI_0}$	b.	$\Delta_{1p} = 0$	c.	$\Delta_{1p} = \frac{90}{EI_0}$

84. Which is the correct primary system if the displacement method must to be applied:

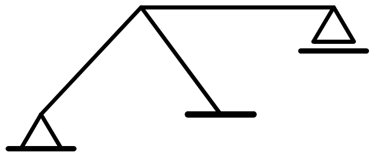


a. 

b. 

c. 

85. Which is the correct value of the elastic degree of freedom (translations) *„m”* for the shown structure:

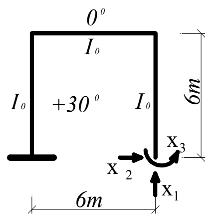


a. m=1 b. m=0 c. m=2

86. For the shown primary system let specify the correct value of the free term Δ_{3t} if:

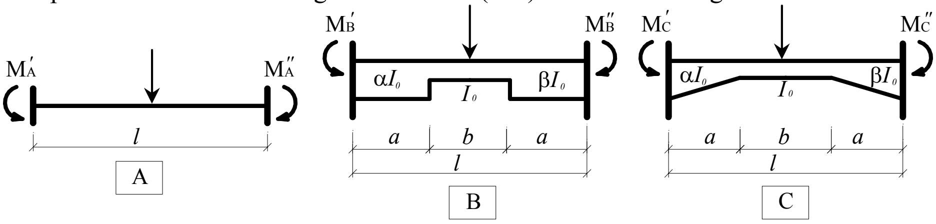
$\alpha_t = 10^{-5\circ} C^{-1}$

$I_0 = \frac{30 \cdot 60^7}{12} cm^4$



a. $\Delta_{3t} = -720 \cdot 10^{-5}$ b. $\Delta_{3t} = 900 \cdot 10^{-5}$ c. $\Delta_{3t} = 480 \cdot 10^{-5}$

87. Which is the correct relationship set between the bending moments $M^{'}(M^{"})$ for the following beams:



a. $\begin{cases} M'_A < M'_B,\ M''_A < M''_B \\ M'_C > M'_B,\ M''_C < M''_B \\ M'_A \geq M'_C,\ M''_C \leq M''_A \end{cases}$

b. $\begin{cases} M'_A < M'_B,\ M''_B > M''_A \\ M'_C < M'_B,\ M''_B > M''_C \\ M'_C > M'_A,\ M''_C > M''_A \end{cases}$

c. $\begin{cases} M'_A > M'_C,\ M''_C > M''_A \\ M'_B < M'_A,\ M''_A > M''_B \\ M'_A \leq M'_C,\ M''_C \geq M''_A \end{cases}$

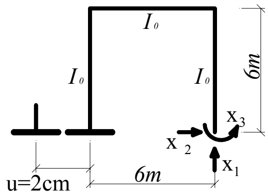
88. Which is the correct global check relationship of the unknown coefficients in forces method:

a. $\sum_{i=1}^{n} \delta_{ij} = \delta_{ss} = \sum \int_0^l \frac{\overline{M}_s \cdot \overline{M}_1}{EI} dx$

b. $\sum_{i,j=1}^{n} \delta_{ij} = \delta_{ss} = \sum \int_0^l \frac{\overline{M}_s^2}{EI}$

c. none

89. For the shown primary system let specify the correct value of the free term $\sum \overline{R}_{k1} \cdot \Delta_k^{ced}$:



a.	$\sum \overline{R}_{k1} \cdot \Delta_k^{ced} = -0{,}02$	b.	$\sum \overline{R}_{k1} \cdot \Delta_k^{ced} = 0{,}02$	c.	$\sum \overline{R}_{k1} \cdot \Delta_k^{ced} = 0$

90. Which is the correct checking relationship for the free terms in the forces method – case of external loads:

a.	$\sum_{i=1}^{n} \Delta_{ip} = \Delta_{sp} = -\sum \int_0^l \frac{\overline{M}_s \cdot \overline{M}_p}{EI} dx$	b.	$\sum_{i=1}^{n} \Delta_{ip} = \Delta_{sp} = \sum \int_0^l \frac{\overline{M}_s \cdot \overline{M}_p}{EI} dx$	c.	none

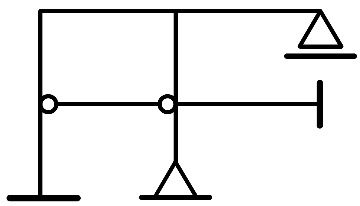
91. Which is the correct checking relationship for the free terms in the forces method – case of different settlements:

a.	$\sum_{i=1}^{n} (\sum_k \overline{R}_{ki} \cdot \Delta_k^{ced}) = \sum_k \overline{R}_{ks} \cdot \Delta_k^{ced}$	b.	$\sum_{i=1}^{n} (\sum_k \overline{R}_{ki} \cdot \Delta_k^{ced}) = -\sum_k \overline{R}_{ks} \cdot \Delta_k^{ced}$	c.	none

92. Which is the correct checking relationship for the free terms in the forces method - case of a temperature nonuniform variation:

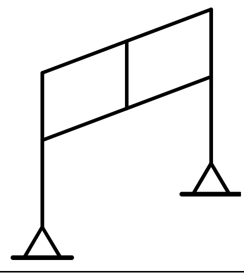
a.	$\sum_{i=1}^{n} \Delta_{it} = \Delta_{st} = \sum \alpha_t \cdot t_m^{\circ} \cdot \Omega_{\overline{N}s} + \sum \alpha_t \cdot \frac{\Delta t_{\circ}}{h} \cdot \Omega_{\overline{M}s}$	b.	$\sum_{i=1}^{n} \Delta_{it} = 0$	c.	none

93. Let specify the correct value of the kinematic-elastic degree of freedom „Z" for the shown structure (axial deformations of the beams are neglected):



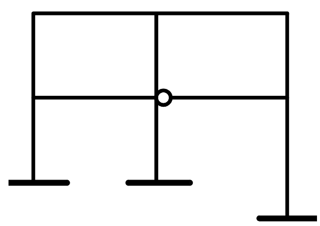
a.	Z=4	b.	Z=5	c.	Z=6

94. How many unknowns have the shown structure in the stiffness matrix method (displacement method):



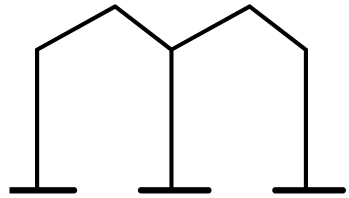
a.	9 unknowns	b.	6 unknowns	c.	8 unknowns

95. How many unknowns have the shown structure in the stiffness matrix method (displacement method):



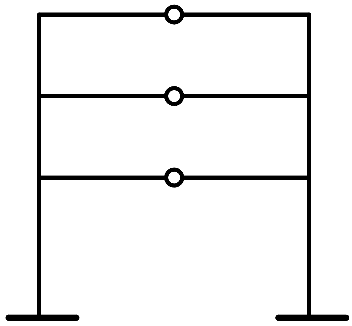
a.	6 rotations and translations	b.	7 rotations and translations	c.	8 rotations and translations

96. How many unknowns have the shown structure in the stiffness matrix method (displacement method):



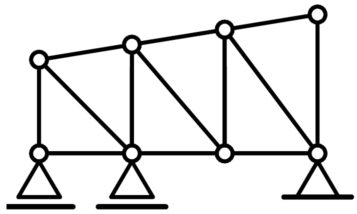
a. 6 unknowns — b. 7 unknowns — c. 8 unknowns

97. Which is the degree of indeterminacy of the shown structure:



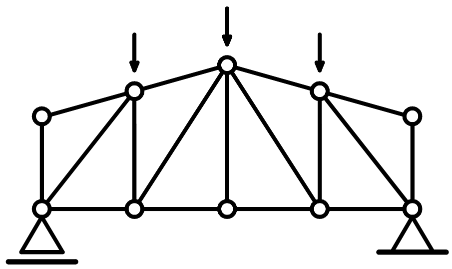
a. 9 — b. 4 — c. 6

98. In which category should be included the shown truss system:



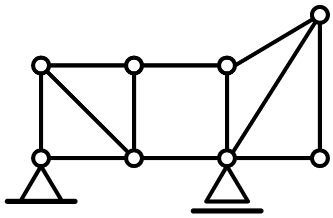
a. statically determined — b. hyperstatic — c. mechanism

99. In which category should be included the shown truss system:



a. statically determined — b. hyperstatic — c. mechanism

100. In which category should be included the shown truss system:



a. statically determined — b. hyperstatic — c. mechanism