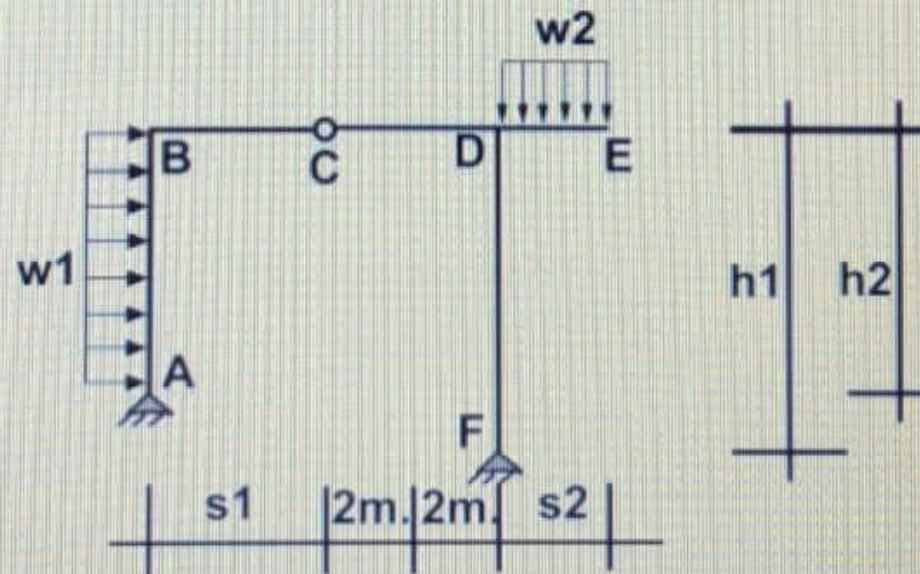


### Question 1 (65 points)

The frame system has pin supports at A and F, internal hinge at C and supports the loading shown below. The flexural rigidity of elements AB, DF is  $2EI$  and of elements BC and CDE is  $EI$ , where  $E = 30\text{GPa}$  and  $I = 800 \times 10^6 \text{mm}^4$

For the frame system Assume Different Values for  $s_1, s_2, h_1, h_2, w_1, w_2$

- Find the reaction forces
- Draw the bending moment diagram indicating key values
- Draw the deformed shape
- Find the **horizontal displacement at B** and the **rotation at F** using the principle of virtual work. Ignore the shear and axial deformations of the frame system





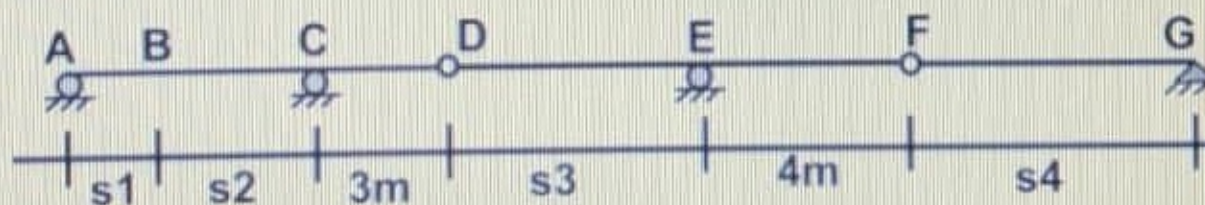
### Question 2 (20 points)

The beam shown below has roller supports at A, C, and E, and pin support at G and internal hinges at D and F. Assume Different Values for  $s_1, s_2, s_3, s_4$

- a. Draw the influence lines for **Shear at B, moment at B, shear at C** indicating key values. Use a method of your choice

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- b. The beam supports dead load of  $2.5\text{kN/m}$  and live load of  $5.5\text{kN/m}$  and Live point load of  $7\text{kN}$ , construct the load cases for maximum and minimum moment at B and find the values of maximum and minimum moments at B for the given loading

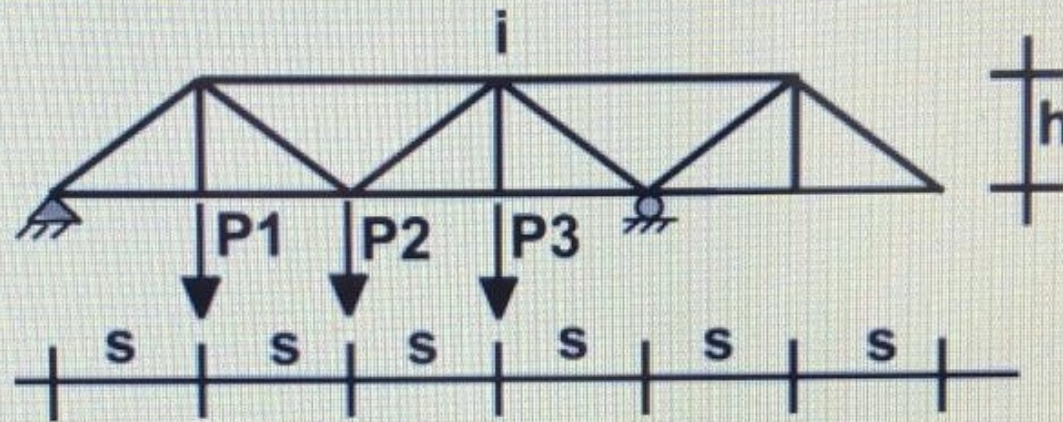




### Question 3 (45 points)

The truss system supports the loading shown below.  $EA$  is constant for the truss members. Assume Different Values for  $s$ ,  $h$ ,  $P_1$ ,  $P_2$ ,  $P_3$

- a. Find the vertical and horizontal displacements at point  $i$  using the principle of virtual work



- b. Draw the influence lines for elements  $hi$ ,  $hc$ ,  $cd$  indicating key values knowing that loading moves from  $a$  to  $g$

