Problem 1 (20 points)

Consider the two-span beam ABC shown in Fig. 1 subjected to a uniform distributed load w.

a) Calculate the reactions at A, B, C using the concept of consistent deformations. (remove support at B)
b) Compare the results in a) with the results obtained using a very simple-minded approach where half of the load of each span is supported by each of its supports. Summarize in a sentence or two your observations from comparing a) and b).
c) If the support at B is replaced by a spring of constant k, what will be the new reactions? (check the limits as \( k \rightarrow 0 \) and \( k \rightarrow \infty \))

Problem 2 (20 points)

For the frame shown in Fig. 2 do the following:

1) Use the method of consistent deformations to calculate the reactions at A and D (remove support at D)
2) Calculate the max. normal stress at A
3) Calculate the max shear stress at A
4) If the modulus of elasticity were doubled would your results change? (yes or no with one sentence explanation)
5) If the beam cross section was increased (while the columns were kept the same) would your results change? (yes or no with one sentence explanation)

(Given \( E=210 \) GPa, \( v=0.25 \))

Problem 3 (20 points)

Repeat problem 2 but for the case where there are no loads applied on the frame but it is known that the inside temperature is +25 degrees Celsius and the outside is −5 degrees Celsius. Assume that during fabrication the temperature was +10 degrees Celsius. (coefficient of thermal expansion \( a=10^{-5} \) degrees^{-1})