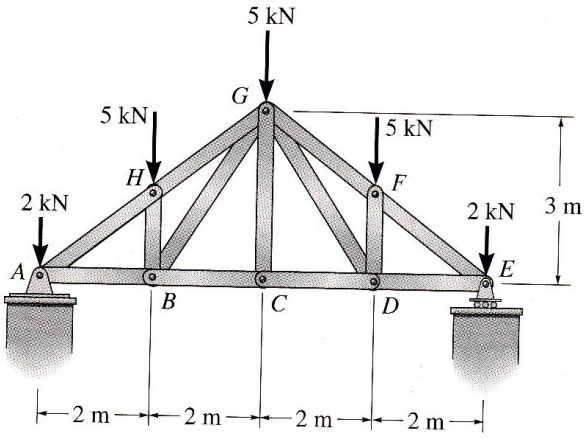
CE483
ADVANCED STRUCTURAL ANALYSIS
FALL SEMESTER 2014-2015
ASSIGNMENT #1 (DUE 4 NOV. 2014)

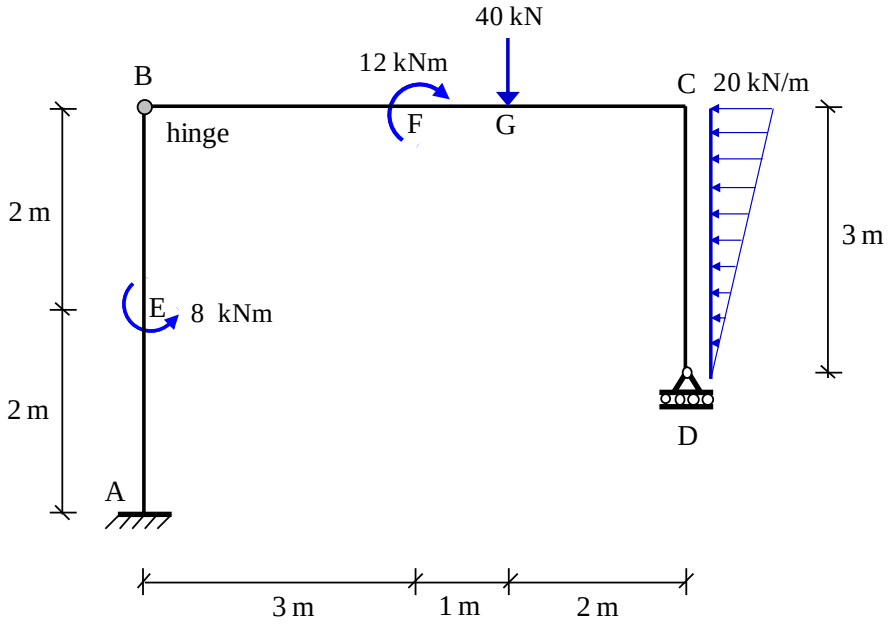
1. The truss system is subjected to the loading shown. Determine the vertical reaction at support E and the forces in members GF, GC and CD by using the *Method of Virtual Displacements.*

Do **not** use any statics! Release one constraint (only the required action) at a time.



2. For the given statically determinate frame, using the *Method of Virtual Displacements,* calculate
a) the vertical reaction at D
b) the support moment at A
c) the internal shear force at mid-length of member BF
d) the internal moment at mid-length of member BF

Note that there is an internal hinge at B. Do **not** use any statics! Release one constraint (only the required action) at a time.



3. A cubic displacement function of the form $v(x)=ax^3+bx+c$ is assumed for both the real and virtual displacement of the column shown.
a) Is this an admissible displacement function with respect to geometrical boundary conditions?
b) Determine the horizontal displacement at the top end of this cantilever (*i.e. @ x=4 m*) by the *Method of Virtual Displacements.*
c) Calculate the real horizontal displacement at the top end by any method of your choice. Compare the results of parts *(b)* and *(c)*. Discuss briefly.

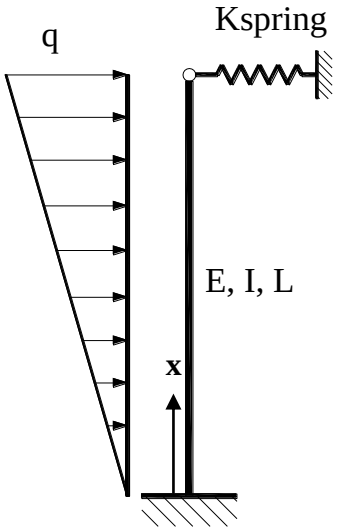
$K_{spring} = 25\ kN/m$

$L = 4\ m$

$q = 50\ kN/m$

$E = 40\ GPa$

$I = 5 \times 10^6\ mm^4$



4. By using the *Unit Dummy Displacement Method*, compute the bar forces in bars *oa* to *oh*, which are connected to a rigid circular frame with equal spacing, under vertical force $P=150\ kN$ acting at *o*. Radius of the frame is $R=4\ m$, and all bars have the same cross-sectional area $A=500\ mm^2$. The modulus of elasticity can be assumed as $E=2\times10^5\ MPa$.