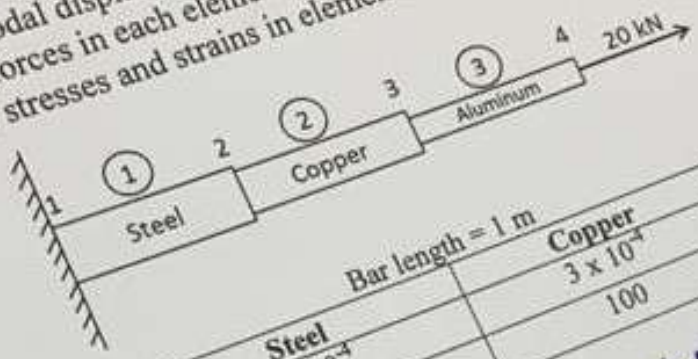
1- Put (√) for right and (X) for wrong for the following statements: (10)

√ or X	
	1- Surface film condition is used to define the lubrication of contacting surfaces.
	2- The density is not essential on simulation using implicit FE.
	3- On meshing materials with interfaces, elements cannot cross interfaces.
	4- Cells partition makes meshing more difficult.
	5- FE-simulation of a machining process is carried out by "implicit" FE-analysis.
	6- Axi-symmetric part is sketched by revolution.
	7- FE-simulation of machining processes is modeled by "explicit" FE-analysis.
	8- Finite volume method is used to simulate materials with solid volume.
	9- The minimum increment time should be higher than initial increment time.
	10- Elastic properties are not needed for the rigid bodies.

2- A- Using a graph show the effect of the element aspect ratio on the accuracy of the results (3)

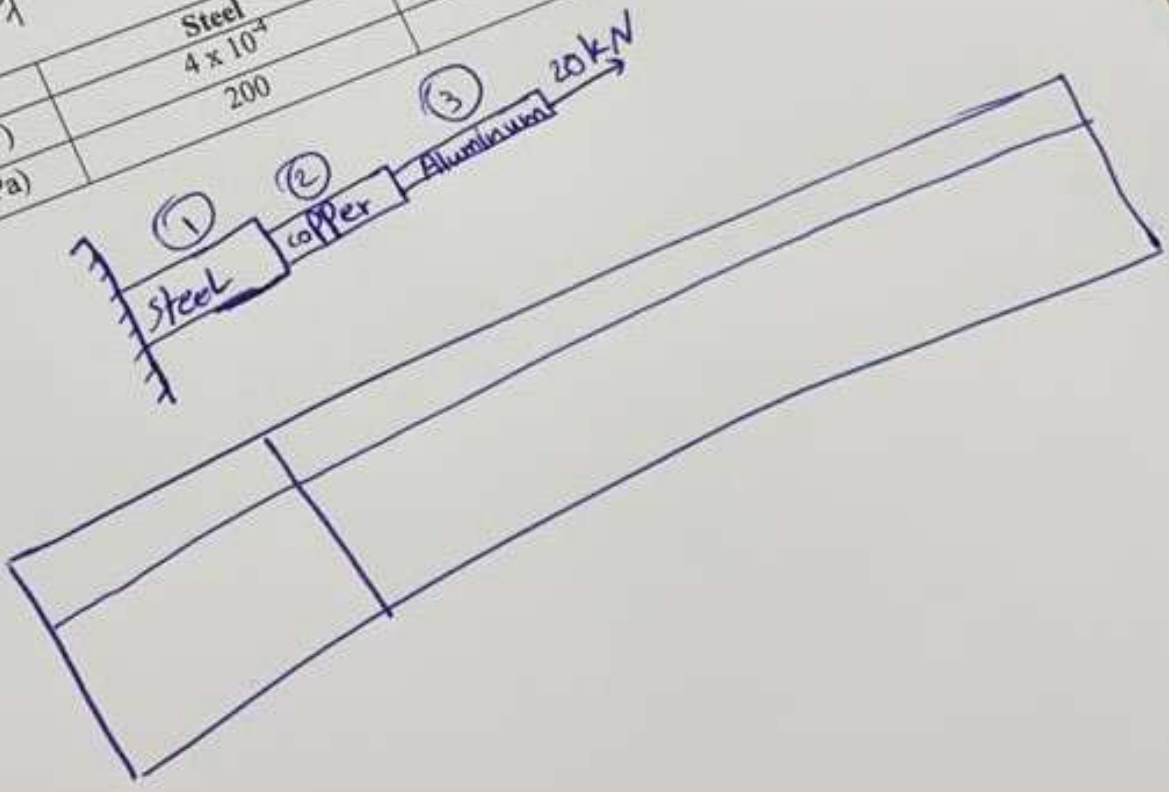
3- For the bar assemblage shown below, using the direct stiffness method find the following : (10)

a) The nodal displacements
b) The forces in each element and the reactions
c) The stresses and strains in elements 1 &2



Bar length = 1 m

	Steel	Copper	Aluminum
Area A (m^2)	4×10^{-4}	3×10^{-4}	2×10^{-4}
E (GPa)	200	100	70



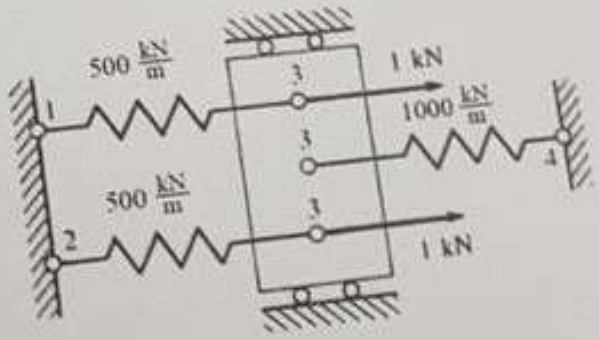
3- (a) For a simple spring, proof that the Element Stiffness Matrix is : (3)

$$[k] = \begin{bmatrix} k & -k \\ -k & k \end{bmatrix}$$

$$k = \begin{bmatrix} k & -k \\ -k & k \end{bmatrix} :$$

3-b. For the spring assemblage shown below, using the direct stiffness method find: (7)

a) The elemental stiffness matrices
b) The global stiffness matrix
c) Determine the nodal displacements,
d) The forces in each element and the reactions



500 k

For element ①

$$\frac{EA}{L_1}$$

a)

B- With the knowledge of ultimate tensile strength (σ_{UTS}) and the strain at fracture (ε_{Ft}) show suing the relation between the true stress (σ) and true strain (φ): $\sigma = k(\varphi)^n$ how to get the flow curve of this material? (3)

C - Describe the content of five (5) different files accompanying the FE-simulation method. (5)

File	Description