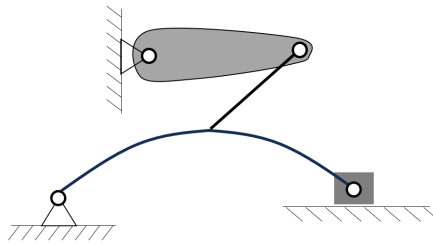


If you use AI-agents, include your prompts just like you would cite any references that you use.

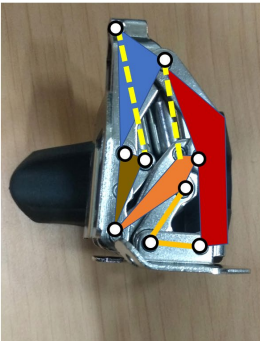
Question 1 (8 points)

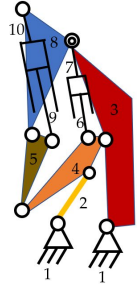
Analyze the mobility of the following mechanisms. That is, use the modified Grübler’s formula to determine the degree of freedom (DoF), and then interpret the DoF as possible actuations to get deterministic motion of the entire mechanism.



- a. This is mandatory for Groups A and B.
- b. **Group A**

See an example of a compact soft-close cabinet hinge mechanism. Now, consider the one shown on the right for your analysis. You can collect both from me.






$n = 10$
 $j_1 = 13$
 $DoF = 3(10 - 1) - 2(13) = 1$

 $j_1 = (6B + 2T + 2Q) / 2 = (12 + 6 + 8) / 2 = 13$

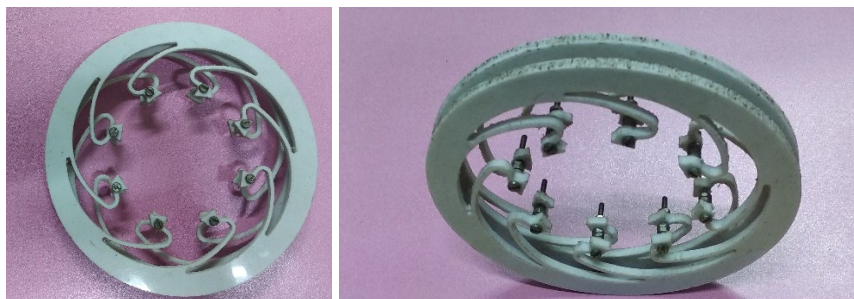
 B → Binary segment
 T → Ternary segment
 Q → Quaternary segment

1	2	3	4	5	6	7	8	9	10
B	B	Q	Q	T	B	B	T	B	B



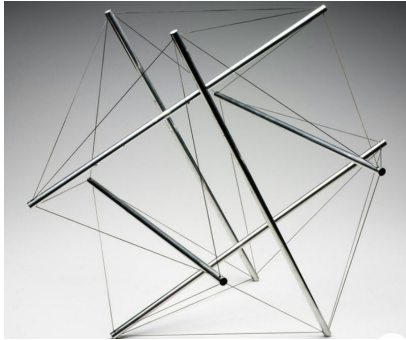
Group B

Consider the top and side views of a circumferentially actuated radial motion mechanism are shown below. You can collect it from me.

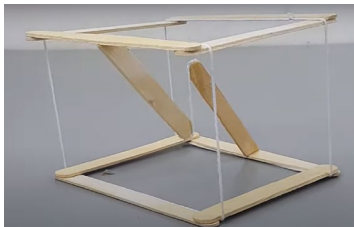


Question 2 (10 points)

Determine the states of self-stress and DoF for one of the tensegrity structures shown here using the 3D tensegrity Matlab code provided to you.



Group A; <https://de.pinterest.com/pin/664069907547176203/>



Group B; <https://www.youtube.com/watch?v=rAtR18o9RyM>

Question 3 (12 points)

Study one of the following papers and analyze the mobility of the mechanism presented in it. Number the segments and pairs (kinematic and elastic), calculate DoF and interpret them.

Group A

X. Gao, Y. Liu , S. Zhang , J. Deng , and J. Liu, "Development of a Novel Flexure-Based XY Platform Using Single Bending Hybrid Piezoelectric Actuator," *IEEE/ASME TRANSACTIONS ON MECHATRONICS*, VOL. 27, NO. 5, OCTOBER 2022

Group B

E. G. Merriam, J. E. Jones, S. P. Magleby, and L. L. Howell¹, "Monolithic 2 DOF fully compliant space pointing mechanism," *Mech. Sci.*, 4, 381–390, 2013. www.mech-sci.net/4/381/2013/; DOI:10.5194/ms-4-381-2013

What you need to submit:

1. Paper copy of your results clearly written down with all details
2. Graphs and pictures of your results with proper annotation (paper copy)
3. If you build any mechanism, you get 10 extra points.