Question 1. Points *A* and *B* are constrained to move in the plane on lines intersecting at angle θ, Figure 1. Describe precisely the fixed and moving centrodes realizing the planar motion of body *AB* starting from a configuration like the one showed in the figure. Provide a rigorous mathematical proof that the instantaneous center traces the curves described by you.
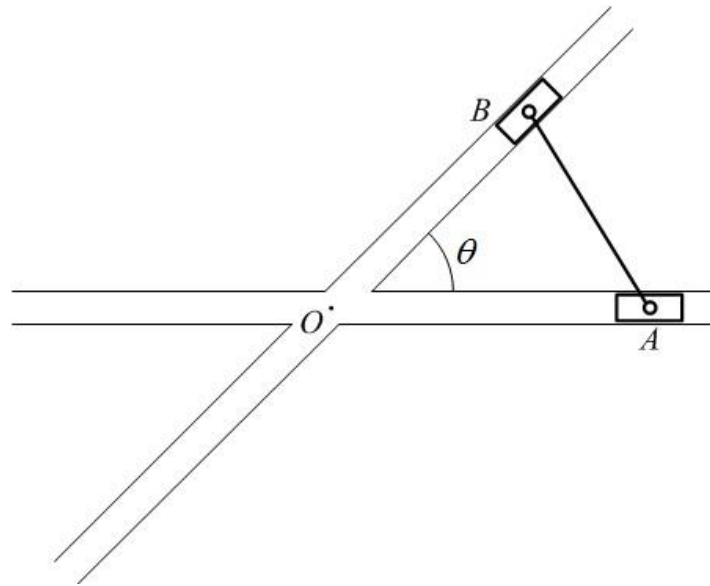
Figure 1.

Question 2. Points *A* and *B* are constrained to move in the plane on circles with centers O_A and O_B with $|O_AA| = |O_BB|$, $|O_AO_B| = |AB|$, and $|O_AA| > |AB|$, Figure 2. Describe precisely the fixed and moving centrodes realizing the planar motion of body *AB* starting from a configuration like the one showed in the figure. Provide a rigorous mathematical proof that the instantaneous center traces the curves described by you. Plot the centrodes for the link-length parameters using a table of value given below.

Question 3. In the conditions of Question 2, let points O_A and *A* be fixed, while points O_B and *B* move on circles. Describe precisely the fixed and moving centrodes realizing the planar motion of the body O_BB starting from a configuration like the one showed in the figure. Provide a rigorous mathematical proof that the instantaneous center traces the curves described by you. Make a drawing (or a computer simulation) illustrating and explaining the rolling of the centrodes. Plot the centrodes for the

link-length parameters using a table of value given below.
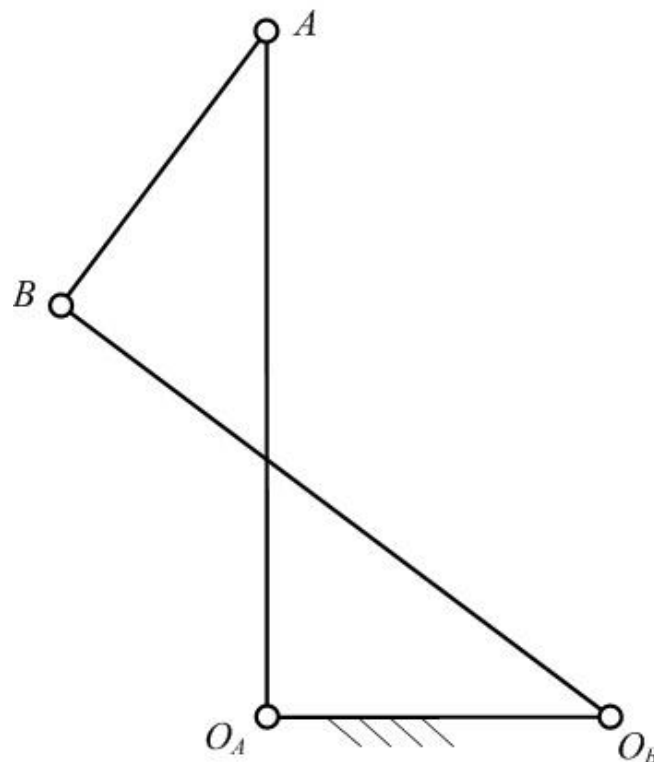
Figure 2.

Question 4 (bonus). For each of Questions 1, 2 and 3: Does the rolling of the identified centrodes yield *all* possible configurations of the moving body allowed by the linkage? Prove your answer.

Hint. In all cases, the centrodes are relatively simple, familiar curves. The proofs required in Questions 1-3 can be made using simple planar geometry.

Note. You can get up to 100% of the mark for this homework by answering the first there questions, and up to 110% by answering all four.
Simulations can be performed in Matlab/Mathematica/Maple or CAD.
For **Question 2 and 3**,
$$|AB| = l_a$$
The value of l_a is given by first digit of your student ID/Matricola.
$$|OA_A| = l_b$$
$$k = 0.1 + (0.012)n$$
$$l_b = 1/k$$
Value of *n* is given below:

Nome	Cognome	n
Amrita	Suresh	1
Davide	Lanza	2
Ravi Kiran	Aggadi	3
Sai Santosh	Narra	4
Vignesh	Durai	5
Astha	Gupta	6
Ariel	Gjaci	7
Mugisha	Stanley	8