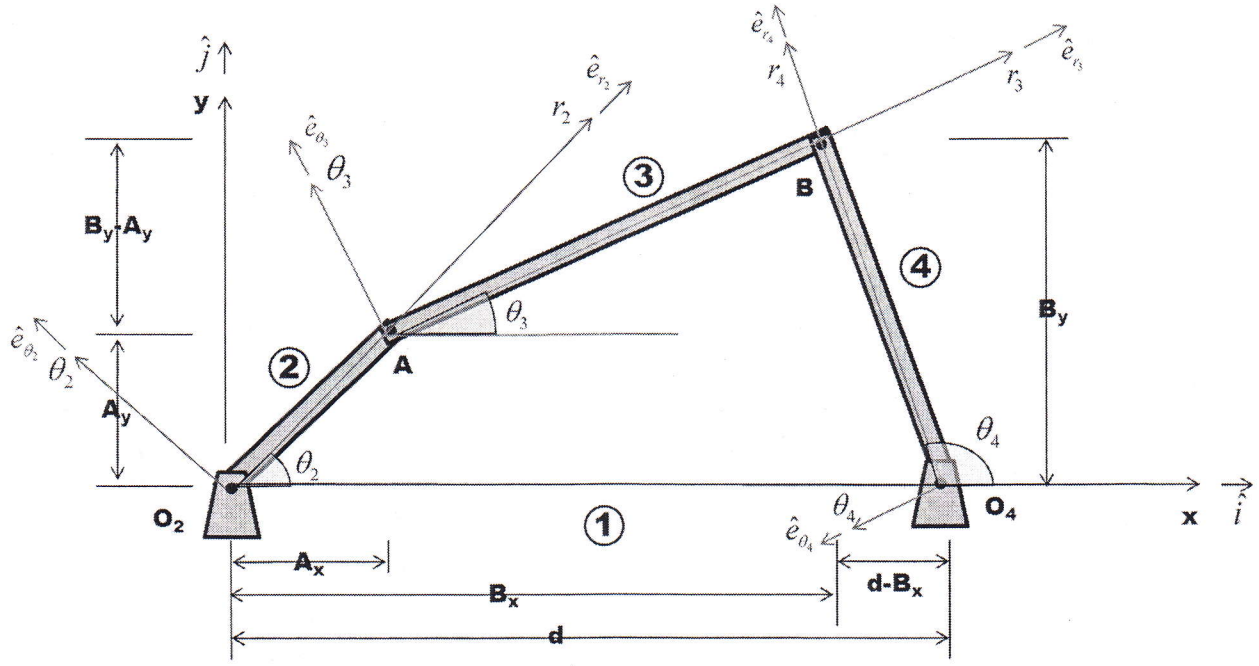
NAME: SOLUTION

PROBLEM 1 (20 pts): The standard 4-Bar configuration is shown in the figure below. The table contains the critical dimensions of the mechanism.

Link 1	Link 2	Link 3	Link 4	θ_2
2m	1m	3m	2.5m	45°
g	s	l	p	



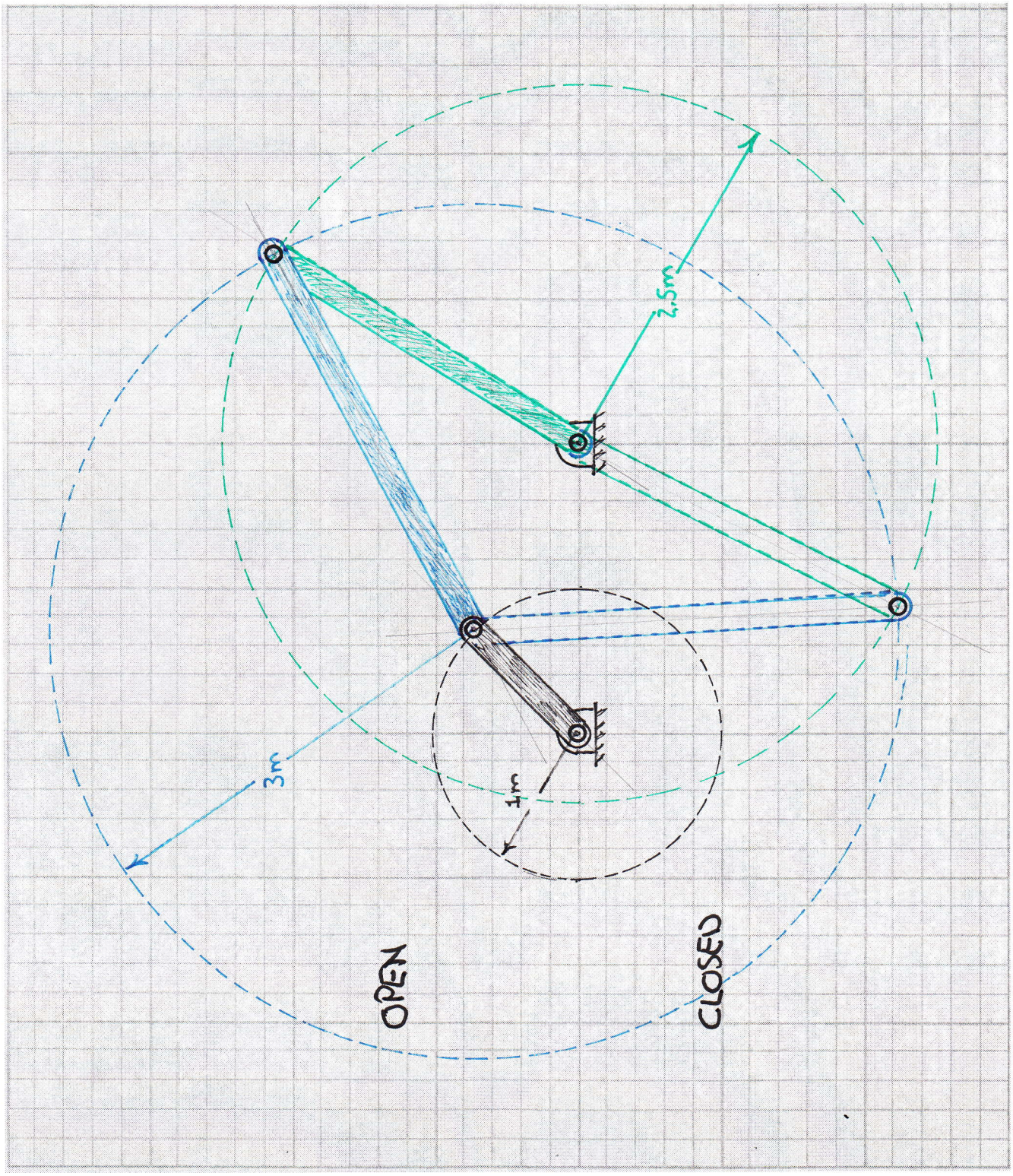
1a. Does the 4-Bar mechanism in this configuration meet the Grashof criterion?

$s + l \leq g + p$

$1m + 3m \leq 2m + 2.5m$

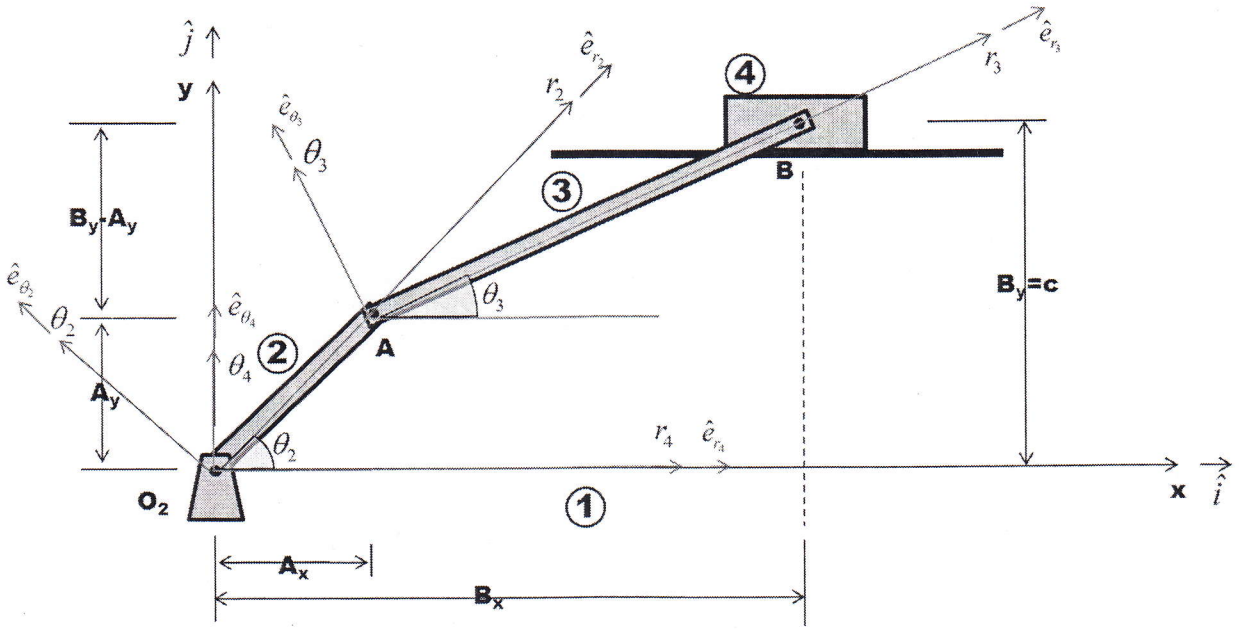
$4m \leq 4.5m$ ✓ GRASHOF DEVICE

1a. Draw this 4-Bar mechanism in the open and crossed configurations below?



PROBLEM 2 (20 pts): The standard Slider Crank configuration is shown in the figure below. The table contains the critical dimensions of the mechanism.

Link 2	Link 3	Offset	θ_2
2m	6m	-3m	60



2a. Does this configuration of the mechanism allow Link 2 to make a 360° rotation about O_2 while keeping the mechanism connected? Explain.

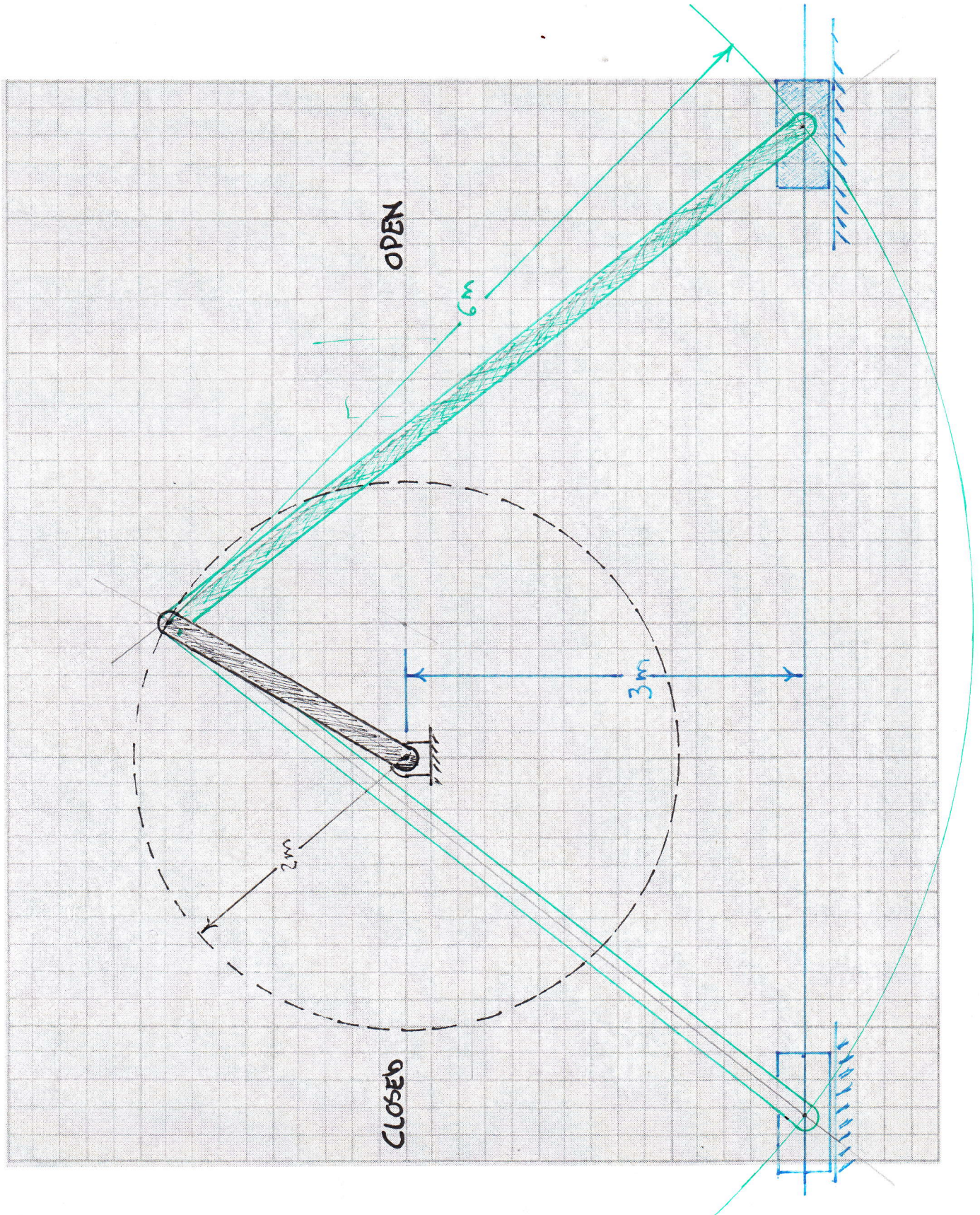
THE WORST CASE WOULD BE THE DRIVE LINK PERPENDICULAR TO THE SLIDE AXIS WITH POINT A AT THE POSITION FURTHEST FROM THE SLIDE AXIS. IN THIS POSITION

$$|l_3 - l_2| > |c|$$

$$|6m - 2m| > |-3m|$$

$$4m > 3m \quad ✓$$

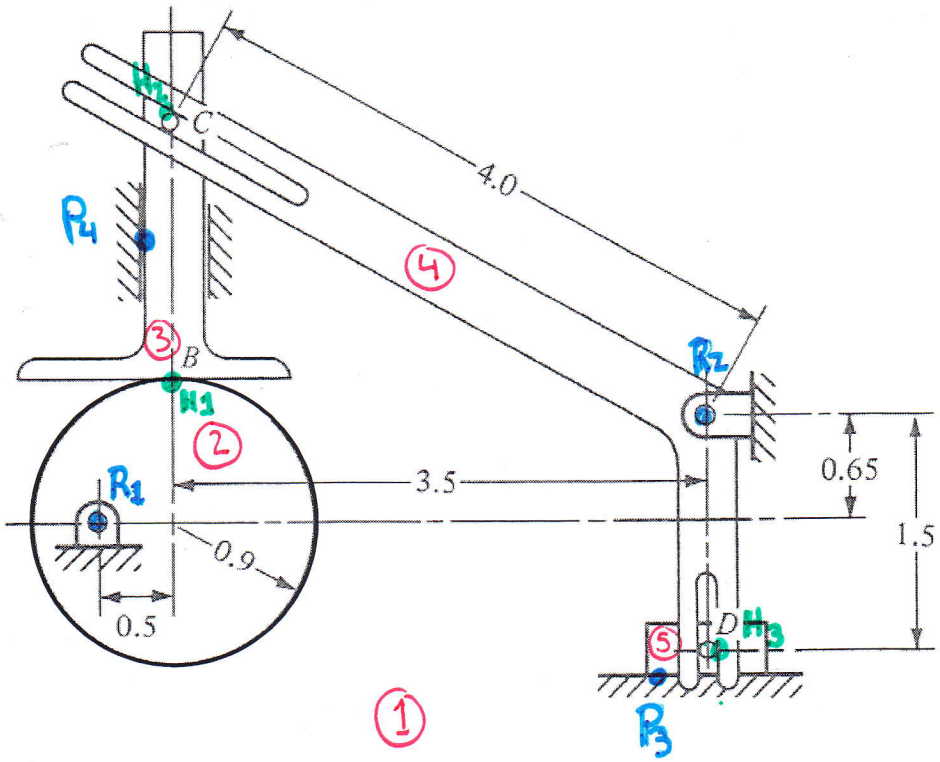
2b. Draw this slider crank mechanism in the open and crossed configurations below?



PROBLEM 3 (20 pts): For each of the following mechanisms:

a. Number each link in the mechanism. (CIRCLED IN RED)
b. Number each joint (kinematic pair) and identify its order (full or half). (FULL, P OR R IN BLUE) (HALF, H IN GREEN)
c. Calculate the mobility of the mechanism and identify any Passive (idle) degrees of freedom or redundant constraints.

3a.

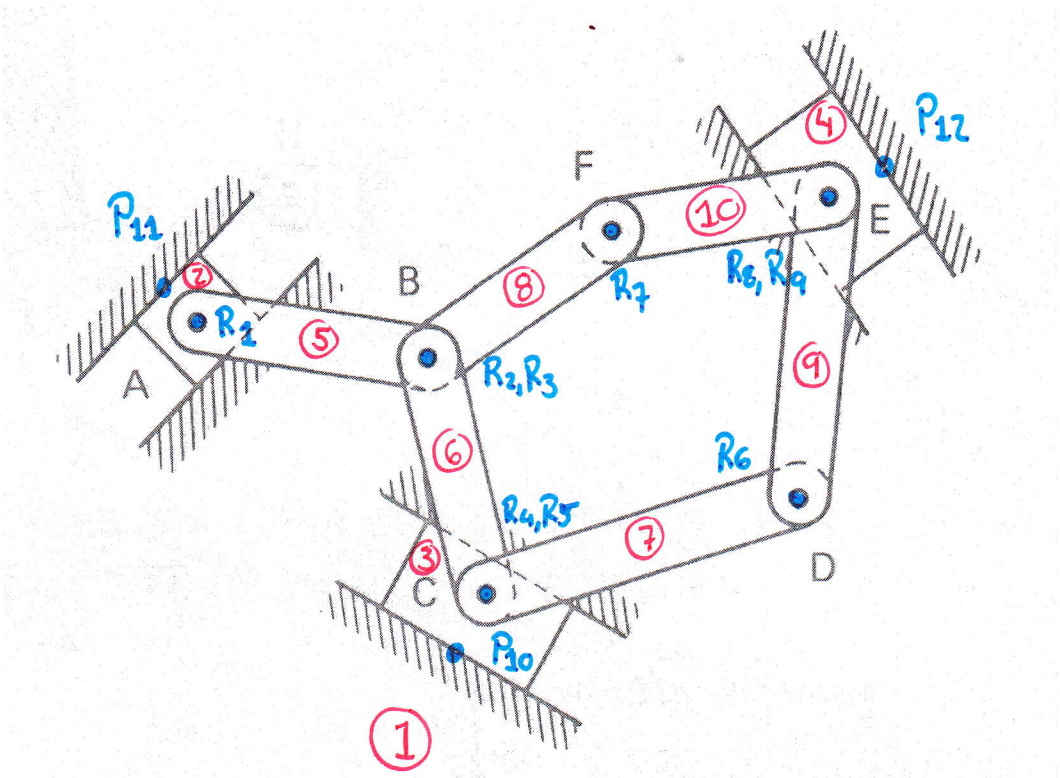


$$M = 3(5-1) - 2\cdot(4) - 3$$

$$= 3(4) - 8 - 3$$

$$= 12 - 11 = \boxed{1}$$

3b.

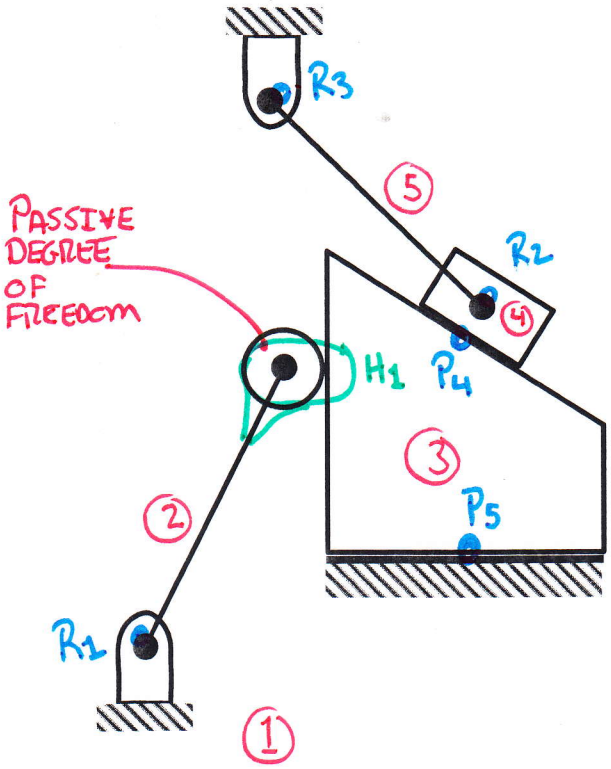


$$M = 3(10-1) - 2(12)$$

$$= 3(9) - 2(12)$$

$$= 27 - 24 = \boxed{3}$$

3b.



$$M = 3(5-1) - 2(5) - 1$$

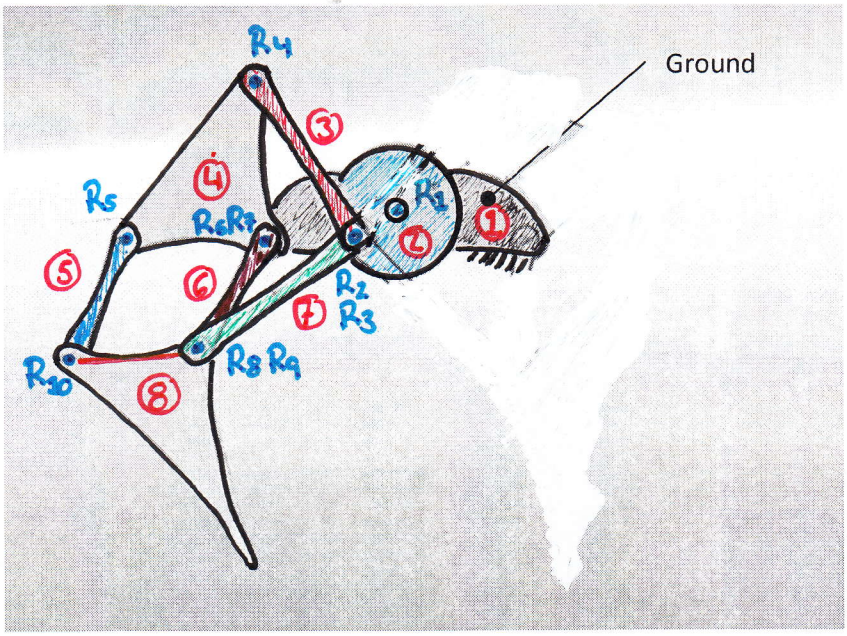
$$= 3(4) - 2(5) - 1$$

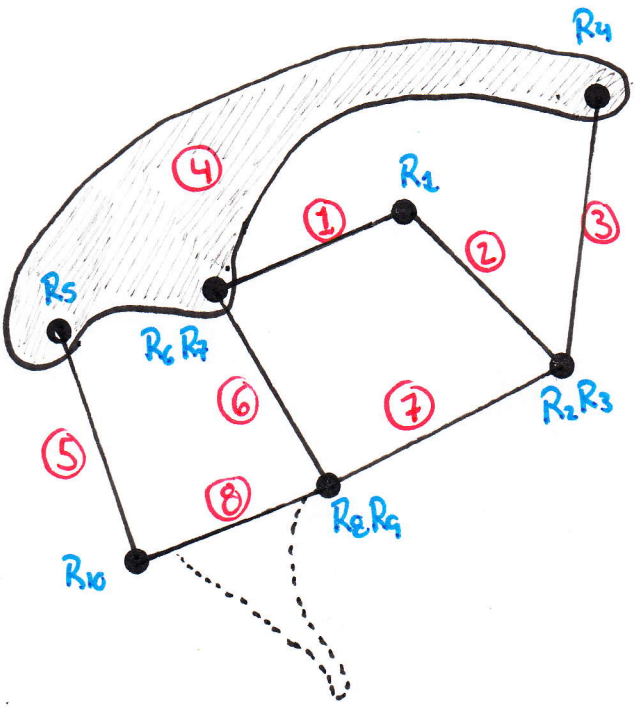
$$= 12 - 10 - 1$$

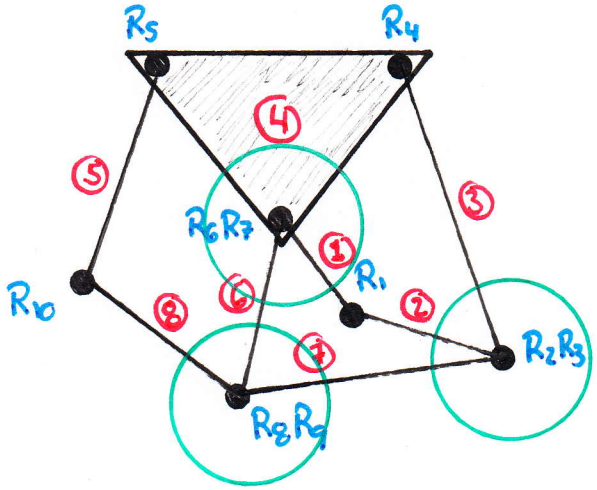
$$= \boxed{1}$$

PROBLEM 4 (20 pts): For the following mechanisms, draw the associated isomer that would be found in our catalog of isomers.

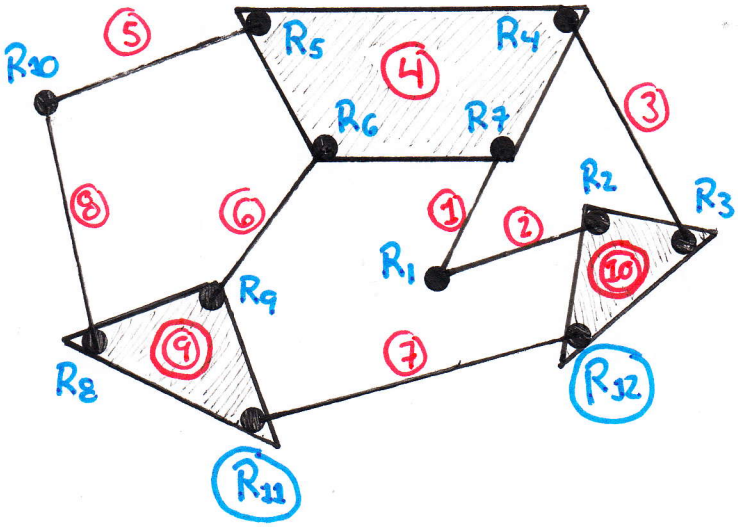
4a.





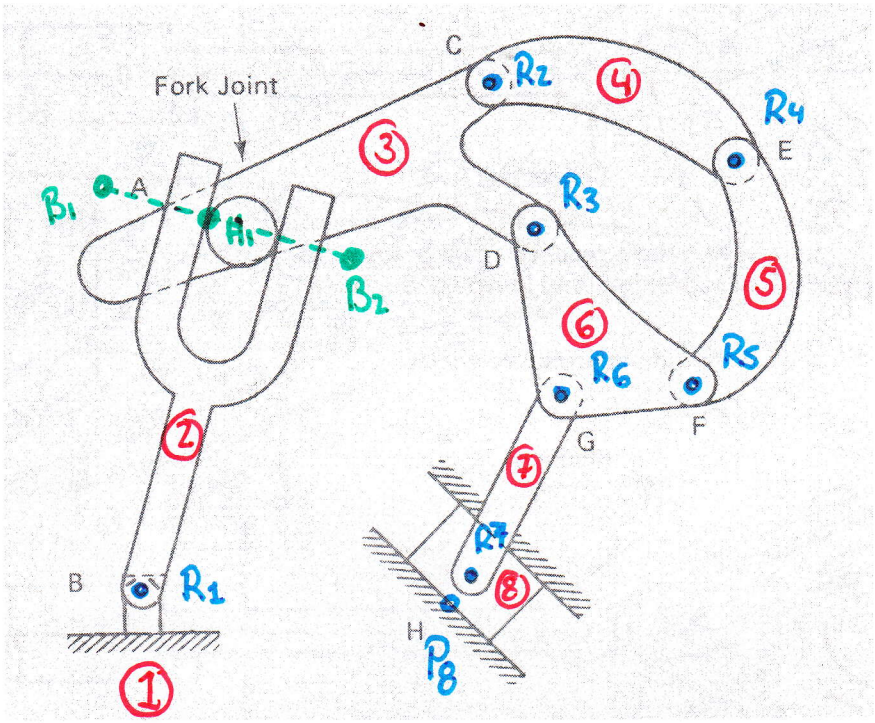


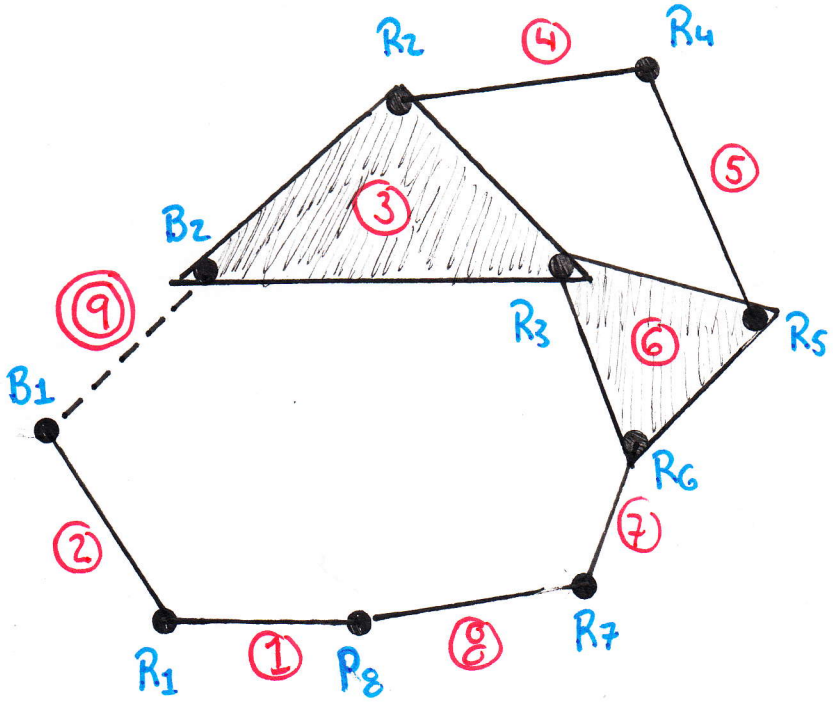
THREE JOINTS NEED TO BE EXPANDED



LINKS (9) & (10) WERE ADDED ALONG WITH JOINTS R_{11} & R_{12}

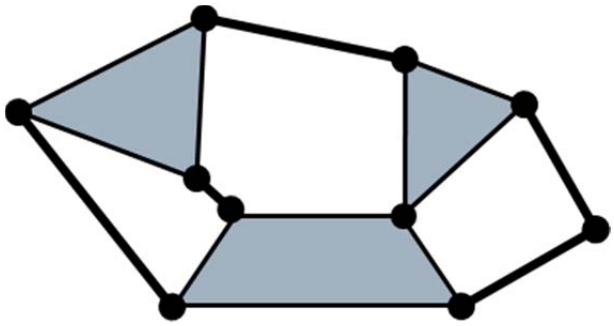
4a.





LINK (9) WAS ADDED TO REPRESENT THE HALF JOINT

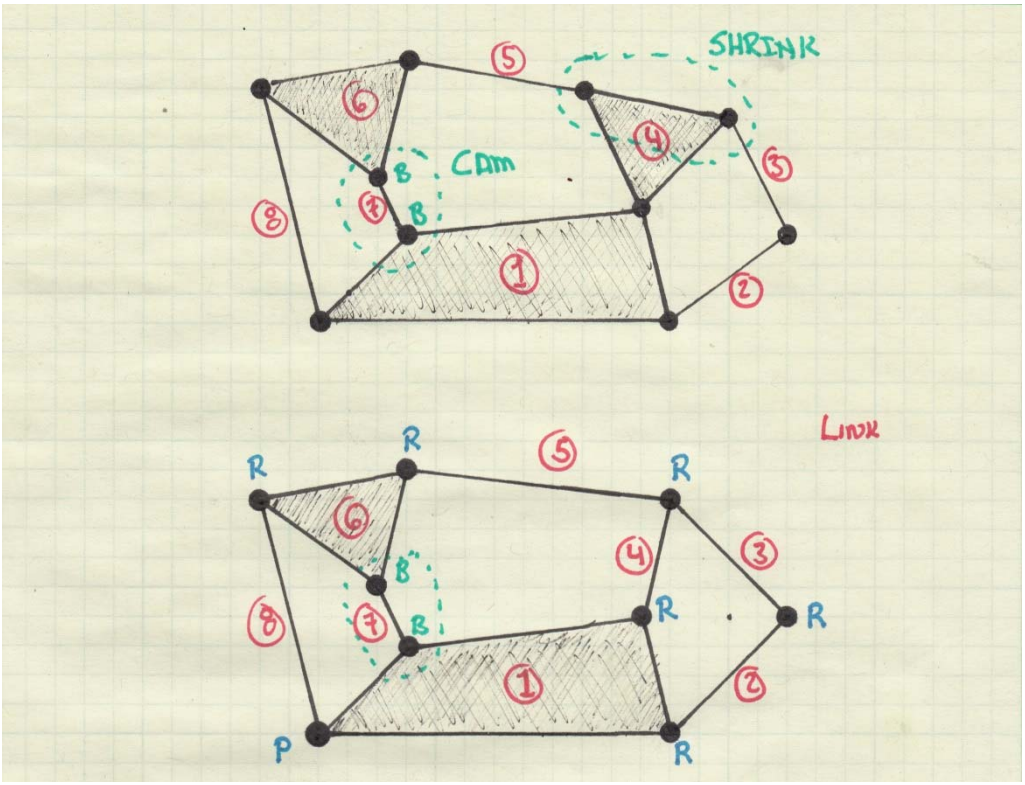
PROBLEM 4 (20 pts): For the M=+1 isomer shown, synthesize a mechanism that has a drive link that completely rotates (attached to a motor) and a slider output. The mechanism must contain the following components:

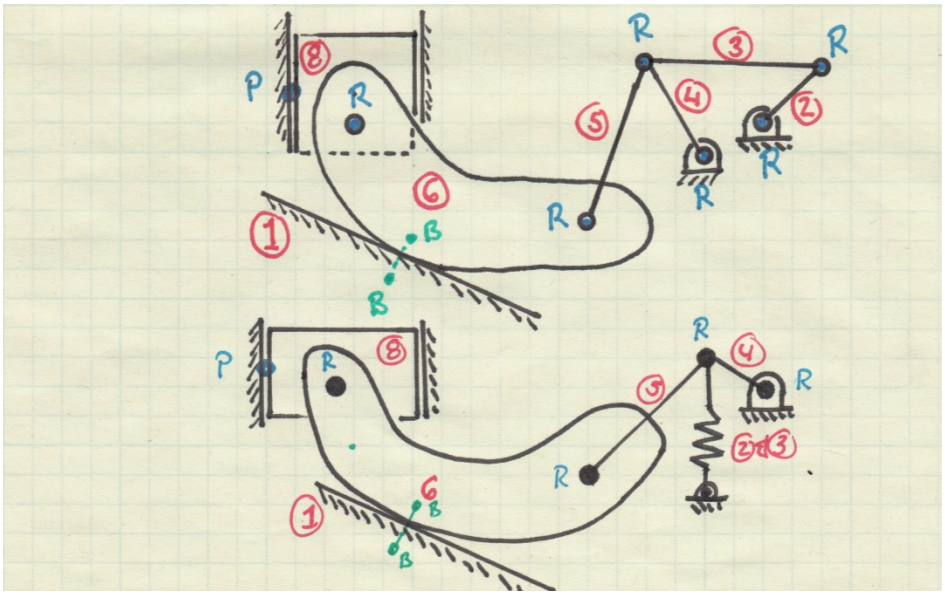


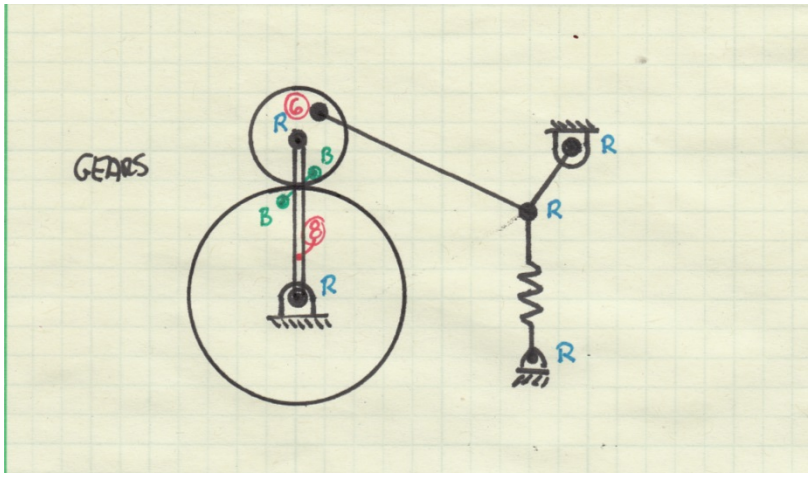
c. Cam (half joint slider)
d. Higher Order Joint

Bonus points will be awarded for each of the following components that are included:

d. Spring
e. Gear
f. Belt or Pulley




P
R
8
R
R
3
R
5
4
2
R
R
6
1
B
B
R
P
R
8
R
4
R
3
2
3
R
6
B
1
B


GEARS
6
R
B
B
8
R
R
R
R

NAME: _____

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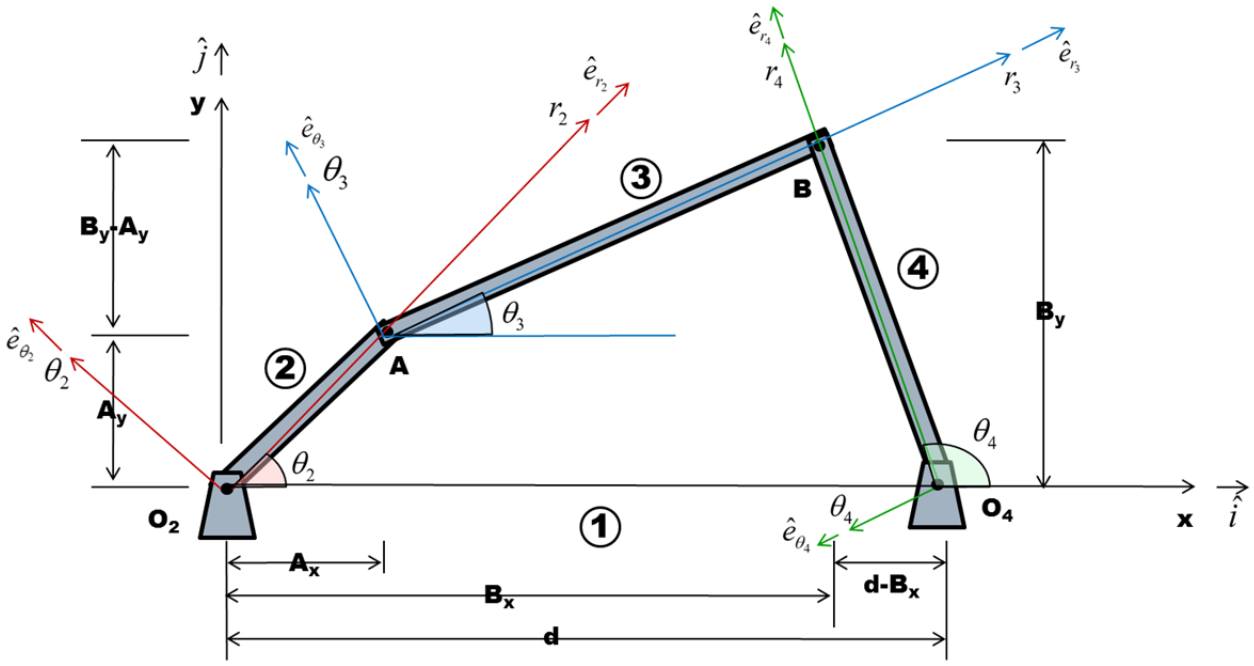
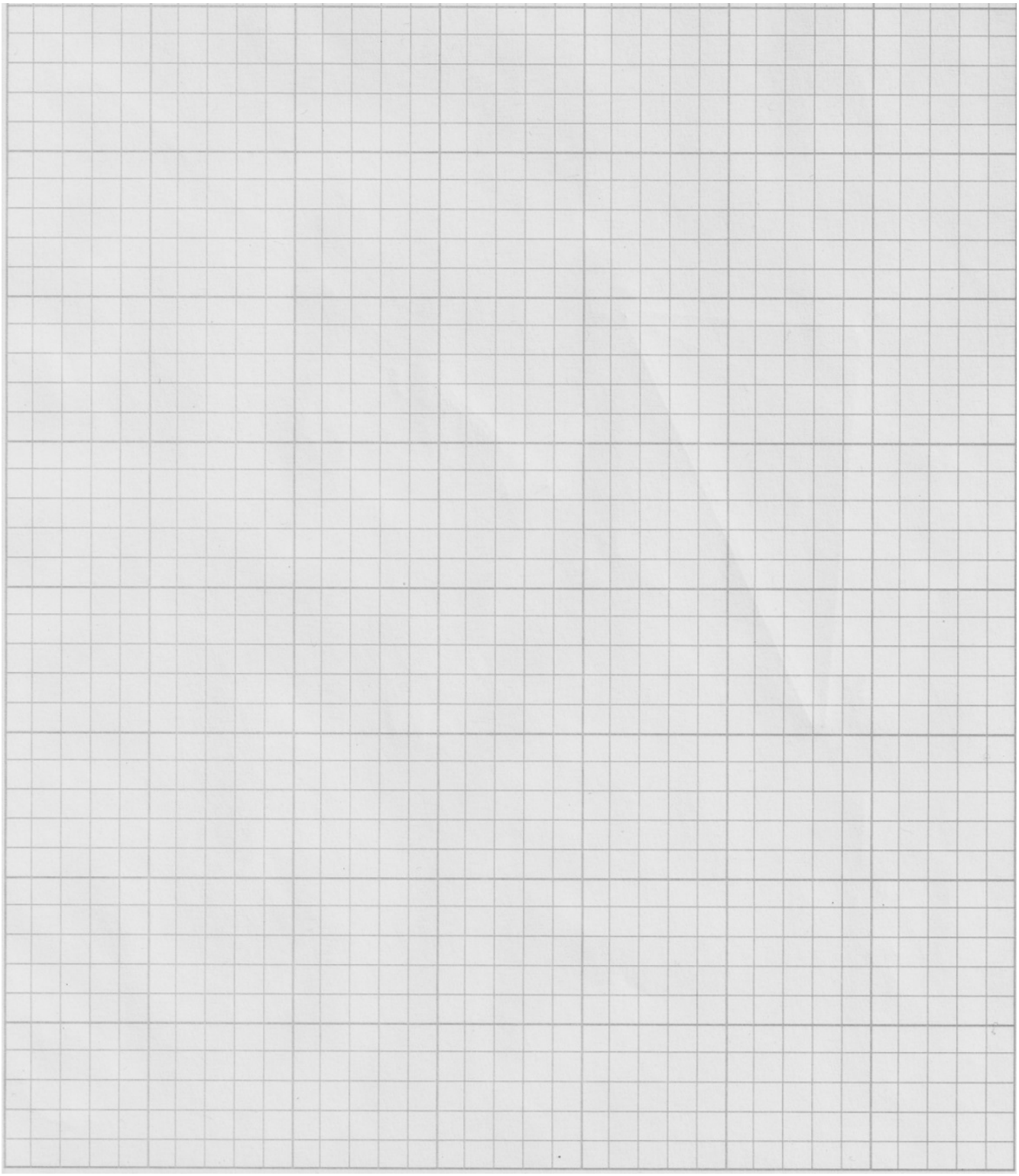


1a. Does the 4-Bar mechanism in this configuration meet the Grashof criterion?

1a. Draw this 4-Bar mechanism in the open and crossed configurations below?



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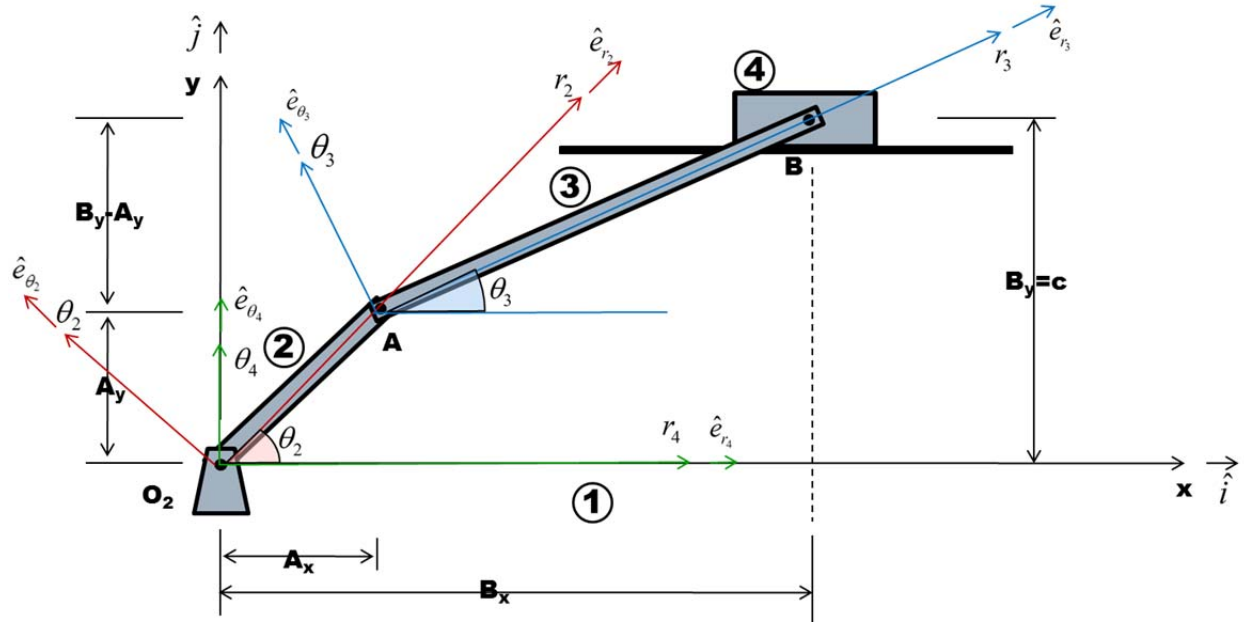
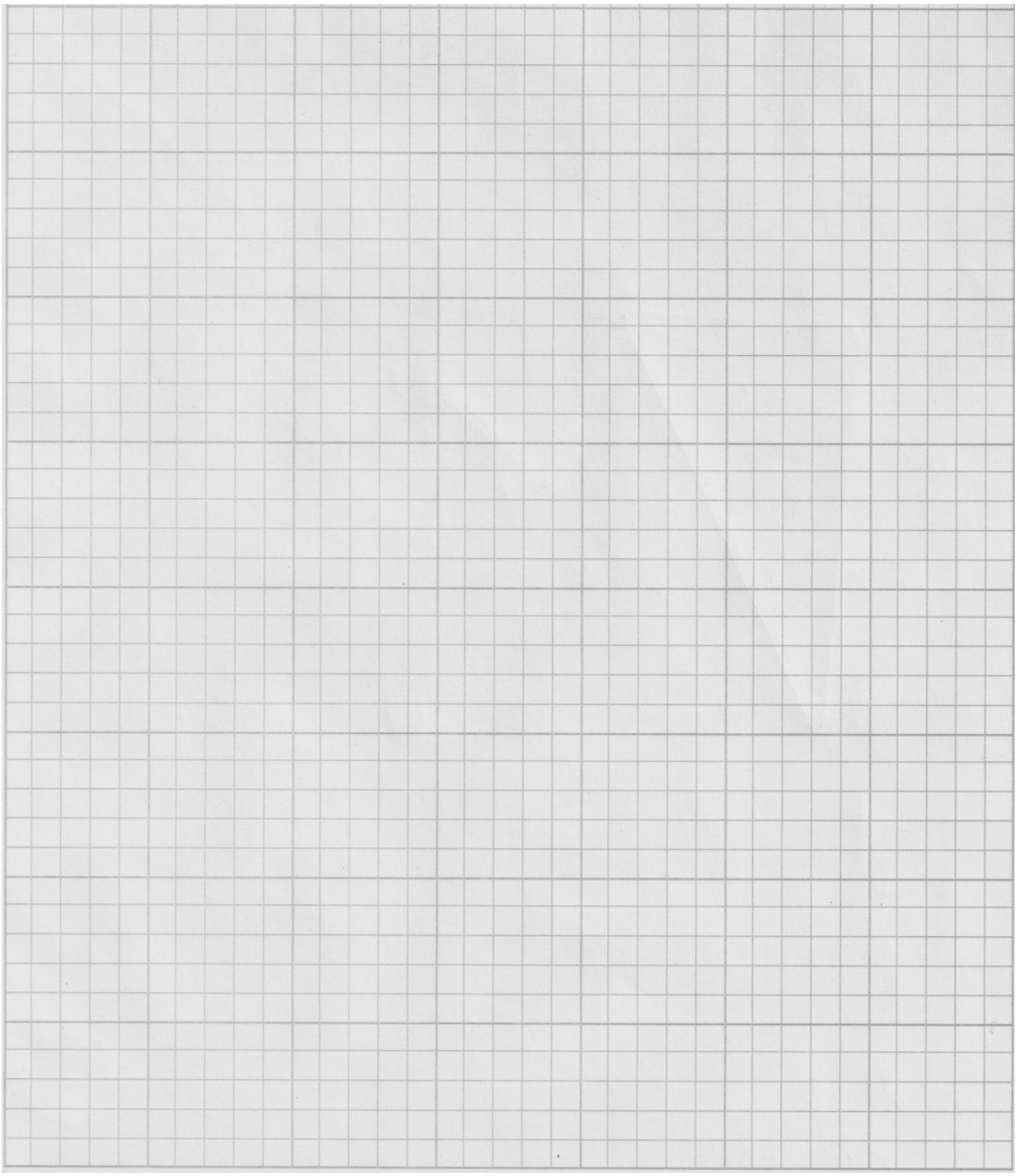


2a. Does this configuration of the mechanism allow Link 2 to make a 360° rotation about O_2 while keeping the mechanism connected? Explain.

2b. Draw this slider crank mechanism in the open and crossed configurations below?



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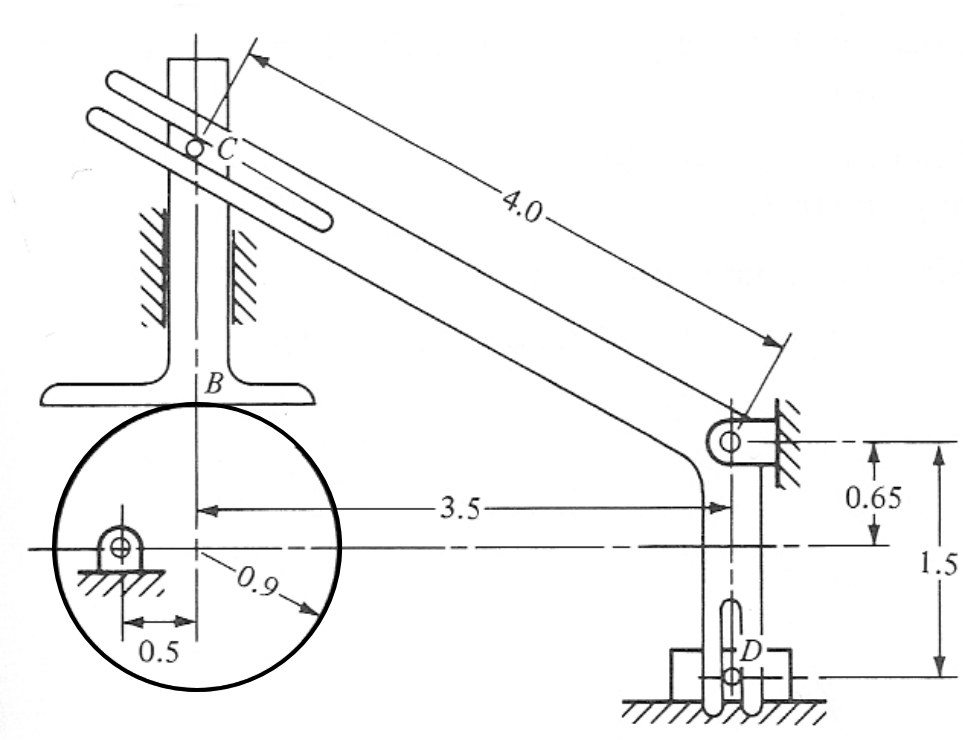
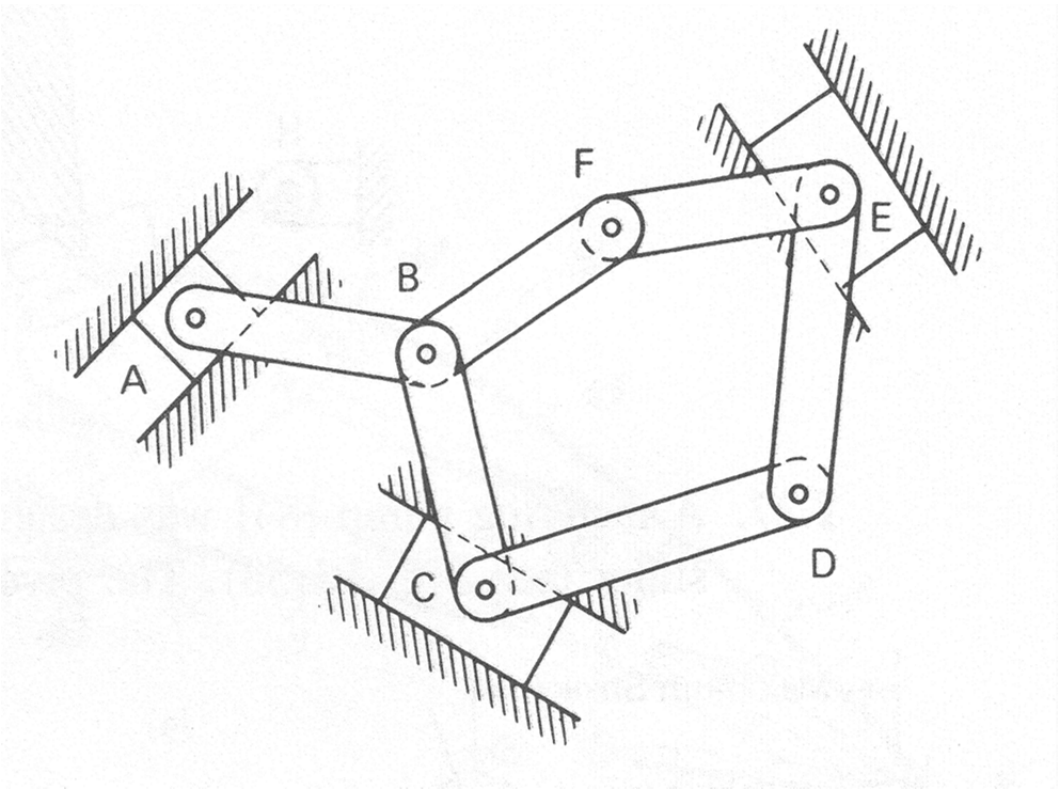
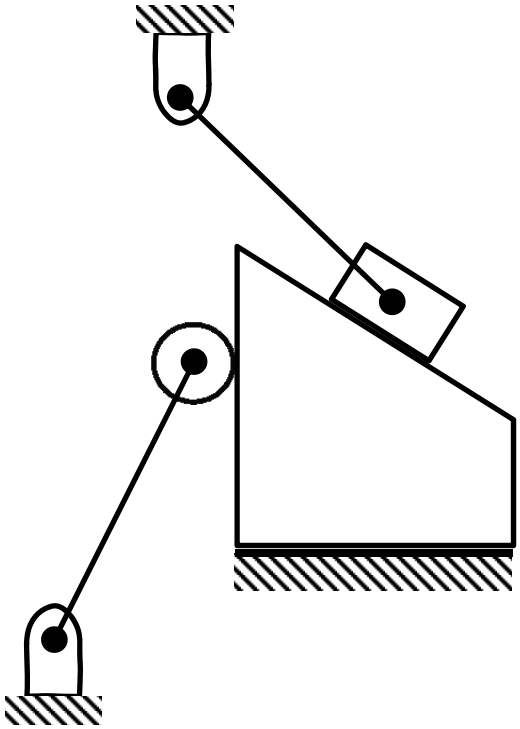


3b.



3b.



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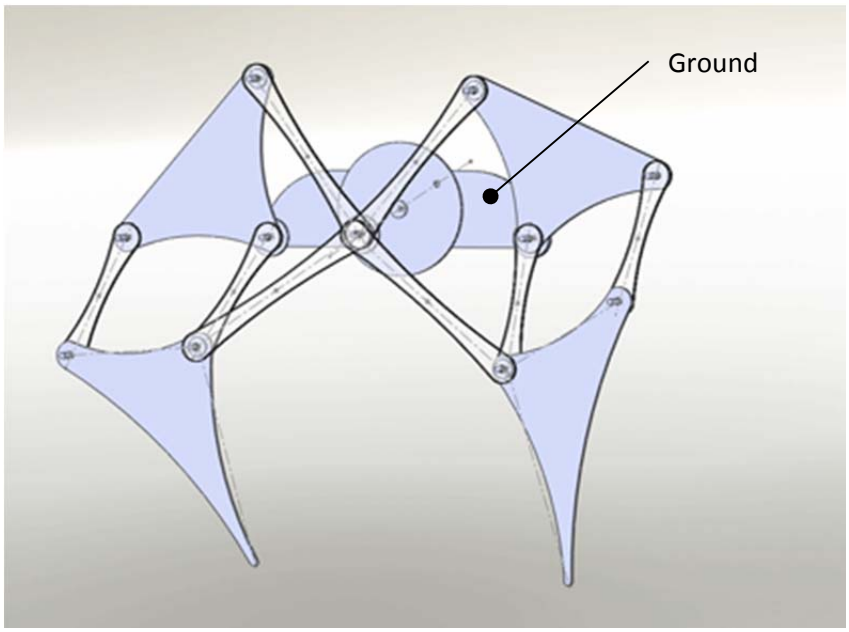

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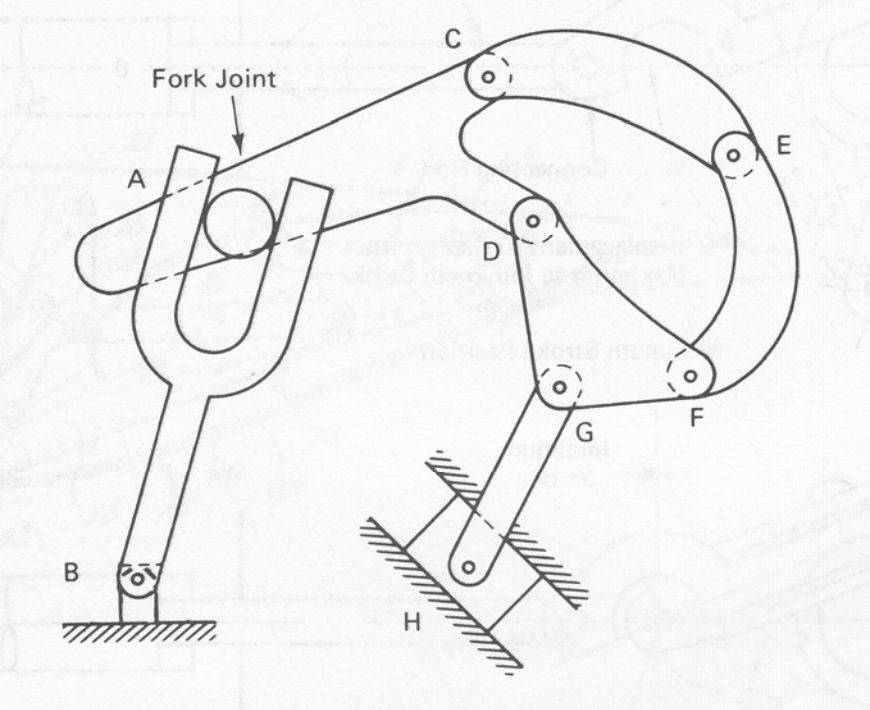

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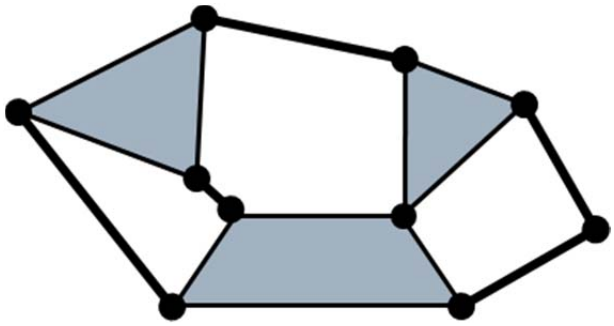

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