

HW 1 Planar Mechanisms - Part 1

● Graded

Student

Shihong Yuan

Total Points

24.8 / 25 pts

Question 1

Problem 1

11.8 / 12 pts

1.1 a. Trebuchet

3.8 / 4 pts

– 0 pts Correct

– 0.5 pts Incorrect joint type

✓ – 0.2 pts Incorrect number of links or joints

– 1 pt No mention of joint types

– 0.2 pts Incomplete link or joint labeling

– 0.2 pts Incorrect number of links

💬 The only part of the mechanism we focus on is the lever arm and counterweight, not the frame. The frame links are considered a ground link, which leaves three links and two joints.

1.2 a. Oil Well

4 / 4 pts

✓ – 0 pts Correct

– 0.2 pts Incorrect number of links or joints

– 1 pt Incomplete

– 1 pt No mention of joint types.

– 0.2 pts Incomplete link or joint labeling

– 0.5 pts Incorrect joint type

1.3 b. Greubler trebuchet

2 / 2 pts

✓ – 0 pts Correct

– 1 pt No Justification

– 0.5 pts Incorrect DOF

– 2 pts missing

– 0.2 pts specify links/joints in justification

1.4 b. Greubler Oil

2 / 2 pts

✓ – 0 pts Correct

– 2 pts missing

– 1 pt No justification

– 0.5 pts wrong DOF

– 0.2 pts specify links/joints in justification

Question 2

Problem 2

13 / 13 pts

2.1 (no title) 2 / 2 pts

✓ - 0 pts Correct

- 0.5 pts Incorrect number of independent coordinates.

- 1 pt missing

2.2 (no title) 3 / 3 pts

✓ - 0 pts Correct

- 0.25 pts incorrect drawing

- 0.25 pts Incorrect DOF

2.3 (no title) 4 / 4 pts

✓ - 0 pts Correct

- 0.1 pts Partial correct response for Partt II

- 0.1 pts Partial correct response for Partt I

- 1 pt Half correct

- 2 pts Incorrect

- 5 pts No answer

2.4 (no title) 2 / 2 pts

✓ - 0 pts Correct

- 0.2 pts Partially Correct

- 2 pts missing

2.5 (no title) 2 / 2 pts

✓ - 0 pts Correct

- 0.2 pts Missing diagram

- 0.2 pts Did not name rule or joint types.

- 0.2 pts into snow

Question 3

Penalties

0 / 0 pts

✓ - 0 pts No penalties

- 6.2 pts Pages not correctly assigned in Gradescope

- 5 pts < 1 day late

- 10 pts 1-2 days late

- 15 pts 2-3 days late

Questions assigned to the following page: [1.2](#), [1.3](#), [1.4](#), and [1.1](#)

NAME: Shihong Yuan UIN: syuan19 665249431**Deadlines and submission information listed on Canvas****Total Points: 25 Points****Problem 1 [12 pts]: Identifying a planar mechanism**

- a. Make a kinematic sketch (a.k.a. kinematic diagram) of the mechanisms in the links listed below. Label all links and joints using the formalism developed in class. Indicate the grounded link, and whether each joint is prismatic (sliding) or rotational. (4 pts each)

□ link

○ full joint

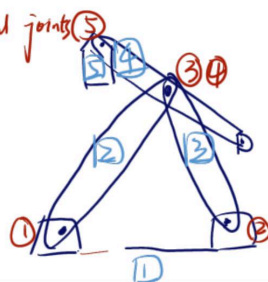
Trebuchet Mechanism:

<https://www.youtube.com/watch?v=r1BGNkYDJuI>

Hint: For the purposed of this question, we can ignore the sling and projectile

□ is grounded link

All the joints are rotational joints



$$DOF = 3 \times (5-1) - 2 \times 5 = 0$$

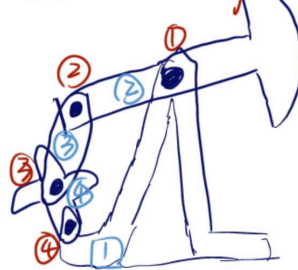
$$= 2$$

Because the box [5] can rotate freely
the link [4] can rotate freely.
So there should be two freedoms

Oil Well Drilling: <https://www.youtube.com/shorts/KmBP2jRFw7I> Hint, treat the samson post as ground and neglect the cable on the right side of the machine.

□ is ground link.

All the joints are rotational joints.



$$DOF = 3 \times (4-1) - 2 \times 4 = 0$$

$$= 1$$

Because when one of the body move,
whole body move, so it make sense
that there is only one freedom.

- b. Use Gruebler's equation to calculate the Degrees of Freedom of each mechanism. Justify why your answer makes sense. Add the calculation to the Box. (2 pts each)

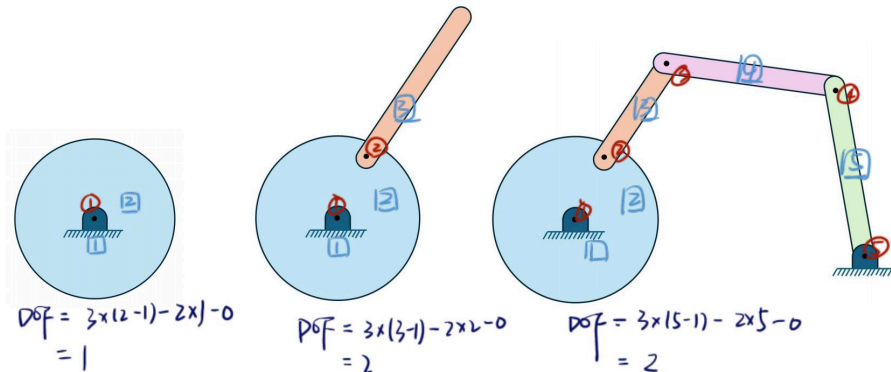
Questions assigned to the following page: [2.1](#), [2.2](#), [2.3](#), [2.4](#), and [2.5](#)

Problem 2 [13 pts]: Understanding degrees of Freedom

- a) How many independent coordinates are needed to define any point in a plane (2D space)? (2 pt)

2. (x, y)

- b) Calculate the degrees of freedom for each of the three planar linkages below. Show work (3 pt)



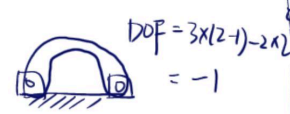
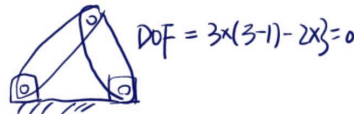
- c) (i) What is a degree of freedom? Explain your answer using simple language, as if your audience was a five-year-old child (2 pt)

Degree of freedom is when you move one object, how many parts you can move.

- (ii) Describe what it means for a linkage to have more degrees of freedom than the dimension of the space it lies in. (2 pt)

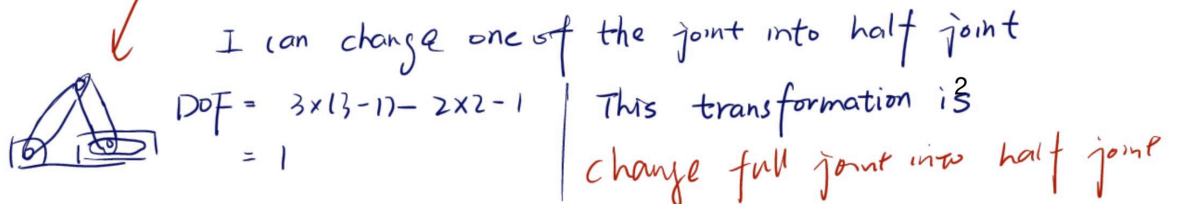
Because three dimensions can have 6 degrees. it is ok to have degree > dim, and it means that though the final destination (the end of the linkage) maybe the same,

- d) Using a kinematic diagram, give an example of a linkage that would have 0 DOF. Give an example of a linkage with -1 DOF. (2 pt)



the middle parts can change because of the extra degrees

- e) How would you turn a 0 DOF linkage into a 1 DOF linkage? Draw an example with a specific linkage. Identify what transformation rule corresponds with your solution. (2 pt)



No questions assigned to the following page.

Select one of the following options:

- a) My answer was created by a Gen AI algorithm, and I have not modified it
- b) My answer was created by a Gen AI algorithm, and I have made some minor changes.
- c) My answer was created by a Gen AI algorithm, and I have made major changes.
- ☒ d) My answer was created solely by myself.
- e) If I used Gen AI, I used ____ (name of program).