

Homework 3: Graphical Linkage Synthesis Part 1

● Graded

Student

Shihong Yuan

Total Points

34 / 35 pts

Question 1

P1

9 / 10 pts

1.1 (no title)

Resolved 5 / 6 pts

– 0 pts Correct

– 6 pts Incorrect

✓ – 1 pt no dimension labels

– 0.75 pts Fully define final position

– 1 pt Incorrect dyad crank length

– 0.5 pts Drawing not to scale

– 2 pts no steps

– 1 pt incomplete steps

– 2 pts No answer

– 0.5 pts Missing perpendicular bisector from b1b2

– 0 pts Click here to replace this description.

🔄 Regrade Request

Submitted on: Nov 13

I mention the length of S L P Q in the Question 1.4

U didn't mention the diameter and distance from b1b2

Reviewed on: Nov 13

1.2 (no title)

2 / 2 pts

✓ – 0 pts Correct

– 1 pt Incorrect DOF

– 1 pt Incorrect steps

– 2 pts Incorrect

– 4 pts Missing

1.3 (no title)

1 / 1 pt

✓ – 0 pts Correct

– 0.2 pts Incorrect link type

1.4 (no title)

1 / 1 pt

✓ – 0 pts Correct

Question 2

P2

25 / 25 pts

2.1 (no title)

10 / 10 pts

✓ - 0 pts Correct

- 1 pt Mark rotopole position
- 2 pts Wrong rotopole postioning.
- 10 pts incomplete
- 1 pt include bisecting line
- 1 pt Final design for rotopole needed.
- 2 pts missing steps. Missing step list.
- 1 pt Wrong Final Design

2.2 (no title)

10 / 10 pts

✓ - 0 pts Correct

- 2 pts Partially Correct
- 3 pts Incorrect
- 1 pt Draw bisecting lines
- 2 pts Distinguish four bar and number.
- 1 pt no steps
- 1 pt 2 ground links
- 1 pt drawing through D1 and D2 missing
- 10 pts missing
- 1 pt Mark position of ground in drawing.
- 1 pt drawing through c1 and c2 missing
- 2 pts Final design of four bar missing
- 2 pts Missing steps
- 1 pt Didn't use the given grid on the homework

2.3 (no title)

5 / 5 pts

✓ - 0 pts Correct

- 0.5 pts ****Minor error with drawing
- 1 pt Partially correct
- 1 pt Input/output gears swapped
- 2 pts Middle gears incorrect
- 4 pts Incorrect
- 0.5 pts Small error with rotopole position
- 1 pt **Missing rotopole**
- 5 pts Wrong work
- 5 pts Missing
- 1 pt Missing written steps

Question 3

AI & Penalties (No page assigned)

0 / 0 pts

3.1 (no title)

0 / 0 pts

✓ - 0 pts Correct

- 3 pts Pages Not Assigned
- 5 pts Less than 1 day late
- 10 pts Less than 2 days late
- 15 pts Less than 3 days late
- 25 pts More than 5 days late

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

Homework 3: Graphical Linkage Synthesis

NAME: Shihong Yuan UIN: 665249431

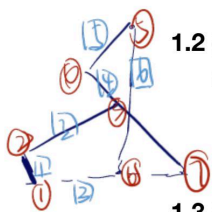
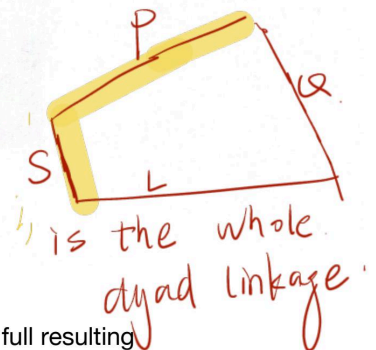
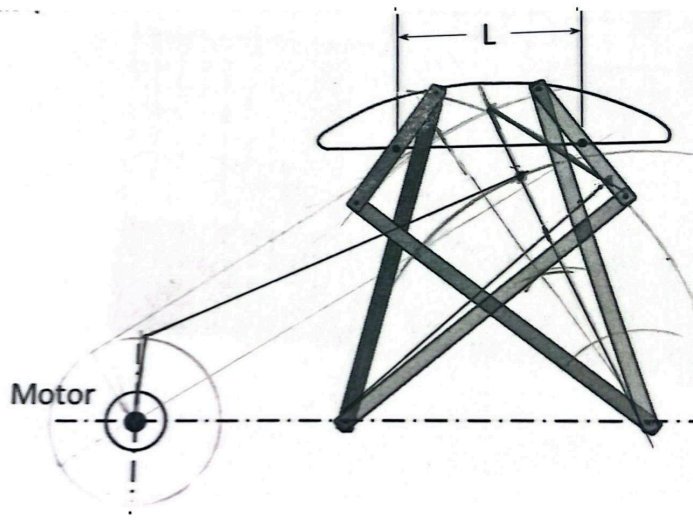
Total Points: 35 points

Synthesis is about precisely defining the length of elements to accurately generate the correct motion. Print the assignment out at full size on a normal piece of paper, and use the graphical synthesis tools developed in class to find real lengths. For all of these problems, you will be graded not just on applying the right steps, but also on precision and accuracy.

Problem 1 (10 pts): Straight line mechanism

A Chebyshev linkage (<https://www.youtube.com/watch?v=o3oczQU8QIY>) is shown below. One position is shown in dark colors, while the other is shown in light colors. These two positions mark the extremes of the perfectly straight path.

- 1.1 (6 pt) Make a drawing **to scale** that shows a dyad linkage that will power this device from the motor and limit the motion to just the straight-line length L . **Make sure that the resulting dyad driver does not produce a quick return mechanism.**



- 1.2 (2 pt) Use Gruebler's equation to calculate the Degrees of Freedom of the full resulting mechanism.

$$Dof = 3 \times 6 - 1 - 7 \times 2 = 1$$

so full mechanism dof = 1

- 1.3 (1 pt) What type of isomer is the resulting mechanism and why?

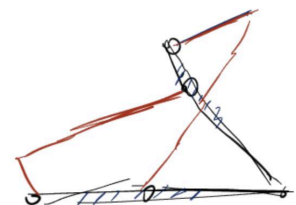
Watt's six-bar linkage

- 1.4 (1 pt) Check the Grashof class of the 4-bar mechanism formed by your added dyad.

$$S + L < P + Q$$

$S = 1.4 \text{ cm}$
 $L = 7.6 \text{ cm}$
 $P = 4.2 \text{ cm}$
 $Q = 6.2 \text{ cm}$

∴ this is grashof crank-rocker



Question assigned to the following page: [2.1](#)

Problem 2 (25 pts): Garbage truck

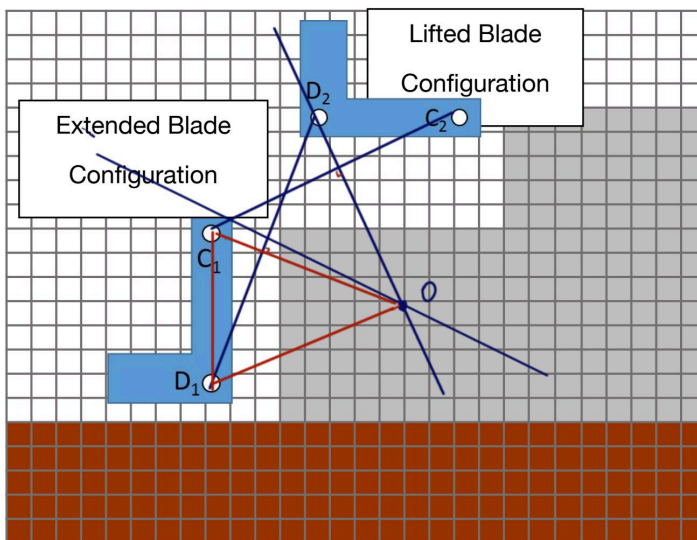
Design a mechanism for a garbage truck to grab and empty dumpsters. The blade needs to be horizontal to the ground to pick up dumpsters but also needs to be lifted to a vertical position to pour out the garbage into the storage.

Use graphical linkage synthesis to design a linkage that will move the dumpster blade through the two desired positions shown below.

For stability, the ground pivot points need to be attached to the body of the truck (grey area).



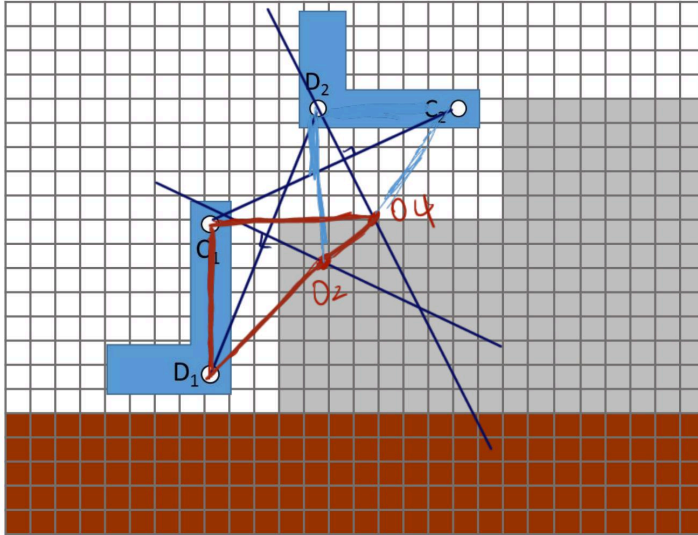
2.1 First design a rotopole. Sketch and list all the steps you perform to design the rotopole to move the blade between the two positions shown (8 points). Using a different color pencil, indicate the final design of the rotopole at one position on the diagram. (2 points)



- 1° biset D_1D_2
- 2° biset C_1C_2
- 3° The cross names O and link OD_1

Question assigned to the following page: [2.2](#)

2.2 Next, design a 4-bar to accomplish the same task. Sketch and list all the steps you perform to design the 4-bar to move the blade between the two positions shown. (8 points). Using a different color pencil, indicate the final design of the 4-bar at one position on the diagram. (2 points)



1. Bisect D_1D_2 . Pick O_2 along the line \rightarrow form link D_1O_2
2. Bisect C_1C_2 Pick O_4 along the line \rightarrow form link C_1O_4
- 3rd check the Grashof Condition.

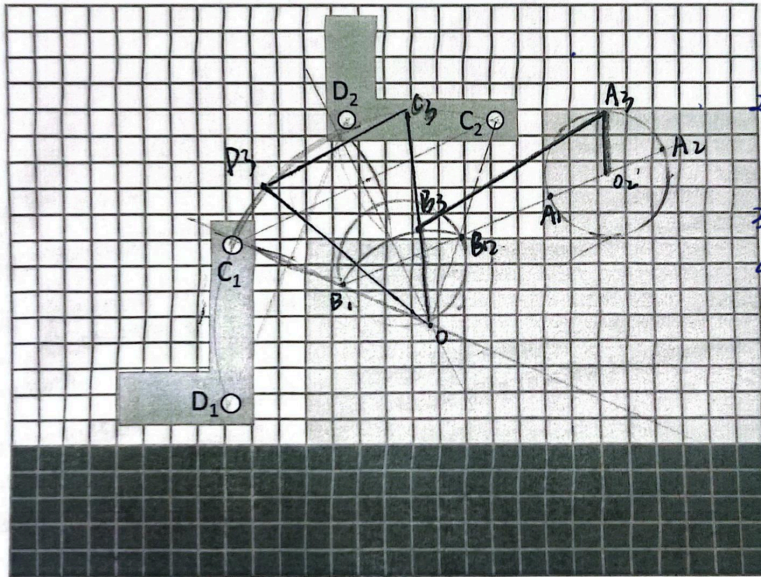
This is a double link

$$S = 2.8 \quad L = 7 \quad P = 6.5 \quad \alpha = 6.4$$

$$S + L < P + \alpha.$$

Questions assigned to the following page: [3.1](#) and [2.3](#)

2.3 Clearly sketch the rotopole link from a) in the two positions below. Using a different color pencil, sketch and list all the steps you would use to design a dyad to drive and limit the motion of the rotopole between these two extreme positions. Assume a time ratio of 1. (5 points)



- 1° Pick B_1 anywhere on OC_1
- 2° Draw about O through B_1
 B_2 will be on this arc and on OC_2
- 3° Extend B_1B_2 Pick O_2
- 4° Bisect B_1B_2 Use distance as radius around O_2
- 5° Check for Grashof condition with dyad.

A_1O_2 dyad	crank
A_1B_1 dyad	coupler
B_1O dyad	rocker
OO_2 dyad	ground.
- 6° If non-Grashof repeat 1°-5°

Select one of the following options:

My answer was created by a Gen AI algorithm, and I have not modified it

My answer was created by a Gen AI algorithm, and I have made some minor changes.

My answer was created by a Gen AI algorithm, and I have made major changes.

☒ My answer was created solely by myself.

If I used Gen AI, I used ____ (name of program).