**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=o3oczQU8QlY> ) 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. (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.**

A picture containing chart

Description automatically generated

* 1. (2 pt) Use Gruebler’s equation to calculate the Degrees of Freedom of the full resulting mechanism.
  2. (1 pt) What type of isomer is the resulting mechanism and why?
  3. (1 pt) Check the Grashof class of the 4-bar mechanism formed by your added dyad.

A large green truck is parked on the side of a road

Description automatically generated**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)

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**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)

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**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)

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Select one of the following options:

1. My answer was created by a Gen AI algorithm, and I have not modified it
2. My answer was created by a Gen AI algorithm, and I have made some minor changes.
3. My answer was created by a Gen AI algorithm, and I have made major changes.
4. My answer was created solely by myself.
5. If I used Gen AI, I used \_\_\_ (name of program).