MEEG301, Fall 2018, Homework 1

Due at start of class, Thursday, September 13, 2018
Text problems from "Design of Machinery," R.L. Norton, 5th Edition

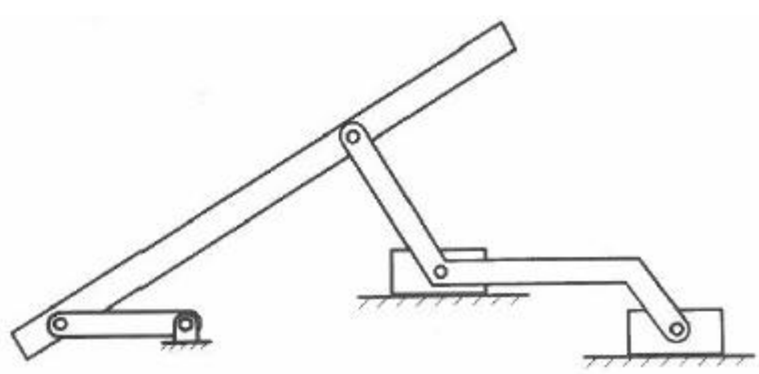
Problems (1 through 5: 10 points each; 6 and 7: 20 points each, 8: 10 points):

1) Textbook 2.1: part f (a folding beach chair), sketch (or scan/photo) the actual devices (book says possibly three but for this homework, find only two examples) and clearly indicate the kinematic chain; identify the ground and then verify the physical degrees of freedom of the mechanism by clearly identifying the links and joints and using the Kutzbach mobility formula.

2) Textbook 2.1: part m (a pickup truck tailgate mechanism), sketch (or scan/photo) the actual devices (book says three but for this homework, find only two examples) and clearly indicate the kinematic chain; identify the ground and then verify the physical degrees of freedom of the mechanism by clearly identifying the links and joints and using the Kutzbach mobility formula.

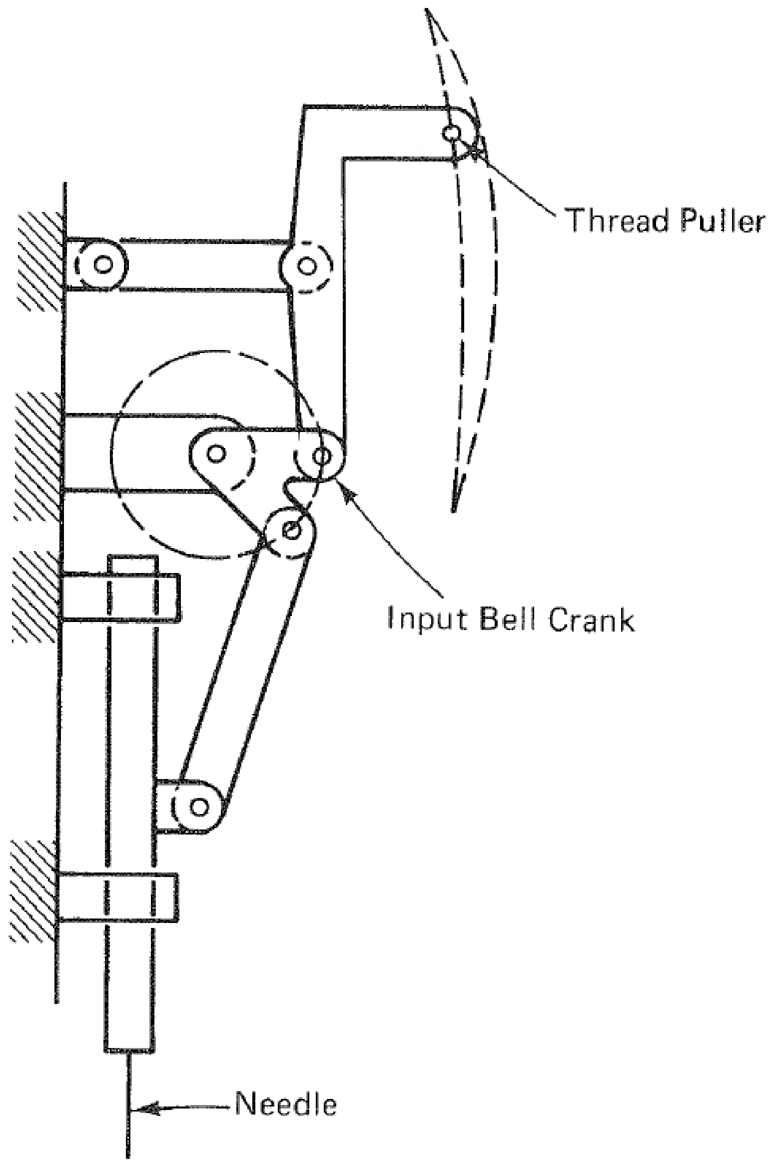
For each of the following mechanisms (3 through 5), number the links, with "1" being the ground link and then letter the joints alphabetically starting with Point A.
a) using your link numbers, describe each link as binary, ternary, etc.;
b) using your joint letters, determine whether the joint is a multiple joint;
c) using your joint letters, determine whether the joint is a half or full joint;
d) use Kutzbach's equation to determine the mobility;
e) identify clearly any paradox - should any exist;
f) if the mechanism has six links and one degree of freedom, identify whether it is a Stephenson or Watt linkage;

3) The casement window mechanism shown:

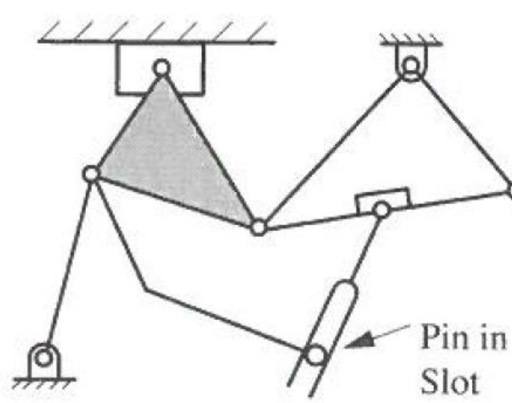


Casement Window Mechanism

4) The following is a path generation design for pulling thread combined with a slider crank to create the straight-line motion of the needle:

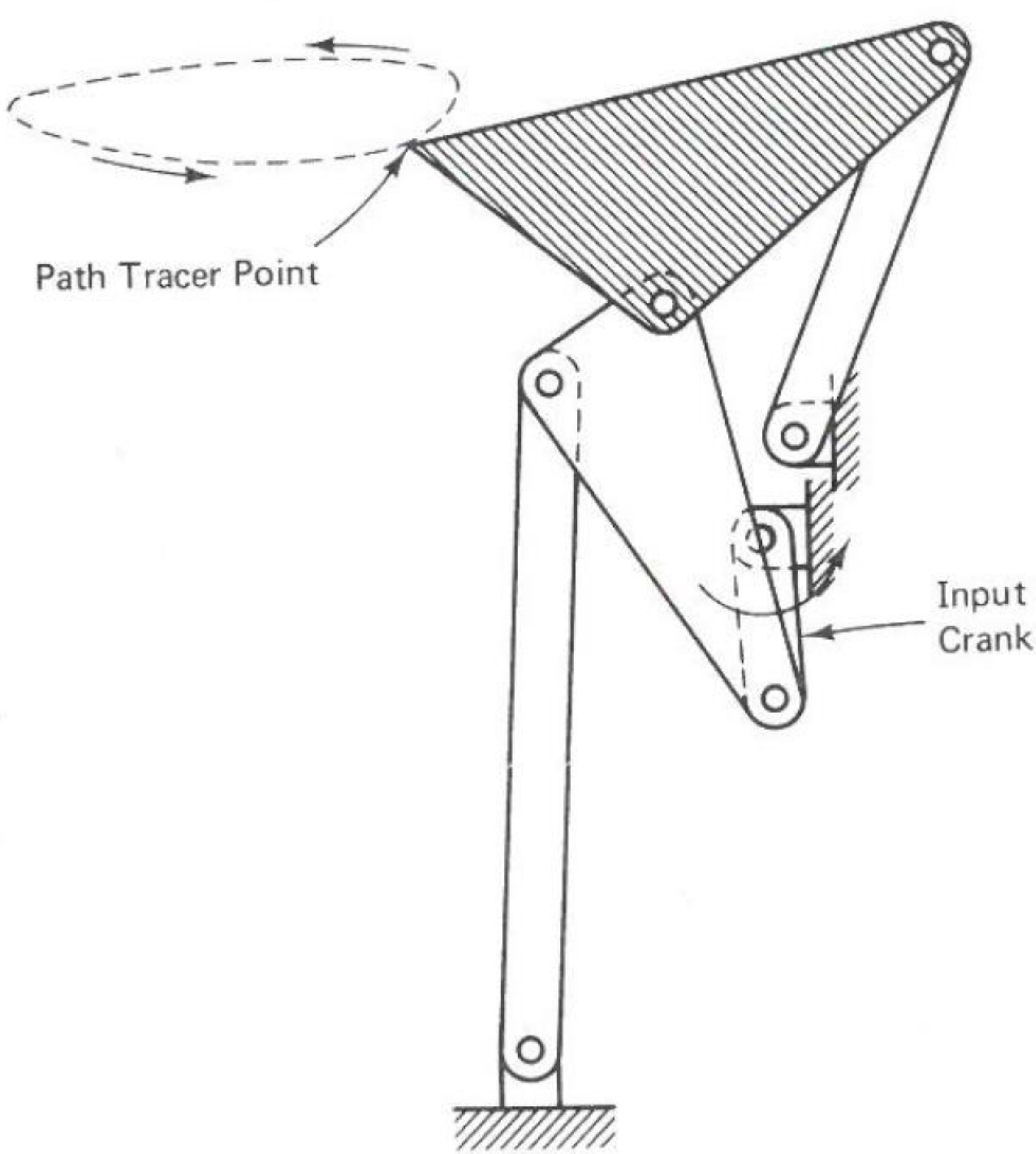


5)



6) Design a fourbar to replace the sixbar shown below and still create the path tracer point curve - scale to make the shown path ~three inches wide:

- o- Clearly show your design step(s) and then present/show the final design reaching at least four path points equally spaced along the path - use separate visuals with clearly defined rigid bodies and the coupler point on the path; and
- o- build a model of your fourbar - DO NOT TURN IN THE MODEL - use that model to verify the Grashof condition you determine for your fourbar and to find the minimum transmission angle; also indicate any difficulties/issues you recognized from your model (if any).



7) Textbook 3-86: Design a fourbar mechanism to give the three motion positions shown.

- o- Clearly show your design step(s) and then present/show the final design in each of the three design positions using three separate visuals with clearly defined rigid bodies; and
- o- build a model of your fourbar and use visuals to show the mechanism in each of the three design positions - DO NOT TURN IN THE MODEL - determine the minimum transmission angle for just the required range of movement; also indicate any difficulties/issues you recognized from the model (if any).

8) Create a driver dyad to turn your solution in Problem 7 into a sixbar that can use a motor to drive the entire system.

- o- Clearly show your design step(s) and then present/show the final design in each of the three design positions using three separate visuals with clearly designed rigid bodies; and
- o- build a model of your sixbar (just add the dyad to the model from Problem 3) and use visuals to show the entire mechanism in each of the three design positions - DO NOT TURN IN THE MODEL - indicate any difficulties/issues you recognized from the model (if any), and
- o- identify which six-bar isomer (Stephenson or Watt) you have designed.