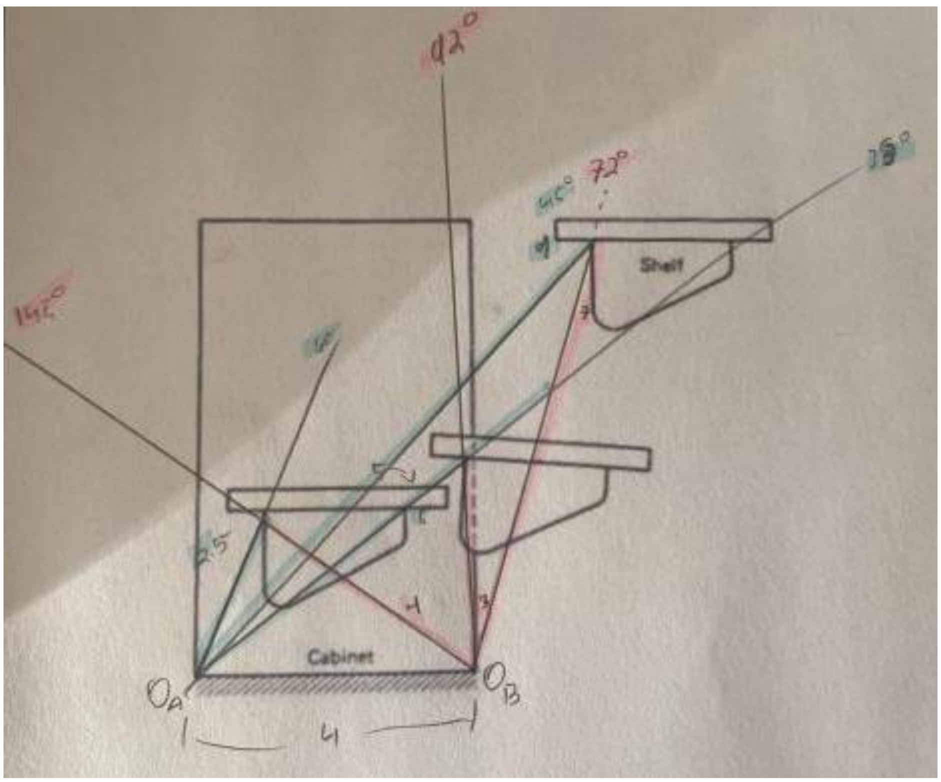
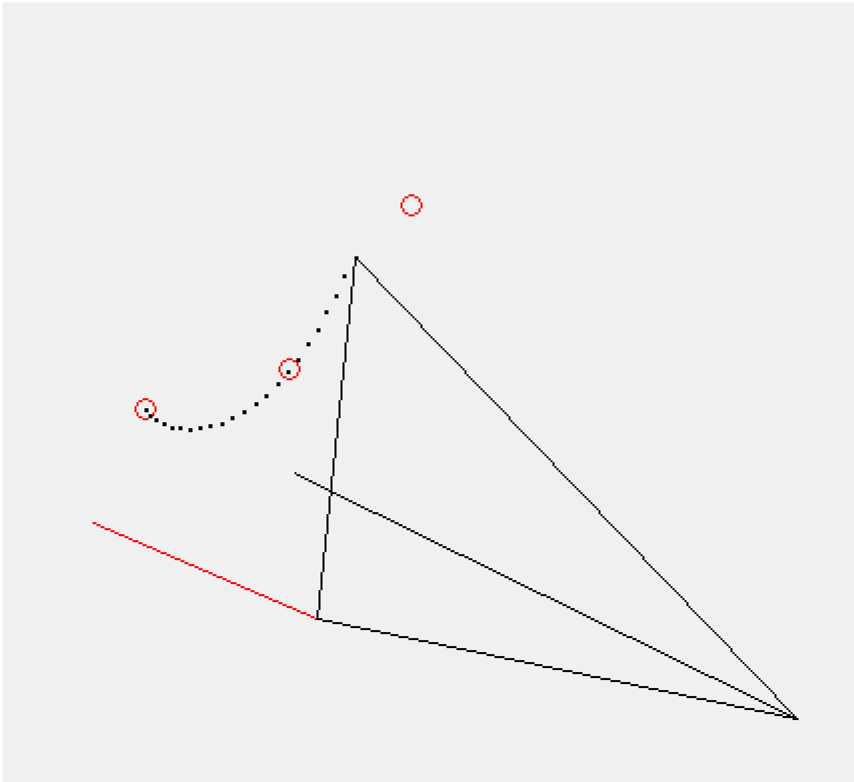
ME 460
HW #7
Leviticus Rhoden

8.17)

It is desired to synthesize a linkage to guide the movable shelf through the three positions shown in Fig. P8.8. The first position is level with the top of the cabinet for writing purposes, and the third position is a stored position for the shelf. Ground pivots should fall within the cabinet while the linkage size should be minimized so as to take up the least amount of cabinet space. Find acceptable locations of ground and moving pivots by (a) the graphical method; (b) the complex-number method; (c) the ground-pivot specification method.





R1 = (-3.36 - 3.54*I) (4.88 @ -133.44018503191052 degs)
R2 = (4.41 + 5.81*I) (7.29 @ 52.7845761700723 degs)
R2 = (-0.17 - 11.2*I) (11.2 @ -90.8670148785741 degs)
R4 = (-2.77 + 12.5*I) (12.8 @ 102.51920831958913 degs)
R5 = (7.19 - 6.68*I) (9.81 @ -42.929869952551186 degs)
R6 = (4.0 + 1.0*I) (4.12 @ 14.035437687729242 degs)

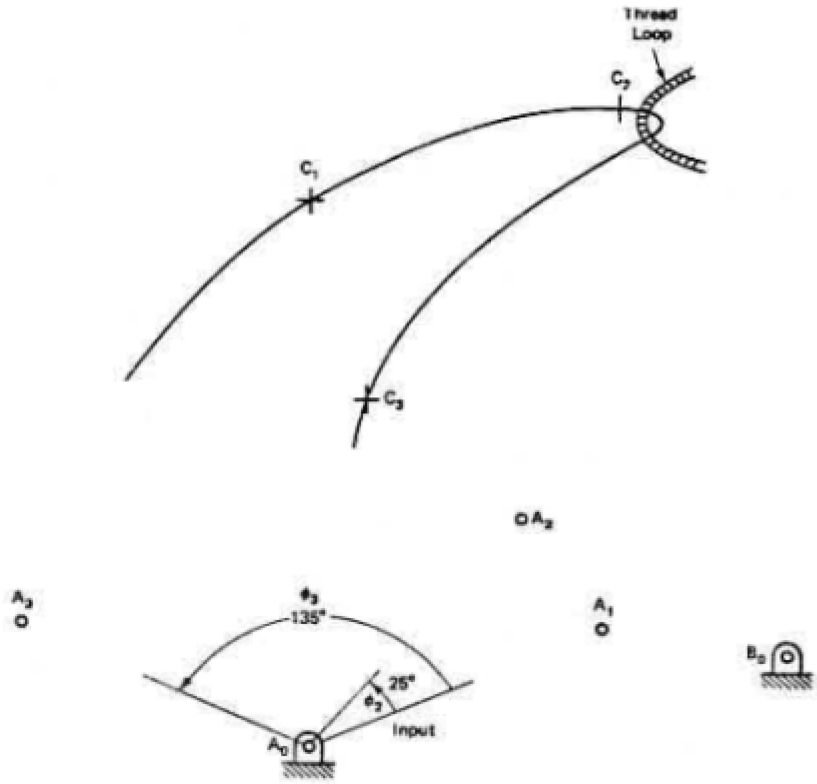
Oa = (-1.06 - 2.27*I + 2.5*exp(1.13446401379631*I))
A = (-4.41 - 5.81*I + 2.5*exp(1.13446401379631*I))
C = (2.5*exp(1.13446401379631*I))
B = (2.77 - 12.5*I + 2.5*exp(1.13446401379631*I))
Ob = (2.94 - 1.27*I + 2.5*exp(1.13446401379631*I))

8.23)

A four-bar linkage must be designed to accomplish one task in an automatic sewing machine (see Fig. P8.14). As input link (A_0A) rotates through $\phi_2 = 25°$ ccw, $\phi_3 = 135°$ ccw, the coupler point C must travel C_1, C_2, and C_3 to catch the thread loop.

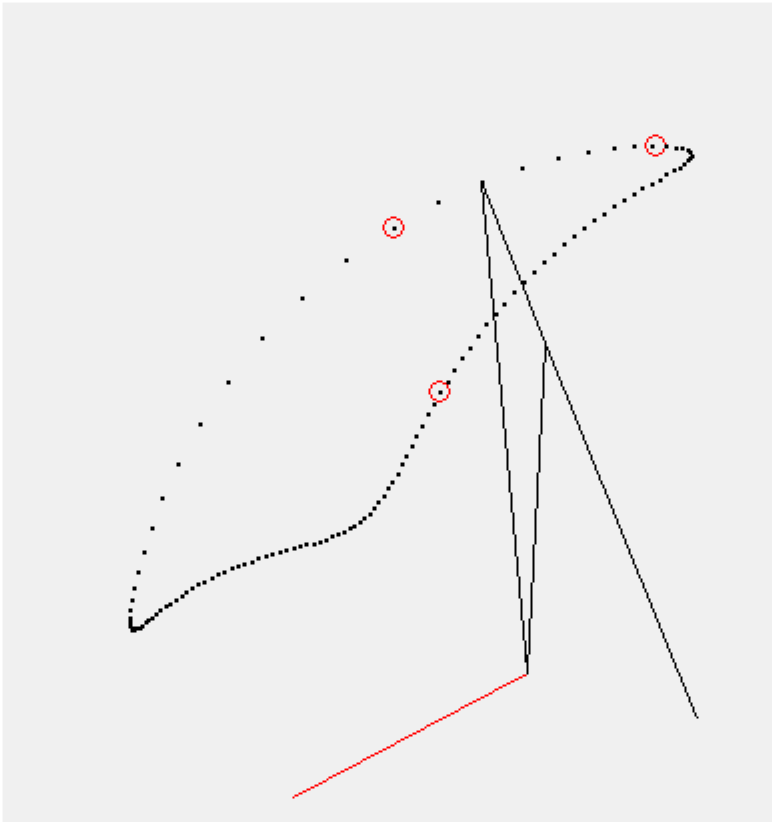
(a) If the positions of A_0, B_0, and A are prescribed (see the figure), find the location of B by the graphical method and draw the linkage in its three design positions.

(b) Use the complex-number method to synthesize a new path generator (the same C_1, C_2, C_3, ϕ_2, and ϕ_3 are prescribed) with better transmission angles.



C_{1x} = 2.0 mm	C_{1y} = 11.4 mm
C_{2x} = 7.27 mm	C_{2y} = 13.03 mm
C_{3x} = 2.95 mm	C_{3y} = 8.1 mm
B_{0x} = 8.08 mm	B_{0y} = 1.55 mm
A_{0x} = 0.0 mm	A_{0y} = 0.0 mm

Figure P8.14



R1 = (4.91 + 1.97*I) (5.29 @ 21.87059357146099 degs)
R2 = (-2.91 + 9.43*I) (9.87 @ 107.16329982309091 degs)
R2 = (-4.17 + 6.95*I) (8.10 @ 120.9696802868146 degs)
R4 = (-1.91 + 2.9*I) (3.48 @ 123.35467306195633 degs)
R5 = (-1.0 + 6.52*I) (6.60 @ 98.7144104612985 degs)
R6 = (8.08 + 1.55*I) (8.23 @ 10.85836153491947 degs)

Oa = (0)
A = (4.91 + 1.97*I)
C = (2 + 11.4*I)
B = (3.91 + 8.49619140625*I)
Ob = (8.08 + 1.55*I)

8.25)

8.25. A crank-rocker path-generating four-bar is required to advance film in a camera, as shown in Fig. P8.16.

(a) Using the graphical method, find the four-bar linkage if A_0, A, B_0, C_1, C_2, C_3, ϕ_2, and ϕ_3 are given.

(b) Using the complex-number method, find other acceptable four-bar linkages given C_1, C_2, C_3, ϕ_2, and ϕ_3.

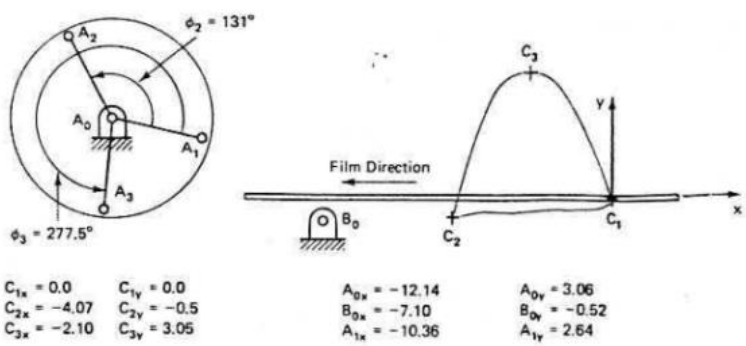
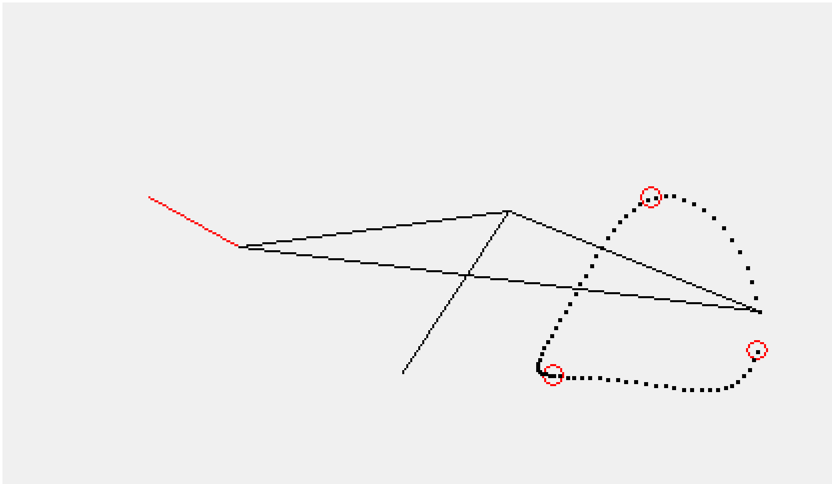


Figure P8.16



R1 = (1.98 - 0.504*I) (2.04 @ -14.281980196010023 degs)
R2 = (10.2 - 2.56*I) (10.5 @ -14.121115580677882 degs)
R2 = (2.4 + 3.12*I) (3.94 @ 52.46984105311812 degs)
R4 = (4.7 - 2.6*I) (5.37 @ -28.955630759785254 degs)
R5 = (5.46 + 0.0449*I) (5.46 @ 0.47155626029768033 degs)
R6 = (5.04 - 3.58*I) (6.18 @ -35.390215373070866 degs)

Oa = (-12.14 + 3.06*I)
A = (-10.160751953125 + 2.55609375*I)
C = (0)
B = (-4.7 + 2.6*I)
Ob = (-7.1 - 0.52*I)

9.12)

Prob. 9.12

Figure P3.11 shows a small bucket that is to be dumped into a large container and a desired path for the center of the bucket. Synthesize a four-bar mechanism that will lift the bucket and dump its contents into the container. Ground pivots are attached to the container. Synthesize for either four precision points (leaving out precision point 3) or for all five precision points.

Number	Precision points		Coupler angle
	x	y	
1	0	0	0°
2	−0.5	4	5°
3	−1.5	5	5°
4	−2.0	5.5	60°
5	−2.5	5	120°

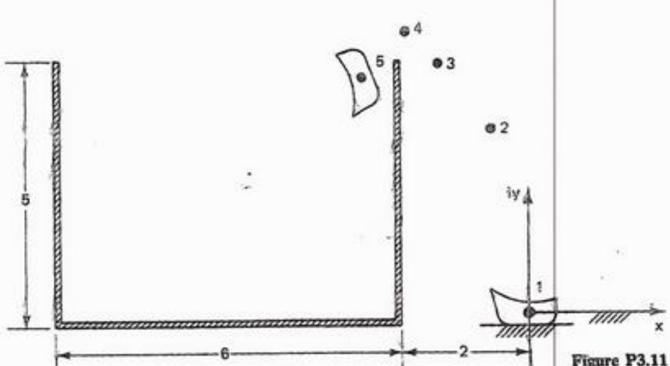
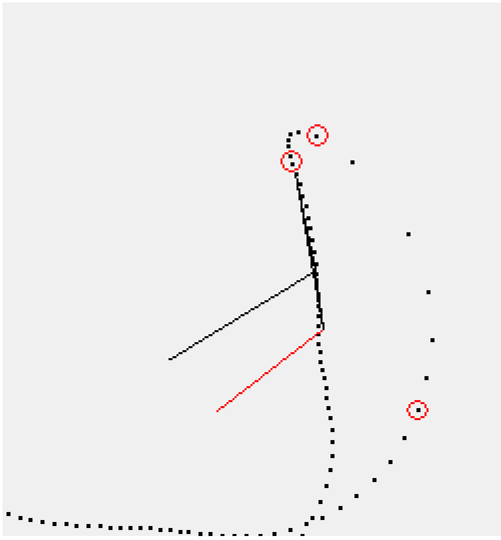


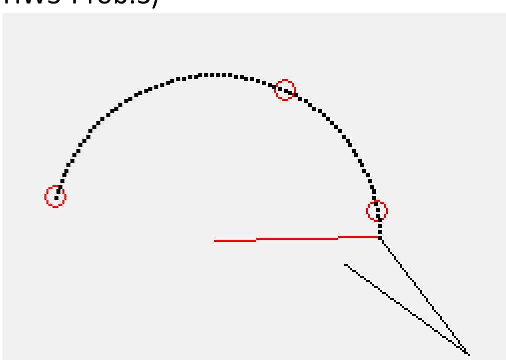
Figure P3.11



R1 = (1.65 + 2.12*I) (2.69 @ 52.21805295955476 degs)
R2 = (2.35 - 2.12*I) (3.17 @ -42.05560573878955 degs)
R2 = (3.47 + 0.305*I) (3.48 @ 5.036636135480762 degs)
R4 = (1.53 - 1.31*I) (2.02 @ -40.37701844836722 degs)
R5 = (0.819 - 0.818*I) (1.16 @ -44.96515704218827 degs)
R6 = (-1.0 + 1.0*I) (1.41 @ 135.01386061668146 degs)

Oa = (0)
A = (1.65 + 2.12*I)
C = (4)
B = (2.46 + 1.31*I)
Ob = (-1.0 + 1.0*I)

HW3-Prob.3)



R1 = (-3.19 + 0.854*I) (3.30 @ 165.00112314870543 degs)
R2 = (5.12e-11 + 1.58e-9*I) (1.58e-9 @ 88.1538092020129 degs)
R2 = (-2.81 + 1.34*I) (3.11 @ 154.49596435614566 degs)
R4 = (-2.97 - 0.0316*I) (2.97 @ -179.3887800315539 degs)
R5 = (2.97 + 0.0316*I) (2.97 @ 0.611219968446101 degs)
R6 = (2.59 - 0.455*I) (2.63 @ -9.964863508455084 degs)

Oa = (3.19 - 0.854*I + 3.3*exp(2.87979326579064*I))
A = (-5.12e-11 - 1.58e-9*I + 3.3*exp(2.87979326579064*I))
C = (3.3*exp(2.87979326579064*I))
B = (2.97 + 0.0316*I + 3.3*exp(2.87979326579064*I))
Ob = (5.78 - 1.31*I + 3.3*exp(2.87979326579064*I))