1) Download http://www.mne.psu.edu/sommer/me581/h01.docx

2) Obtain a digital image of a mechanism, and paste it into this Word document. You may take a digital photo, scan a hardcopy photograph or drawing, or obtain an on-line image.



3) Provide a name and brief description of the purpose for your mechanism.

Bar Clamp: Secures Parts to facilitate assembly.



5) Identify the number of links (nL), 1 DOF joints (nJ₁), 2 DOF joints (nJ₂), 3 DOF joints (nJ₃) and mobility (M).

nL ____5 ___ nJ_1 __2 (1:P,1:H) ___ nJ_2 __1(1:C) ___ nJ_3 __1(1:G) ___ M ___7 ___

$$M = 6 * (nL - 1) - 5(nJ1) - 4(nJ2) - 3(nJ3)$$
(1)
 $M = 6 * (5 - 1) - 5(2) - 4(1) - 3(1) = 7$ (2)

Makes sense becase the head (link 5) has all **3** rotational DoF. The Helical allows **1** DOF, the Cylindrical allows **2**, one rotation and one translation (link 2). Finally, link 1 has **1** DoF, translation.

6) Diagram the topology of your mechanism.



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3) Provide a name and brief description of the purpose for your mechanism.

Door automatic closer with a push mechanism





5) Identify the number of links (nL), 1 DOF joints (nJ₁), 2 DOF joints (nJ₂), 3 DOF joints (nJ₃) and mobility (M).

 $nL__4_ \quad nJ_1__3_ \quad nJ_2__1_ \quad nJ_3__0_ \quad M__2_$



6) Diagram the topology of your mechanism.

ME 581 - H01

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Foldable ladder

3) Provide a name and brief description of the purpose for your mechanism.

The above image shows a foldable ladder. The ladder can be completely expanded to unravel the steps and then can be completely closed, thus making it compact and easy to carry and store.





The revolute joint is behind the blue link where the both green links intersect.



Two revolute joints are present at L – between links 5 and 9 and links 9 and 10

5) Identify the number of links (nL), 1 DOF joints (nJ₁), 2 DOF joints (nJ₂), 3 DOF joints (nJ₃) and mobility (M).

 $nL_10_ \qquad nJ_1_13_ \qquad nJ_2_0_ \qquad nJ_3_0_ \qquad M_1__$

Since, during the opening and closing of the ladder, link 3 needs to remain steady and link 2 is pulled out or pushed in to open and close the ladder respectively. Hence, in these cases, no relative motion is expected between links 1 and 3. Similarly, since, link 2 is shorter than link 3, it doesn't maintain contact with the ground. The contact is established only when the link is

completely open. Hence, the joint between, links 1 and 2 is also inactive during the opening and closing of the ladder. Therefore, these joints aren't considered for mobility calculations.

6) Diagram the topology of your mechanism.



ME 581 – H01

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3) Provide a name and brief description of the purpose for your mechanism.

Whitworth quick return mechanism – a crank slider that retracts faster than it extends

4) Use the MS-Word drawing toolbar or other drawing tools to draw the kinematic skeletal diagram for your mechanism <u>directly on top of your image</u>. Additionally, copy the skeletal diagram and past it onto a blank area of this this MS-Word file. Clearly label the links and joints. Number the links using 1 for the ground link, and letter the joints A, B, C, etc.

5) Identify the number of links (nL), 1 DOF joints (nJ_1), 2 DOF joints (nJ_2), 3 DOF joints (nJ_3) and mobility (M).

 $nL_\underline{6}_ nJ_1_\underline{7}_ nJ_2_\underline{0}_ nJ_3_\underline{0}_ M_\underline{1}_$

- 6) Diagram the topology of your mechanism.
- 7) Submit PDF copy via Canvas.









ME 581 – H01

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3) Provide a name and brief description of the purpose for your mechanism.

Umbrella arm mechanism

4) Use the MS-Word drawing toolbar or other drawing tools to draw the kinematic skeletal diagram for your mechanism <u>directly on top of your image</u>. Additionally, copy the skeletal diagram and past it onto a blank area of this this MS-Word file. Clearly label the links and joints. Number the links using 1 for the ground link, and letter the joints A, B, C, etc.

5) Identify the number of links (nL), 1 DOF joints (nJ_1), 2 DOF joints (nJ_2), 3 DOF joints (nJ_3) and mobility (M).

- 6) Diagram the topology of your mechanism.
- 7) Submit PDF copy via Canvas.







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2) Obtain a digital image of a mechanism, and paste it into this Word document. You may take a digital photo, scan a hardcopy photograph or drawing, or obtain an on-line image.



Source: <u>https://www.globalindustrial.com/p/bishamon-mobilift-battery-powered-double-scissor-lift-table-660lb-cap?infoParam.campaignId=T9F&gclid=Cj0KCQiAip-</u>PBhDVARIsAPP2xc3aqhLgDVz6nSYyePN1SDkjBYEfg_uE6dOqzICAwF9q47SoW9bmY0EaAmbLEALw_wcB

3) Provide a name and brief description of the purpose for your mechanism.

Scissor Lift – used to vertically raise and lower a load



5) Identify the number of links (nL), 1 DOF joints (nJ₁), 2 DOF joints (nJ₂), 3 DOF joints (nJ₃) and mobility (M).

 $nL: 11 \quad nJ_1: 13 \quad nJ_2: 2 \quad nJ_3: 0 \quad M: 2$

6) Diagram the topology of your mechanism.



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2) Obtain a digital image of a mechanism and paste it into this Word document. You may take a digital photo, scan a hardcopy photograph or drawing, or obtain an on-line image.



3) Provide a name and brief description of the purpose for your mechanism.

This mechanism is a stabilizer for a tractor. Its purpopose is to stabilize the tractor and prevent excessive lateral movement or tipping when bucket loads are dynamic. High lateral loads would otherwise cause the tractor to bounce around on the large rear tires or possibly tip. The foot rotates freely to adapt to the slope of the terrain.

4) Use the MS-Word drawing toolbar or other drawing tools to draw the kinematic skeletal diagram for your mechanism <u>directly on top of your image</u>. Additionally, copy the skeletal diagram and past it onto a blank area of this this MS-Word file. Clearly label the links and joints. Number the links using 1 for the ground link, and letter the joints A, B, C, etc.



5) Identify the number of links (nL), 1 DOF joints (nJ₁), 2 DOF joints (nJ₂), 3 DOF joints (nJ₃) and mobility (M).

 $nL_\underline{5}_ nJ_1_\underline{5}_ nJ_2_\underline{0}_ nJ_3_\underline{0}_ M_\underline{2}_$

6) Diagram the topology of your mechanism.



1) Download http://www.mne.psu.edu/sommer/me581/h01.docx

2) Obtain a digital image of a mechanism, and paste it into this Word document. You may take a digital photo, scan a hardcopy photograph or drawing, or obtain an on-line image.



3) Provide a name and brief description of the purpose for your mechanism.

The mechanism of interest is just one of four pistons in a 4-cylinder in-line engine, which was designed and animated in SOLIDWORKS. The provided image presents a "down-axis" view of the 4C engine.

4) Use the MS-Word drawing toolbar or other drawing tools to draw the kinematic skeletal diagram for your mechanism <u>directly on top of your image</u>. Additionally, copy the skeletal diagram and past it onto a blank area of this this MS-Word file. Clearly label the links and joints. Number the links using 1 for the ground link, and letter the joints A, B, C, etc.



5) Identify the number of links (nL), 1 DOF joints (nJ_1), 2 DOF joints (nJ_2), 3 DOF joints (nJ_3) and mobility (M).

 $nL__4__ nJ_1__4__ nJ_2_0__ nJ_3__0__ M_1__$

ME 581 – H01

6) Diagram the topology of your mechanism.



ME 581 – H01

Name _____

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2) Obtain a digital image of a mechanism, and paste it into this Word document. You may take a digital photo, scan a hardcopy photograph or drawing, or obtain an on-line image.



3) Provide a name and brief description of the purpose for your mechanism.

MECHANICAL FINGER JOINT – Linkage that resembles a finger curling in.

4) Use the MS-Word drawing toolbar or other drawing tools to draw the kinematic skeletal diagram for your mechanism <u>directly on top of your image</u>. Additionally, copy the skeletal diagram and past it onto a blank area of this this MS-Word file. Clearly label the links and joints. Number the links using 1 for the ground link, and letter the joints A, B, C, etc.



5) Identify the number of links (nL), 1 DOF joints (nJ_1), 2 DOF joints (nJ_2), 3 DOF joints (nJ_3) and mobility (M).

 $nL_6_ \qquad nJ_1_7_ \qquad nJ_2_0_ \qquad nJ_3_0_ \qquad M_1_$

- 6) Diagram the topology of your mechanism.
- 7) Submit PDF copy via Canvas.



Name _____



ME 581 – H01

1) Download http://www.mne.psu.edu/sommer/me581/h01.docx

2) Obtain a digital image of a mechanism, and paste it into this Word document. You may take a digital photo, scan a hardcopy photograph or drawing, or obtain an on-line image.



3) Provide a name and brief description of the purpose for your mechanism. This is a 4 bar heavy duty friction hinge. The purpose of this device is to hold a window and allow it to project outward from the frame in which it is attached.



5) Identify the number of links (nL), 1 DOF joints (nJ_1), 2 DOF joints (nJ_2), 3 DOF joints (nJ_3) and mobility (M).

 $nL__6__ nJ_1__7__ nJ_2__0__ nJ_3__0__ M__1__$

6) Diagram the topology of your mechanism.



ME 581 - H01

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3) Provide a name and brief description of the purpose for your mechanism.

Black Diamond climbing cam: designed to be used as a portable climbing anchor when collapsed and inserted into gaps or cracks in rock faces

4) Use the MS-Word drawing toolbar or other drawing tools to draw the kinematic skeletal diagram for your mechanism <u>directly on top of your image</u>. Additionally, copy the skeletal diagram and past it onto a blank area of this this MS-Word file. Clearly label the links and joints. Number the links using 1 for the ground link, and letter the joints A, B, C, etc.

5) Identify the number of links (nL), 1 DOF joints (nJ₁), 2 DOF joints (nJ₂), 3 DOF joints (nJ₃) and mobility (M). If modelled as a planar mechanism (the device is designed for planar motion):

 $nL_6_ nJ_1_7 (6R, 1P)_ nJ_2_0_ M_3*(6-1)-2*7-2*0=1_$

If modelled as a 3D mechanism (in which case link 2 really meets ground as a cylindridal joint): $nL_6_nJ_1_6(6R)_nJ_2_1(1C)_nJ_3_0_M_6^*(6-1)-5^*6-4^*1-3^*0=-4_M$ M=-4 implies the mechanism may rely on special geometry to move in 3D. I suspect that if the device is not symmetric about ground (i.e. if the loops formed by 1-2-3-5 and 1-2-4-6 are not the same geometry) the mechanism may lock-up.

6) Diagram the topology of your mechanism.







ME 581 - H01

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Locking Pliers



3) Provide a name and brief description of the purpose for your mechanism.

Locking pliers have a simple fourbar mechanism involved which can be seen in the image above. The input link is link 3, or the handle. The input will cause the jaw to to open or close depending on direction of the input, and will lock depending on the angle of link 2. Joint A is adjustable based off of the postion of the screw.





5) Identify the number of links (nL), 1 DOF joints (nJ₁), 2 DOF joints (nJ₂), 3 DOF joints (nJ₃) and mobility (M).

 $nL_4_ nJ_1_4_ nJ_2_0_ nJ_3_0_ M_1_$

6) Diagram the topology of your mechanism.



I called this prismatic because joint A is adjustable. It translates along a fixed path based off the input of the screw , which it contacts.

1) Download <u>http://www.mne.psu.edu/sommer/me581/h01.docx</u>

✓ - ZK

2) Obtain a digital image of a mechanism, and paste it into this Word document. You may take a digital photo, scan a hardcopy photograph or drawing, or obtain an on-line image.



3) Provide a name and brief description of the purpose for your mechanism.

Name: Kerrison Rongeur

<u>Description</u>: Rongeurs are heavy duty surgical instruments used for removing bone or hard tissue. They can be used to remove diseased bone, create a path to access other tissue, or they can obtain a bone graft that can then be placed into a new location. I have observed the use of rongeurs in the operating room for patients with Charcot neuropathic arthropathy, and in rat surgeries to obtain bone for a spinal fusion. However, I have never seen Kerrison Rongeurs, which work through a slider mechanism as opposed to the more typical rongeurs (Fig. below).



Videos:

- 1. "Kerrison Rongeur Here's what you need to know!" <u>https://www.youtube.com/watch?v=VnMjjwSuKzI</u> "
- 2. "Decompression using Dreal® vs. Kerrison Ronguers" <u>https://www.youtube.com/watch?v=hjqFD_Qkcgg</u>
- 3. "Take Apart Kerrison Rongeurs HD 720p" https://www.youtube.com/watch?v=735wEe3gZA8

4) Use the MS-Word drawing toolbar or other drawing tools to draw the kinematic skeletal diagram for your mechanism <u>directly on top of your image</u>. Additionally, copy the skeletal diagram and past it onto a blank area of this this MS-Word file. Clearly label the links and joints. Number the links using 1 for the ground link, and letter the joints A, B, C, etc.



5) Identify the number of links (nL), 1 DOF joints (nJ₁), 2 DOF joints (nJ₂), 3 DOF joints (nJ₃) and mobility (M).

$$nL_6$$
 nJ_1_7 nJ_2_0 nJ_3_0 $M_1_$
 $M = 3(6-1) - 2(7) - (0)$

M = 1

6) Diagram the topology of your mechanism.



exist at point D.

7) Submit PDF copy via Canvas.
 ✓ - ZK

ME 581 - H01

1) Download <u>http://www.mne.psu.edu/sommer/me581/h01.docx</u>

2) Obtain a digital image of a mechanism, and paste it into this Word document. You may take a digital photo, scan a hardcopy photograph or drawing, or obtain an on-line image.



3) Provide a name and brief description of the purpose for your mechanism. Scissor Lift- Mechanism Lifts individuals and equipment





5) Identify the number of links (nL), 1 DOF joints (nJ₁), 2 DOF joints (nJ₂), 3 DOF joints (nJ₃) and mobility (M).

6) Diagram the topology of your mechanism.



ME 581 – H01

 Name
 Alexander Mathews

2) Obtain a digital image of a mechanism, and paste it into this Word document. You may take a digital photo, scan a hardcopy photograph or drawing, or obtain an on-line image.



3) Provide a name and brief description of the purpose for your mechanism. Aircraft Landing Gear System- Riasing and lowering the wheels



5) Identify the number of links (nL), 1 DOF joints (nJ₁), 2 DOF joints (nJ₂), 3 DOF joints (nJ₃) and mobility (M).

 $nL__7__ nJ_1__8__ nJ_2__0__ nJ_3__0__ M__2__$

6) Diagram the topology of your mechanism.

See above

1) Download http://www.mne.psu.edu/sommer/me581/h01.docx

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3) Provide a name and brief description of the purpose for your mechanism.

JLG 660SJ:

This machine is a Mobile Elevating Work Platform (MEWP). The operator can move the work platform up and down, as well as drive the base of the machine. For the purposes of this asignment, only the boom and jib movement in the plane of the page will be considered. The telescoping boom is assumed to be fixed length.

4) Use the MS-Word drawing toolbar or other drawing tools to draw the kinematic skeletal diagram for your mechanism <u>directly on top of your image</u>. Additionally, copy the skeletal diagram and past it onto a blank area of this this MS-Word file. Clearly label the links and joints. Number the links using 1 for the ground link, and letter the joints A, B, C, etc.



5) Identify the number of links (nL), 1 DOF joints (nJ₁), 2 DOF joints (nJ₂), 3 DOF joints (nJ₃) and mobility (M).

 $nL = 14 \quad nJ_1 = 18 \quad nJ_2 = 0 \quad nJ_3 = 0 \quad M = 3$

ME 581 – H01



6) Diagram the topology of your mechanism.

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3) Provide a name and brief description of the purpose for your mechanism.

Answer: This is the new ABB gripper robot. It is often used in lab research to finish grasping tasks precisely such as medical research.



5) Identify the number of links (nL), 1 DOF joints (nJ₁), 2 DOF joints (nJ₂), 3 DOF joints (nJ₃) and mobility (M).

 $\label{eq:mL} \begin{array}{ll} nL = 6 & nJ_1 = 4 & nJ_2 = 1 & nJ_3 = 0 & M = 6 \\ M = 3(nL\text{-}1) \mbox{-}2 & nJ1 \mbox{-}nJ2 \end{array}$

6) Diagram the topology of your mechanism.



7) Submit PDF copy via Canvas.

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3) Provide a name and brief description of the purpose for your mechanism.

It is a Monitor Arm. The purpose of this mechanism is to behave as a adjustable stand for computer or screens or television.

4) Use the MS-Word drawing toolbar or other drawing tools to draw the kinematic skeletal diagram for your mechanism <u>directly on top of your image</u>. Additionally, copy the skeletal diagram and past it onto a blank area of this this MS-Word file. Clearly label the links and joints. Number the links using 1 for the ground link, and letter the joints A, B, C, etc.

5) Identify the number of links (nL), 1 DOF joints (nJ_1), 2 DOF joints (nJ_2), 3 DOF joints (nJ_3) and mobility (M).

 $nL_4_ \qquad nJ_1__1_ \qquad nJ_2_2_ \qquad nJ_3__0_ \qquad M_5_$

M =6(4-1)-5(1)-4(2) = 18-5-8 = 5

- 6) Diagram the topology of your mechanism.
- 7) Submit PDF copy via Canvas.





ME 581 - H01

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3) Provide a name and brief description of the purpose for your mechanism.

_Chair hinge_____



5) Identify the number of links (nL), 1 DOF joints (nJ₁), 2 DOF joints (nJ₂), 3 DOF joints (nJ₃) and mobility (M).

 $nL __4_ \qquad nJ_1 __4_ \qquad nJ_2 __0_ \qquad nJ_3 __0_ \qquad M __1_$

6) Diagram the topology of your mechanism.





ME 581 - H01

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3) Provide a name and brief description of the purpose for your mechanism.

Anti-theft door mechanism in Vending Machine

4) Use the MS-Word drawing toolbar or other drawing tools to draw the kinematic skeletal diagram for your mechanism <u>directly on top of your image</u>. Additionally, copy the skeletal diagram and past it onto a blank area of this this MS-Word file. Clearly label the links and joints. Number the links using 1 for the ground link, and letter the joints A, B, C, etc.

5) Identify the number of links (nL), 1 DOF joints (nJ_1), 2 DOF joints (nJ_2), 3 DOF joints (nJ_3) and mobility (M).

 $nL \underline{5} \quad nJ_1 \underline{5} \quad nJ_2 \underline{0} \quad nJ_3 \underline{0} \quad M \underline{-2}$

6) Diagram the topology of your mechanism.





ME 581 - H01

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Downloaded from : https://www.youtube.com/watch?v=vTVTfCOWH70

3) Provide a name and brief description of the purpose for your mechanism.

Manual Press, it is used to exert pressure on the workpiece.



5) Identify the number of links (nL), 1 DOF joints (nJ_1) , 2 DOF joints (nJ_2) , 3 DOF joints (nJ_3) and mobility (M).

6) Diagram the topology of your mechanism.



ME 581 – H01

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2) Obtain a digital image of a mechanism, and paste it into this Word document. You may take a digital photo, scan a hardcopy photograph or drawing, or obtain an on-line image.





3) Provide a name and brief description of the purpose for your mechanism.

Folding Step Ladder: Ladder extends by pushing on top of first step, and folds up by rotating the top step up. There is a "hard stop" that stops the top step when the step is parallel to the ground.



5) Identify the number of links (nL), 1 DOF joints (nJ_1), 2 DOF joints (nJ_2), 3 DOF joints (nJ_3) and mobility (M).

nL ____8 ___ nJ_1 ___10 ___ nJ_2 ___1 ___ nJ_3 ___0 ___ M ___0 ___

$$M = 3 \cdot (L-1) - 2 J_1 - J_2 \qquad M \coloneqq 3 \cdot (8-1) - 2 \cdot 10 - 1 = 0$$

But we know that the ladder does indeed have a mobility of one. The steps are creating a special geometry like the following:





6) Diagram the topology of your mechanism.



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3) Provide a name and brief description of the purpose for your mechanism.

Arm of extendable, tiltable TV wall mount. The mount enables the TV to be extended several inches from the wall and allows the TV to be tilted away/towards the floor.



5) Identify the number of links (nL), 1 DOF joints (nJ_1), 2 DOF joints (nJ_2), 3 DOF joints (nJ_3) and mobility (M).

nL <u>5</u> nJ_1 <u>4</u> nJ_2 <u>2</u> nJ_3 <u>M</u> <u>2</u> M = 3(5-1) - 2(4) - 2 M = 12 - 8 - 2M = 2



6) Diagram the topology of your mechanism.

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3) Provide a name and brief description of the purpose for your mechanism.

This is an engine hoist, sometimes also referred to as a "cherry picker." It is used to lift equipment/hardware and usually has adjustable height and arm position. It utilizes a hydraulic ram and can have lift capacities anywhere from 1000 - 8000 lbs on average.

4) Use the MS-Word drawing toolbar or other drawing tools to draw the kinematic skeletal diagram for your mechanism <u>directly on top of your image</u>. Additionally, copy the skeletal diagram and past it onto a blank area of this this MS-Word file. Clearly label the links and joints. Number the links using 1 for the ground link, and letter the joints A, B, C, etc.



5) Identify the number of links (nL), 1 DOF joints (nJ₁), 2 DOF joints (nJ₂), 3 DOF joints (nJ₃) and mobility (M).

 $nL \ \underline{3} \qquad nJ_1 \ \underline{2} \qquad nJ_2 \ \underline{0} \qquad nJ_3 \ \underline{0} \qquad M \ \underline{2}$

6) Diagram the topology of your mechanism.



ME 581 – H01

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3) Provide a name and brief description of the purpose for your mechanism.

My mechanism is an ABB IRB6700 robotic arm. The arm can be outfitted with tools for uses in assembly lines, palletizing operations, and additive manufacturing (shown above) to name a few.



5) Identify the number of links (nL), 1 DOF joints (nJ₁), 2 DOF joints (nJ₂), 3 DOF joints (nJ₃) and mobility (M).

 $nL__7__ nJ_1__6__ nJ_2__0__ nJ_3__0__ M__6__$

6) Diagram the topology of your mechanism.

