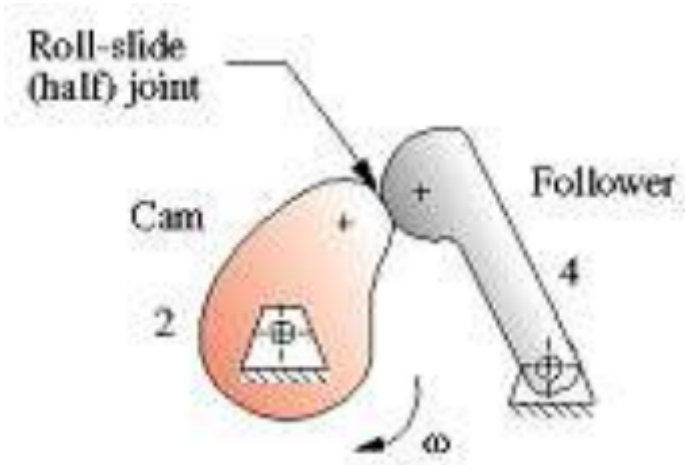
EX_2

Notation: the ground is always the first link in DOF questions

EX 2.1

an ordinary question on DOF of cam



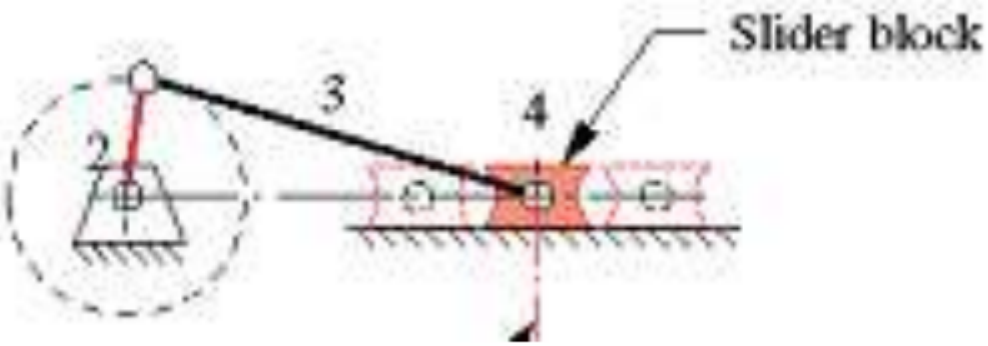
Notation: the touch of the cam and the follower is a two freedom joint

$L = 3$, $J_1 = 2$ and $J_2 = 1$

$DOF = 3(L-1) - 2J_1 - J_2 = 1$

EX 2.2

an ordinary question on DOF of crank-slider



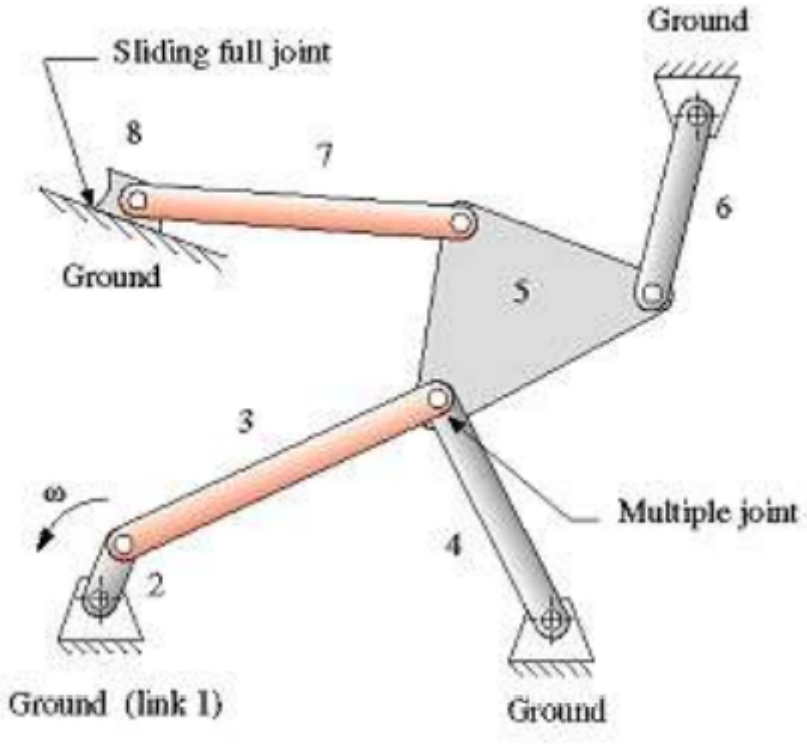
Notation: the touch between the slider block and the ground is a one freedom joint, and the slider block is also a link

$L = 4$, $J_1 = 4$ and $J_2 = 0$

$DOF = 3(L-1) - 2J_1 - J_2 = 1$

EX 2.3

an ordinary question on DOF of multiple joint and the sliding joint

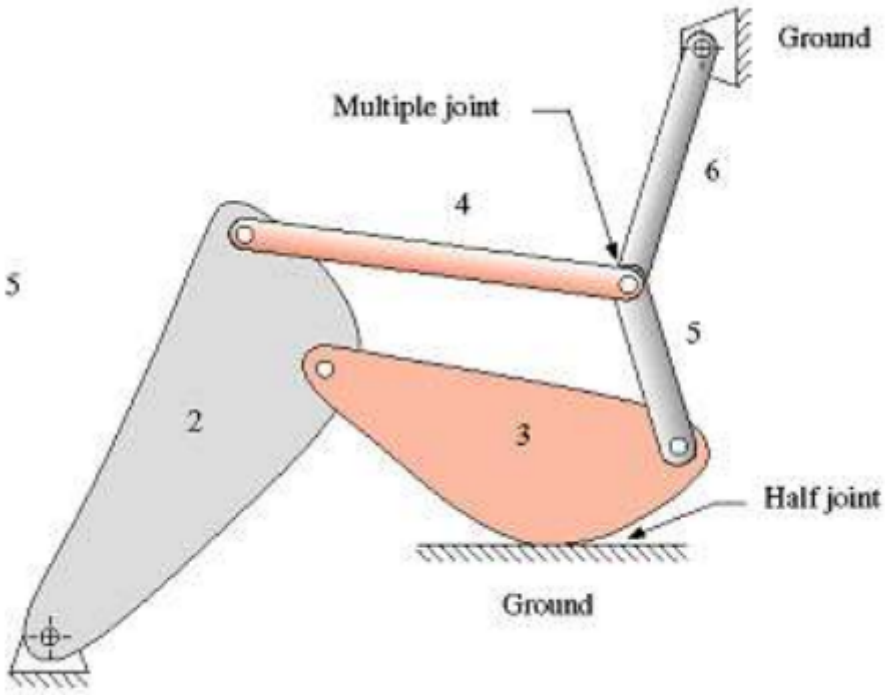


$L = 8$, $J_1 = 10$ and $J_2 = 0$

$DOF = 3(L-1) - 2J_1 - J_2 = 1$

EX 2.4

an ordinary question on DOF of multiple joint and the joint on cam



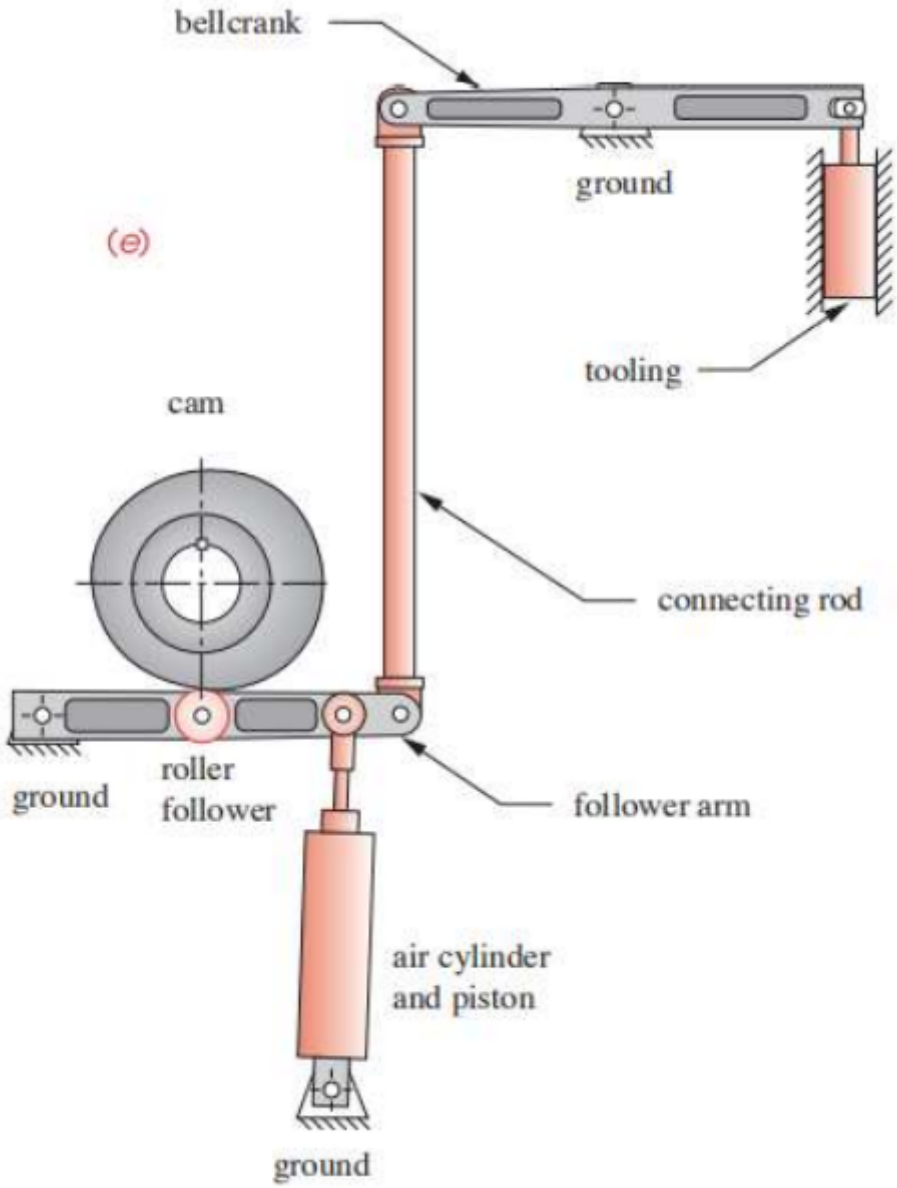
$L = 6$, $J_1 = 7$ and $J_2 = 1$

$DOF = 3(L-1) - 2J_1 - J_2 = 0$

> it's really hard to form a general model from the particular existences

EX 2.5

tricky problem in the homework 1



Link:

1. Ground
2. Follower Arm
3. **Roller Follower**
4. **Cam**
5. Piston
6. Air Cylinder
7. Connecting Rod
8. Bell Crank
9. **Short Slider** (lies in the end of the bell crank)
10. Tooling (sliding on the ground)

Full Joint:

1. joint of L_1 and L_2
2. joint of L_2 and L_3
3. joint of L_4 and L_1
4. joint of L_3 and L_4 (the rotation is the pure rotation)
5. joint of L_2 and L_5
6. joint of L_5 and L_6 (sliding joint)
7. joint of L_6 and L_1

8. joint of L_2 and L_7
9. joint of L_7 and L_8
10. joint of L_8 and L_1
11. joint of L_8 and L_9 (sliding joint)
12. joint of L_9 and L_{10}
13. joint of L_{10} and L_1

Notation: if the rotation between the cam and other links is the pure rotation, then the joint between them is the full joint

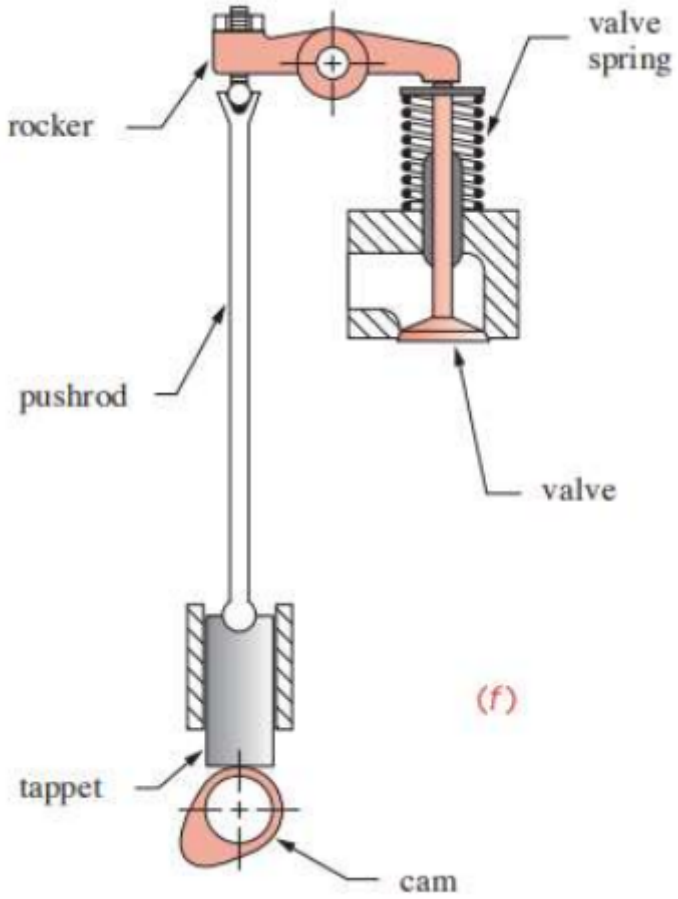
Half Joint

None

$DOF = 3(L-1) - 2J_1 - J_2 = 1$

EX 2.6

tricky problem in homework



Link

1. Ground
2. Cam
3. Tappet
4. Push Rod
5. Rocker
6. Valve

Full Joint

1. joint of L_1 and L_2
2. joint of L_3 and L_1 (sliding joint)
3. joint of L_3 and L_4
4. joint of L_4 and L_5
5. joint of L_5 and L_1
6. joint of L_6 and L_1 (sliding joint)

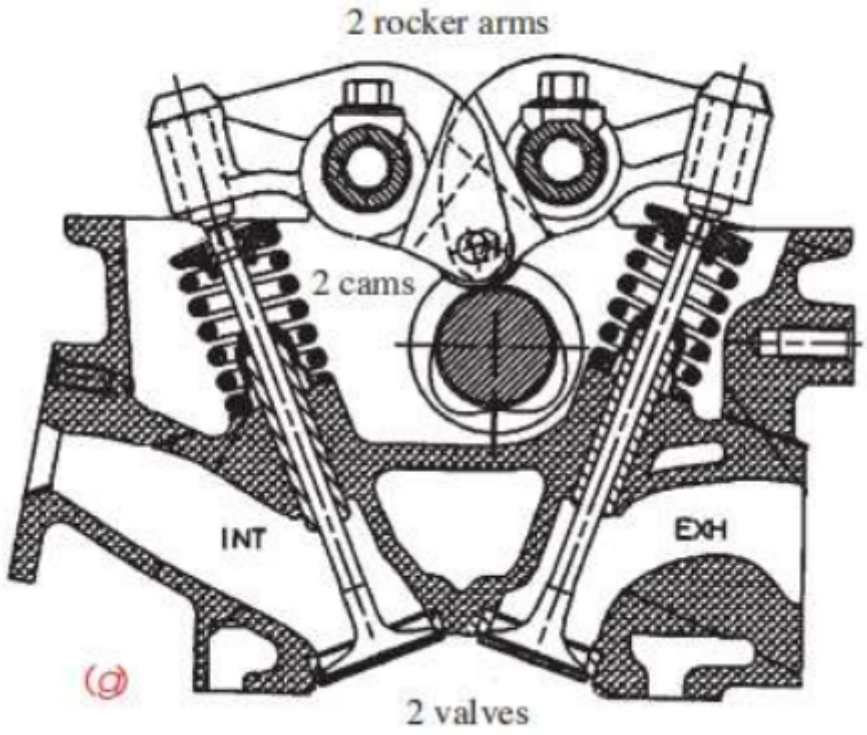
Half Joint

1. joint of L_2 and L_3
2. joint of L_5 and L_6

$DOF = 3(L-1) - 2J_1 - J_2 = 1$

EX 2.7

the hard question in homework



Link

1. Ground
2. Cams (cams fixed in the same position)
3. Roller Follower 1
4. Roller Follower 2
5. Rocker Arm 1
6. Rocker Arm 2
7. Valve 1
8. Valve 2

Full Joint

1. joint of L_1 and L_2
2. joint of L_2 and L_3
3. joint of L_2 and L_4

4. joint of L_3 and L_5
5. joint of L_4 and L_6
6. joint of L_5 and L_1
7. joint of L_6 and L_1
8. joint of L_7 and L_1 (sliding joint)
9. joint of L_8 and L_1 (sliding joint)

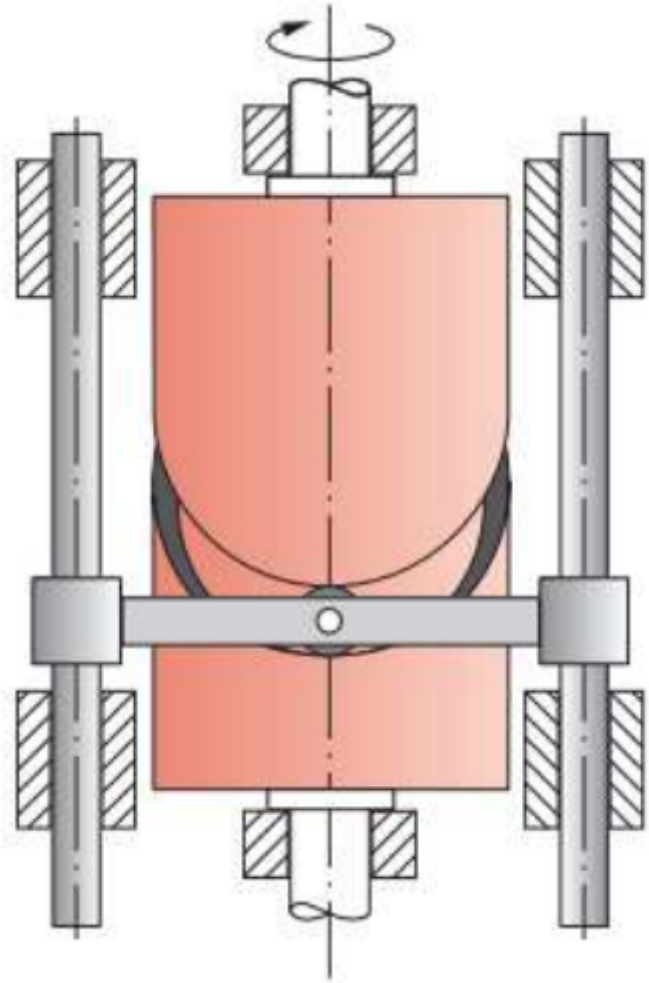
Half Joint

1. joint of L_5 and L_7
2. joint of L_6 and L_8

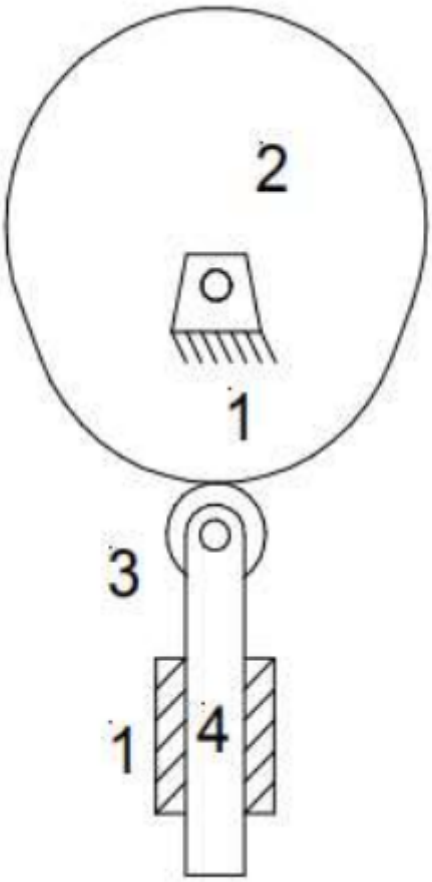
$DOF = 3(L-1) - 2J_1 - J_2 = 1$

EX 2.8

a tricky question in the homework



Notation: It can be simplified as the rotation of cam and the Up and down reciprocating movement of connecting rod with the attached roller follower



Link

1. Ground
2. Cam
3. Roller Follower
4. Connecting Bar

Full Joint

1. joint of L_1 and L_2
2. joint of L_2 and L_3
3. joint of L_3 and L_4
4. joint of L_4 and L_1

Half Joint

None

$DOF = 3(L-1) - 2J_1 - J_2 = 1$