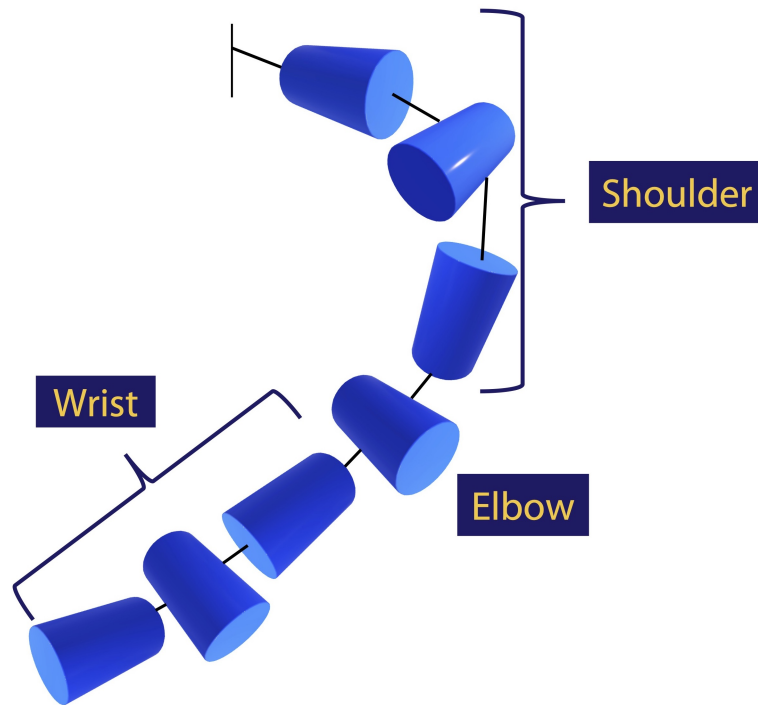**Question 1.** Consider a robot arm with seven degrees of freedom (DOFs) that mimics the seven degrees of freedom (DOFs) of the human arm (Three rotational degrees of freedom (DOFs) for the shoulder, one rotational degree of freedom (DOF) for the elbow, and three rotational degrees of freedom (DOFs) for the wrist):
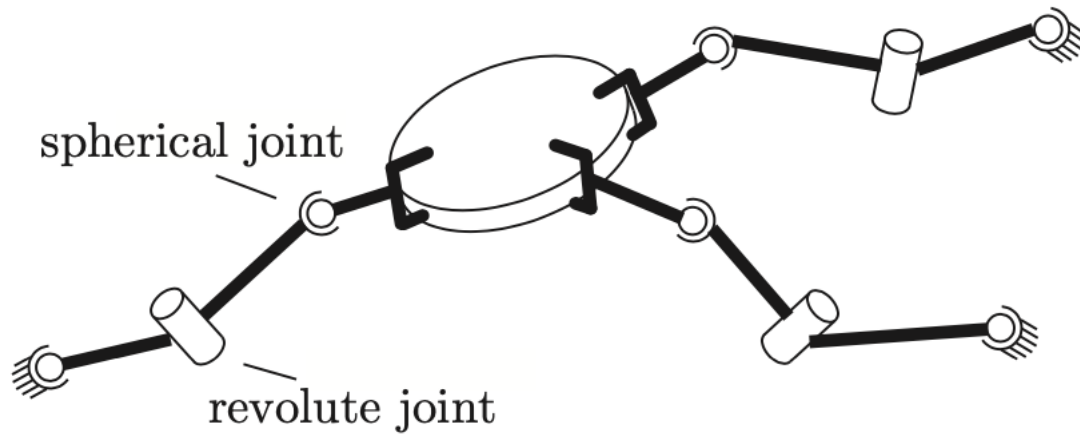

And assume that this robot should carry a tray with drinks on it. The drinks should not be spilled from the tray.
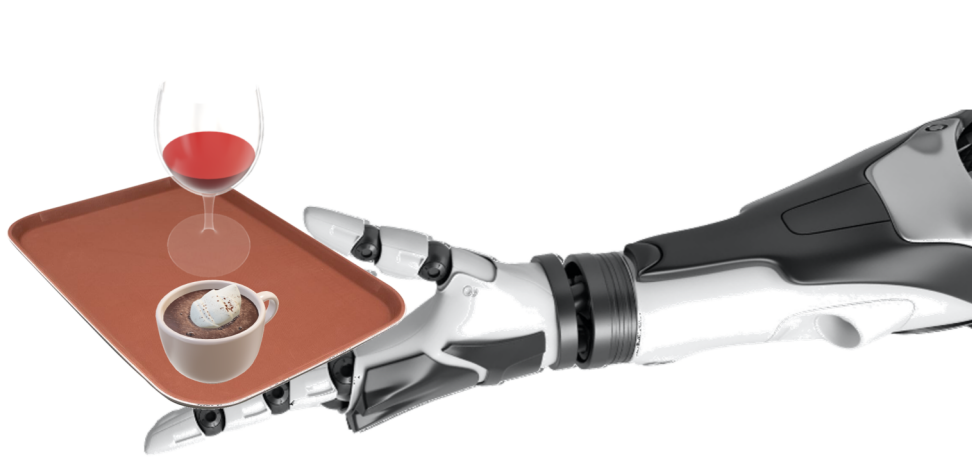
How many DOFs does the robot arm have while satisfying this constraint?

Question 2. Grubler's formula. Three identical SRS open-chain arms are grasping a common object, as shown in the following figure:

(a) Find the number of degrees of freedom of this system. (answer = 9)

(b) Suppose there are now a total of n such arms grasping the object. How many degrees of freedom does this system have? (answer = n + 6)

(c) Suppose the spherical **wrist** joint in each of the n arms is now replaced by a universal joint. How many degrees of freedom does this system have? (answer = 6)