

Chapter 1 Solutions for Introduction to Robotics

```
1. do the following seven times {  
    playerCounter = 1  
  
    do the following four times {  
        open gripper  
        move to P_deck  
        close gripper  
        move to P_playerCounter  
        playerCounter = playerCounter + 1  
    } // end four-times loop  
}  
} // end seven-times loop
```

2. Mechanical manipulators: welding robots on automotive assembly lines, wafer-handling robots in semiconductor manufacturing, parallel-platform robots for flight simulators
Fixed automation machines: container filling at bottling plant; automatic car wash; printing, cutting, and folding of newspapers

3. A rigid body in space has six *degrees of freedom*. It's free to translate in three directions and to independently rotate about each of those three axes.

4.

$${}^AP_3 = \sin(\pi/6) \begin{bmatrix} 3 \\ 1 \\ 5 \end{bmatrix} + \cos(\pi/3) \begin{bmatrix} 2 \\ 6 \\ 9 \end{bmatrix} = \begin{bmatrix} 2.5 \\ 3.5 \\ 7.0 \end{bmatrix}$$

5. Below are some possible considerations when using motors at joints

Pros:

- Simple design
- Low maintenance requirement

Cons:

- More moving mass $\rightarrow$ larger motors required
- Greater inertia effects

Robotics Craig Solution Manual

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