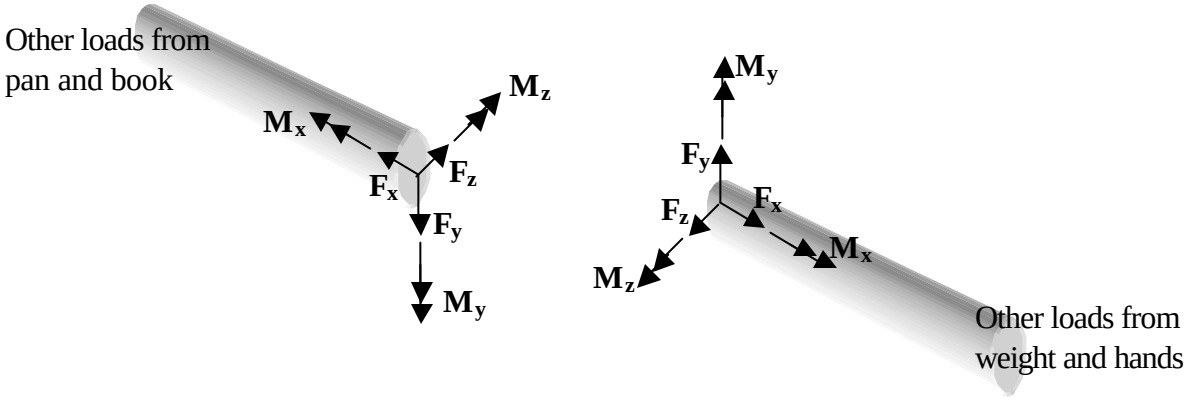
24-261 Statics October 2, 2001
Problem Set #6 Due: October 9, 2001

1. Consider the solutions from Problem Set #3 (http://www.andrew.cmu.edu/~lkara/hwksolution/sol3.pdf) for Configuration #3 of the snow shovel. Determine the internal loads in the cross-section of the stick 10" toward the pan from the 3lb force. Do this by redrawing the two parts of the shovel divided at the above cross-section. Acting on the left half will be the 4 lb due to the book and the 2 lb due to the pan. Acting on the right half will be the 3 lb due to the weight and the forces and moments exerted by the hands. In addition there are internal loads, which are now discussed.

At the cut cross-section you should draw the unknown internal loads as shown below. Since these two parts were rigidly attached, all forces and moments could be exerted by each part on the other. The internal forces and moments drawn on one part of the stick and labeled F_x, etc., represent the force and moment exerted by the other part of the stick. Since the two parts of the stick interact with each other across this cross-section, they produce equal and opposite forces and moments on each other. This is represented by the directions of the arrows. If, for example, the force F_x turns out to be negative, then the directions of both vectors associate with F_x would be in the reverse direction.



?? Complete the free body diagram of the right part with the other applied forces. Use the equations of equilibrium to determine all the internal loads.

?? Complete the free body diagram of the left part with the other applied forces. Use the equations of equilibrium to determine all the internal loads.

?? Check that the values internal loads F_x, et., found from analyzing the left part agree with those found from analyzing the right part.

?? Of the non-zero internal moments, consider each one and indicate whether it causes bending or twisting.