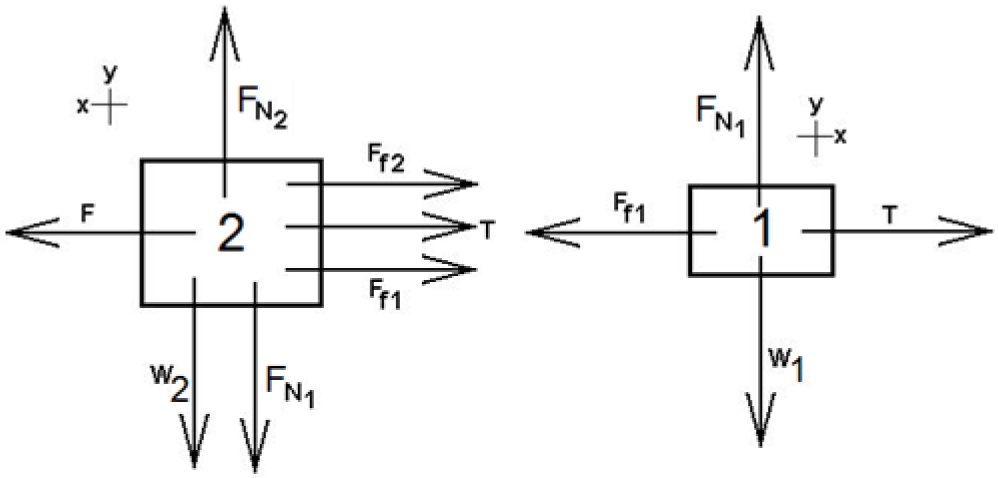
4-6

Draw a free-body-diagram for each block:



Note that I have use the 'fractured' co-ordinate system discussed in class.

For Block Two, F_{N2} is the normal force exerted by the table, F_{N1} is the normal force exerted by Block One, F_{f2} is the frictional force exerted by the table, and F_{f1} is the frictional force exerted by Block One. W_2 is the weight of Block Two, F is the applied force, and T is the tension in the string.

For Block One, T is the tension in the string, F_{f1} is the frictional force from Block Two, F_{N1} is the normal force from Block Two, W_1 is the weight of Block One.

The tensions should be the same.

We also know that $W_1 = gM_1 = 10*14 = 140N$, $W_2 = gM_2 = 10*42 = 420N$, and $\mu_K = 0.3$ at each interface. Also, since the blocks move at constant velocity, all accelerations are zero.

Write NII for each block in each direction:

$\Sigma_n F_n = ma.$

Block Two	Block One
x: $F - F_{f1} - F_{f2} - T = m_2a_x = 0$	x: $T - F_{f1} = m_1a_x = 0$
y: $-F_{N1} + F_{N2} - gM_2 = m_1a_y = 0$	y: $F_{N1} - gM_1 = m_1a_y = 0$

$F_{f1} = \mu_K F_{N1}$ and $F_{f2} = \mu_K F_{N2}$

Solve for F and start substituting:

$F = F_{f1} + F_{f2} + T = F_{f1} + F_{f2} + F_{f1} = F_{f2} + 2F_{f1} = \mu_K F_{N2} + 2\mu_K F_{N1} = \mu_K(F_{N2} + 2F_{N1}) =$

$\mu_K(F_{N1} + W_2 + 2F_{N1}) = \mu_K(W_2 + 3F_{N1}) = \mu_K(gM_2 + 3gM_1) = 0.3(420 + 3*140) =$ 252 N