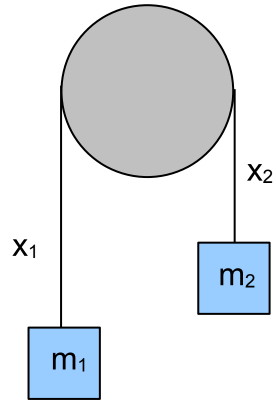
1,2,3) Consider the 2-body Atwood machine given as an example in Chapter 1 (problem 2, page 27), We are going to solve this many different ways.

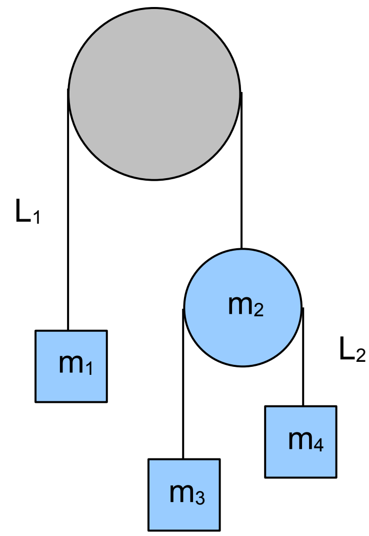


1) Solve this problem using Newton's 2nd equation: F=ma for {a, T}, the acceleration of the masses and the tension T.

2) Solve this again, but use the Lagrangian method (as illustrated in your book) with ONE independent variable by using x1+x2=L, therefore x2=L-x1.

3) Solve this again, but use the Lagrangian method (as illustrated in your book) with TWO independent variables, {x1,x2}. This time you will use a constraint equation x1+x2=L and introduce a Lagrange multiplier λ. Solve for {a1,a2,λ}

4) An Atwood machine is built as follows: A string of length L1 passes over a fixed light pulley supporting a mass m1 on one end and a pulley of mass m2 (negligible moment of inertia) on the other. Over this second pulley passes a string of length L2 supporting a mass m3 on one end and m4 on the other where m3 ≠ m4. Set up Lagrange's equations for this system using the method of Lagrange multipliers. Use as coordinates the (not independent) distances of the four masses from the fixed pulley $(x1, x2, x3, x4)$. Solve for the two forces of constraint and show that the mass m1 remains in equilibrium if:



$$m1 = m2 + m3 + m4 - \frac{(m3 - m4)^2}{(m3 + m4)}$$

5) Given that the kinetic energy is T= (½) m v^2 (where velocity v=x') and the potential energy is $U = e\phi - \frac{e}{c}\vec{A} \circ \vec{v}$ where ϕ is a scalar potential and A is a vector potential which depends on x. Compute the equations of motion.