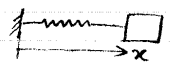
Common errors in #1 — TAM 203, SPRING 2000 — Prelim 1

(a)

1) FBD shouldn't include initial conditions. For writing the equation of motion, the FBD should be drawn for an arbitrary position 

X

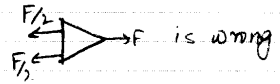
2) Set up the axes & write consistent equations
eg: $m\ddot{x} = kx$ X

3) 

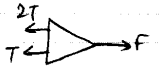
If x is defined this way, the differential equation reduces to $m\ddot{x} + kx = kx_0$ ($x_0 \rightarrow$ relaxed length) and the initial condition @ $t=0$ is $x = x_0 + d$.
It not $x = d$.

(b) 

1) $F \neq ma_A$ $\qquad F \neq ma_B$
when writing the LMB acceleration is the acceleration of the man

2) FBD of 1 

is wrong

it should be 

because the same string passes through all pulleys so the tension is same.

3) Constraint equation shouldn't be written with respect to a moving point

(c)

1) No numerical values should be seen in the code (as mentioned in problem)

2) NO FBD, NO LMB

3) A = [uAB uAC uAD] and not

A = [uAB ; uAC ; uAD] this was given as a Hint in the problem

4) Following are the commands which are correct

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T = A\(m*a)
T = inv(A) * m*a
T = A^-1 * m * a
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or if rref was used then

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X = [A m*a]
C = rref(X) ; T = C(:,4)
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Common errors in Problem #2 — Page ___

1. no FBD ⇒ no mechanics
2. The direction of the drag force is unclear on the free body diagram.
3. There is no coordinate system to show directions of forces, accelerations, etc.
4. Scalar ≠ Vector !
5. Velocity and acceleration terms are incorrectly written, e.g.

$\underset{\sim}{v} \neq x\hat{\imath} + y\hat{\jmath}$, $|\underset{\sim}{v}| \neq \sqrt{(\dot{x}\hat{\imath})^2 + (\dot{y}\hat{\jmath})^2}$

$\underset{\sim}{a} \neq \ddot{x}(\hat{\imath} + \hat{\jmath})$ - Nonsense!

6. Answers shouldn't be left in terms of $\sin\theta$, $\cos\theta$, & $|\underset{\sim}{v}|$. You must define these in terms of $\dot{x}, \dot{y}, x$, and y.
7. You musn't draw the FBD and perform LMB on a system at a specific time. You must be able to apply LMB at any time during the motion.
8. There were numerous errors in solving the equations of motion by hand
   a) $\ddot{x} + \frac{c}{m}\dot{x} = 0$ is not the simple harmonic motion equation
   b) completely nonsensical integration
   e.g. $\frac{dv}{dt} = -\frac{c}{m}v \not\Rightarrow v = -\frac{c}{m}vt + A$
   c) For those who solved the y-eqn. by summing the homog. & particular solns., the ICs must be used to find the integration constants for the entire soln., not just the homog. part.
   d) various algebraic errors in finding constants of integration or in evaluating definite integrals
9. Matlab errors (if you tried this)
   a) various syntax errors, e.g.
   » plot(z(1), z(2)) should be
   » plot(z(:,1), z(:,2)) to plot, say, y vs. x
   b) The derivative file must return a column vector.
   c) Looking at a plot or at the output is an approximation in finding h.

Common mistakes for problem #3

a) ① Write down $S = \frac{1}{2}at^2$ without justifying the reason

② Neglect the fact that acceleration is the 2nd derivative of displacements hence there should be two const. $s(0)$, $v(0)$, although in this problem they are zero. [If you write Δs then it's all right without specifying $s(0)$]

b) ① In the FBD, draw the friction force in the backward direction. This problem is an accelerating problem, not a breaking one.

② Treat the problem as a static one, that is to say the total moment is zero with respect to every point. That's wrong only to a few points, i.e. center of the mass, the total moment is zero

③ Some sign errors for calculating the moments.