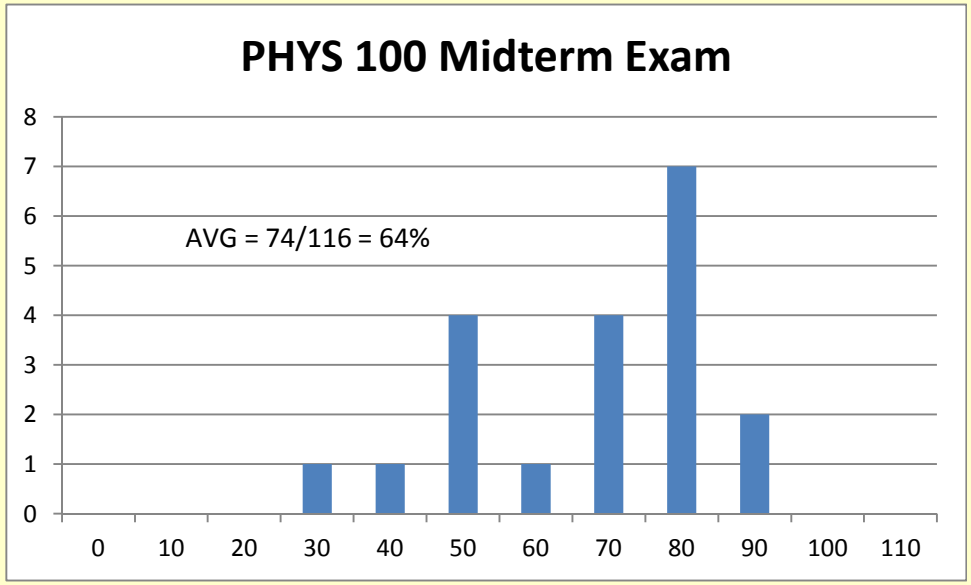
PHYS 100
Recap of Midterm Exam



What Will We Do for the Rest of the Semester?

Music

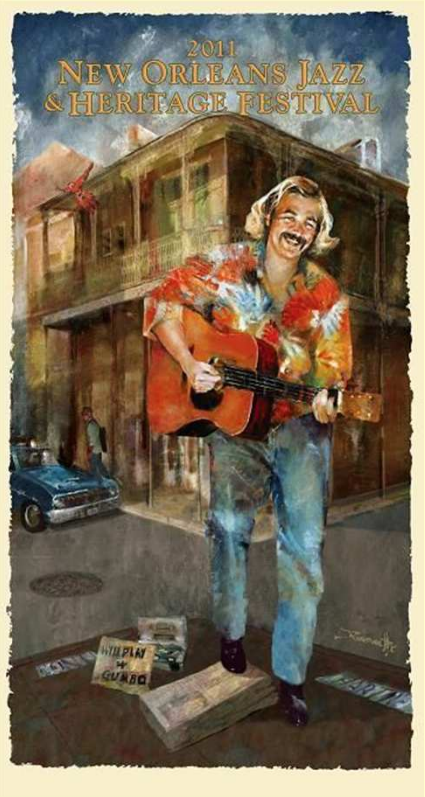
Who is the Artist?

A) Delbert McClinton
B) Elvis Costello
C) Jimmy Buffett
D) Randy Newman
E) John Prine

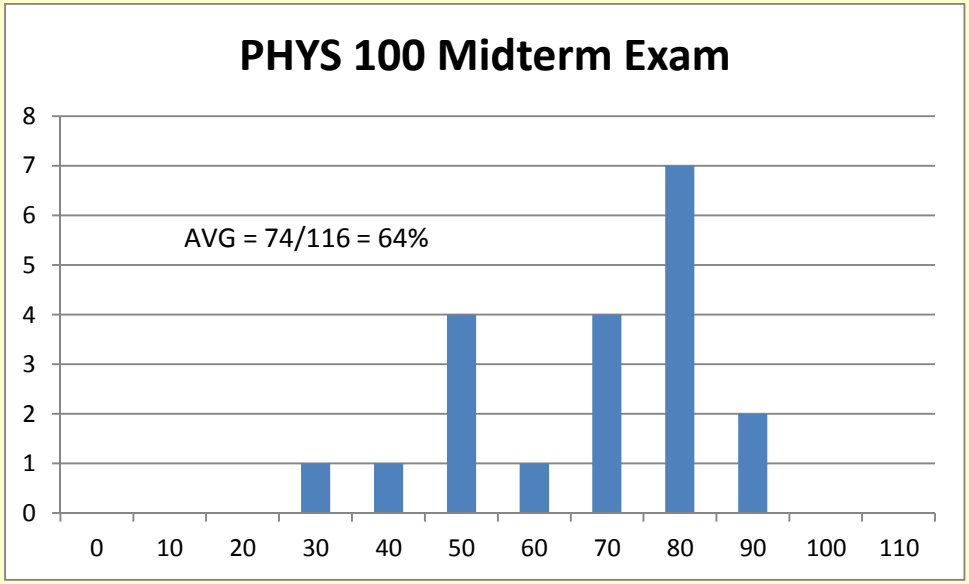
Why?
Spring Break?? Parrotheads??

Easing away from New Orleans ..

Though he is the Jazzfest Poster this year and he will play



Midterm Exam Results



The "One-Hour" Option

- We have reused previous PHYS 100 exam questions that have been shown to correlate well with later performance in PHYS 211.
- We have approved a few of the current PHYS 100 students to drop down to one hour credit if they choose and have informed them by e-mail.

WHAT DOES THIS MEAN?
Let's talk about it on the next slide

Where To From Here?

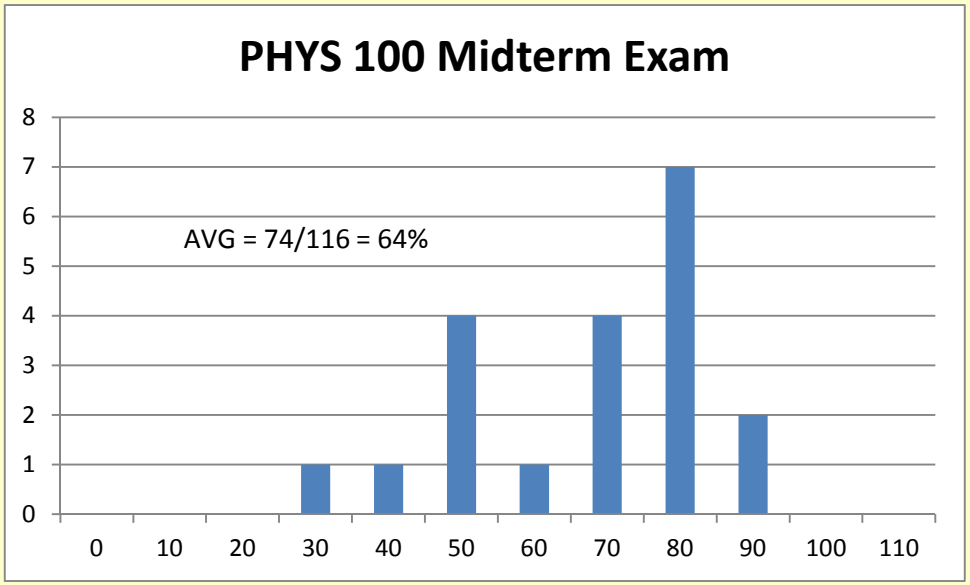
Midterm Exam:

- **You should NOT be discouraged by a low score on the midterm!**
  - This is information without GPA consequences !!!!
  - In remaining 5 weeks, we only have one week of new material
  - We will spend most of our time solving problems on material that we have already covered.
- **If you continue to do the work, your grade will be OK**
  - Midterm counts for 15% (Final Exam counts for 20%)
  - I grade leniently (at least one grade higher than in 211)

PHYS 100 (2 credit hours) for remainder of term:

- **One more bit of content to cover all topics in PHYS 211 first hour exam**
  - Springs & Universal Gravitation (week of April 4)
- **All other weeks**
  - No Prelectures (no new content)
  - Preflights will be required though to help focus the Lectures

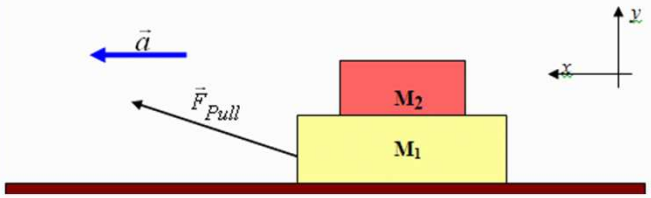
Midterm Exam:



What Were The Most Difficult Questions?

7. In the figure below, a block of mass, M_1, is being pulled across a frictionless table. A second blc of mass, M_2, rests on top of block M_1. Both blocks are accelerating to the left with a magnitude of

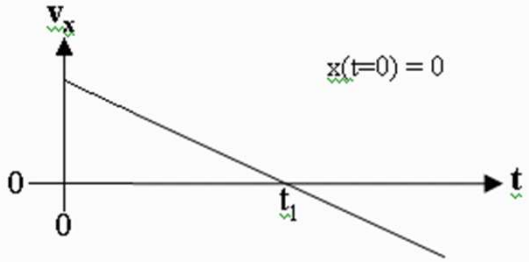
45%



Identify all the forces acting on M_2 that have components along the x-axis.

(a) There are no forces acting on M_2 along the x-axis
(b) Static friction
(c) Static friction and M_2a
(d) Static friction and F_{Pull}
(e) Static friction, F_{Pull}, and M_2a

The velocity of an object that moves along the x-axis is shown in the plot below. At time t=0, the object's position was x=0.



45%

10. Which of the following statements concerning the determination of the value of t_1 is true?

(a) The time t_1 can be correctly calculated knowing only the acceleration and the position at time t = 0.

(b) The time t_1 can be correctly calculated knowing only the acceleration and the x-component of the velocity at time t = 0.

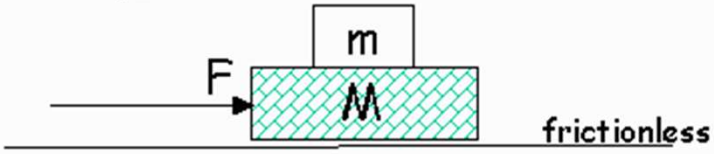
(c) The time t_1 can be correctly calculated knowing only the position and the x-component of the velocity at time t = 0.

20. A boat is traveling at 15 m/s North on a still lake. The boat carries a harpoon gun that fires harpoons at 40 m/s. If the captain fires a harpoon with the gun pointed 30 degrees East of North, how fast will the harpoon be travelling with respect to the water?

(a) 25 m/s
(b) 37.1 m/s
(c) 40 m/s
(d) 53.5 m/s
(e) 55 m/s

42%

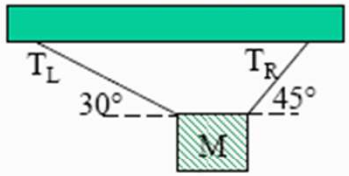
18. A block of mass $m = 1$ kg rests on another block of mass $M = 3$kg as shown below. A constant force $F = 14$ N is applied to the bottom block and both blocks are observed to move together with constant acceleration along a frictionless floor. The coefficient of static friction between the two blocks is $\mu_S = 0.45$.



42%

What is the magnitude of the force f_{monM}, the frictional force the top block (m) exerts on the bottom block (M)?

A sign of mass M = 5 kg is suspended from the ceiling. The string on the right is connected to the sign such that it makes an angle of 45° with respect to the horizontal. The string on the left is connected to the sign such that it makes an angle 30° with respect to the horizontal.



40%

16. How does T_L, the tension in the left string, compare to T_R, the tension in the right string?

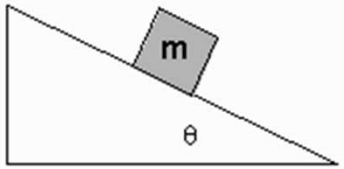
(a) $T_L < T_R$
(b) $T_L = T_R$
(c) $T_L > T_R$

17. What is T_L, the tension in the left string?

(a) $T_L = 24.5$ N
(b) $T_L = 28.3$ N
(c) $T_L = 35.9$ N
(d) $T_L = 40.6$ N
(e) $T_L = 49.0$ N

40%

4. An inclined plane makes an angle θ with respect to horizontal. A box of mass *m* sits at rest on the ramp, held in place by friction. The coefficient of static friction is μ. What is the magnitude of *f*, the frictional force exerted by the ramp on the box?



40%

(a) $f = mg \sin\theta$
(b) $f = mg \cos\theta$
(c) $f = \mu mg \cos\theta$

3. Two drag cars race. They line up at the starting line at rest. The winning car accelerates at a constant rate ***a*** and reaches the finish line with a final velocity ***v***. The losing car accelerates at a constant rate ***a/2***. How far had the losing car traveled, ***d***, when the winning car crossed the finish line?

(a) $d = \frac{2v^2}{a}$
(b) $d = \frac{v^2}{a}$
(c) $d = \frac{v^2}{2a}$
(d) $d = \frac{v^2}{4a}$
(e) $d = \frac{v^2}{8a}$

39%

HOW WOULD I CLASSIFY THESE PROBLEMS ??

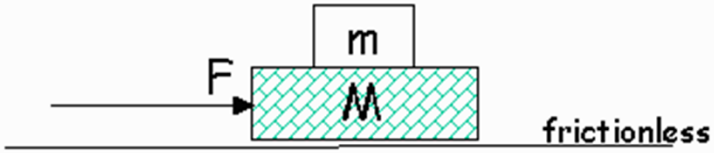
- Multi-Body Problems
- Symbolic Problems
- Math to English Problems
- Relative Motion
- Static Friction

NOTE: ONLY TWO OF MY CLASSIFICATIONS ARE SPECIFICALLY PHYSICS:
STATIC FRICTION & RELATIVE MOTION

WE WILL DEAL EXPLICITLY
WITH ALL OF THESE SOURCES
OF PROBLEMS IN REMAINING
WEEKS OF PHYS 100

MULTI-BODY PROBLEMS

18. A block of mass $m = 1$ kg rests on another block of mass $M = 3$kg as shown below. A constant force $F = 14$ N is applied to the bottom block and both blocks are observed to move together with constant acceleration along a frictionless floor. The coefficient of static friction between the two blocks is $\mu_S = 0.45$.



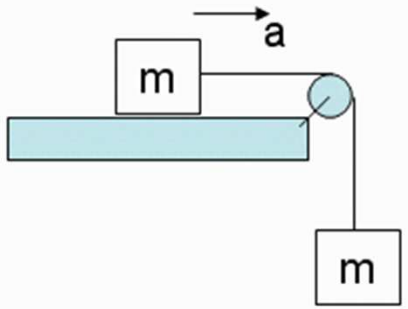
42%

What is the magnitude of the force f_{monM}, the frictional force the top block (m) exerts on the bottom block (M)?

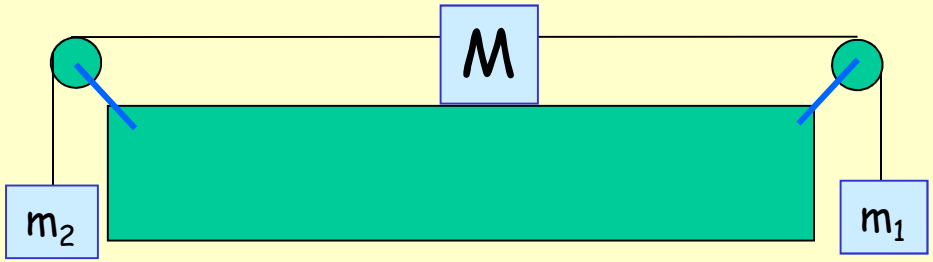
2. A block of mass m is connected by a string over an ideal pulley to another block of mass m as shown. The two blocks have acceleration a. Which of the following statements describes the tension T in the string? ($g = +9.81$ m/s^2)

(a) T < mg
(b) T = mg
(c) T > mg

55%



EXAMPLE: MULTI-BODY PROBLEMS



Suppose $m_1 > m_2$

What is the net force F on the mass M?

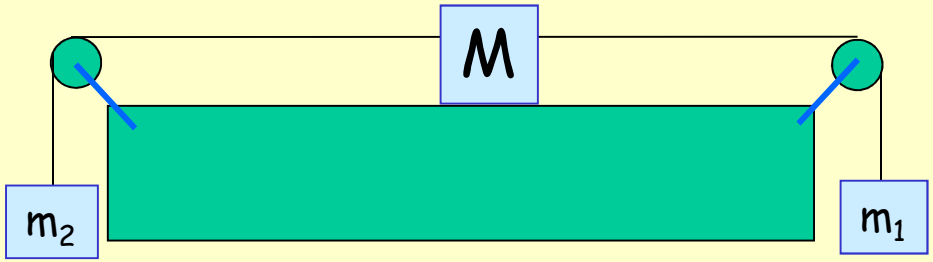
A) $F < (m_1 - m_2)g$

B) $F = (m_1 - m_2)g$

C) $F > (m_1 - m_2)g$

EXAMPLE: MULTI-BODY PROBLEMS

BB



Suppose $m_1 > m_2$

What is the net force F on the mass M?

A) $F < (m_1 - m_2)g$

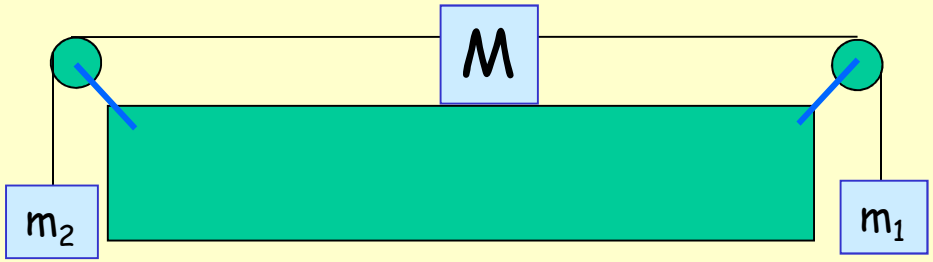
B) $F = (m_1 - m_2)g$

C) $F > (m_1 - m_2)g$

What is the confidence level of your answer?

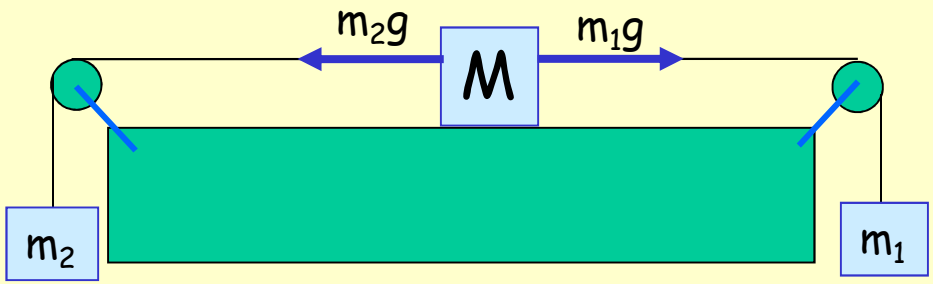
A) PRETTY SURE IT'S RIGHT
B) PROBABLY RIGHT
C) UNSURE (GUESS?)

EXAMPLE: MULTI-BODY PROBLEMS



Suppose $m_1 > m_2$

This is tempting:

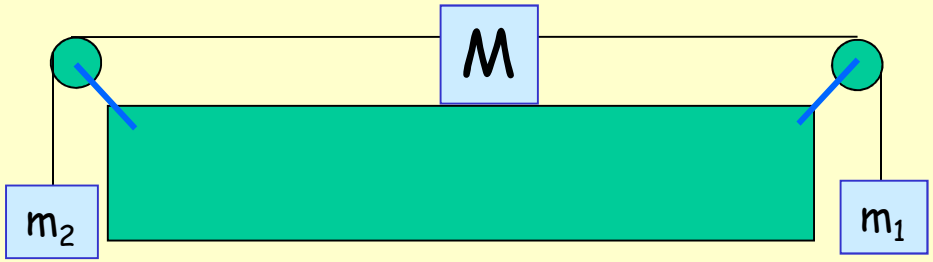


$$F = (m_1 - m_2)\, g$$

HOW DO WE KNOW IF THIS IS RIGHT ???

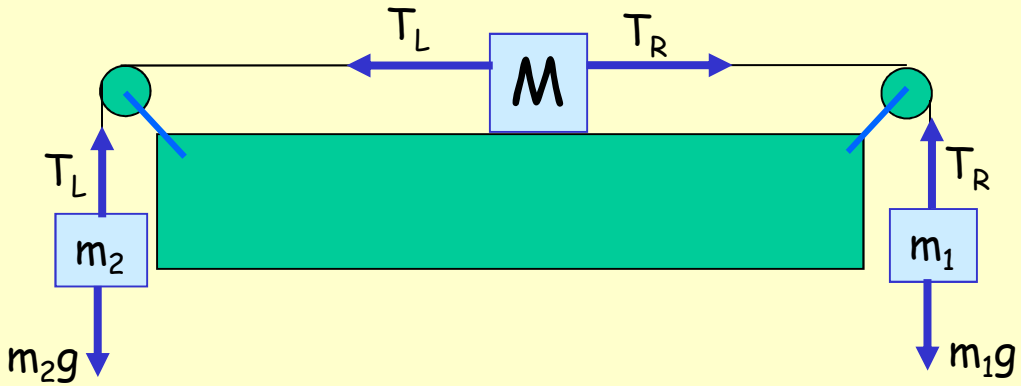
EXAMPLE: MULTI-BODY PROBLEMS

BB



Suppose $m_1 > m_2$

FREE-BODY DIAGRAMS



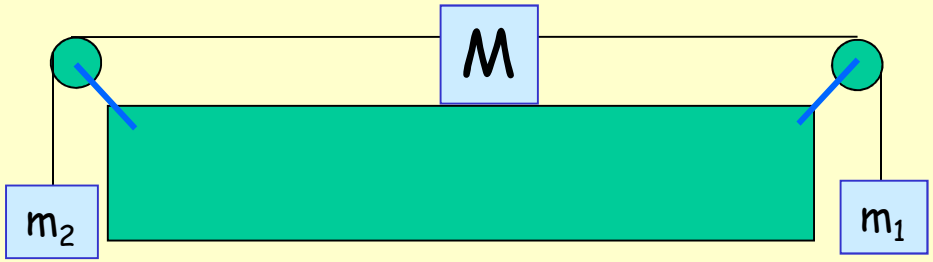
A) $T_R < T_L$

B) $T_R = T_L$

C) $T_R > T_L$

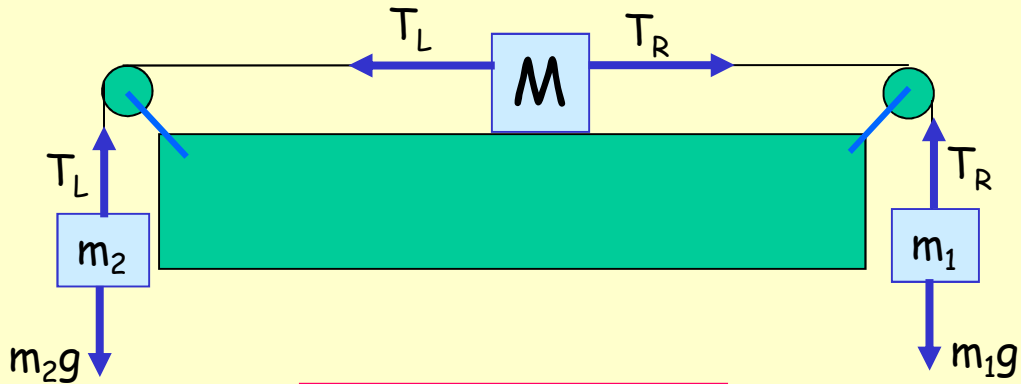
EXAMPLE: MULTI-BODY PROBLEMS

BB



Suppose $m_1 > m_2$

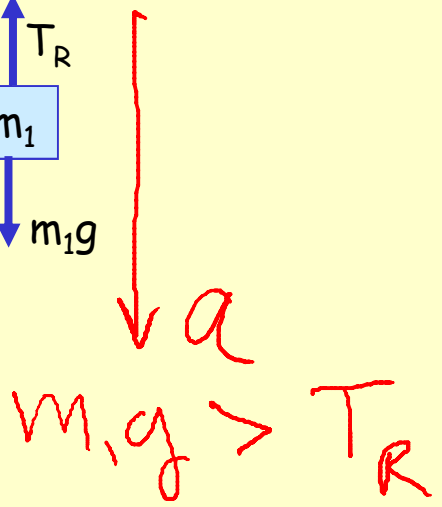
FREE-BODY DIAGRAMS



A) $T_R < m_1g$

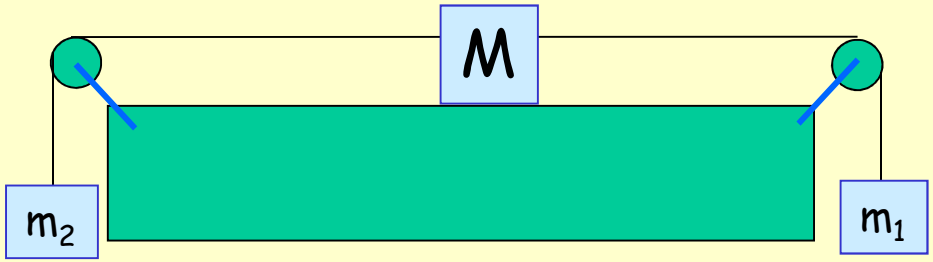
B) $T_R = m_1g$

C) $T_R > m_1g$



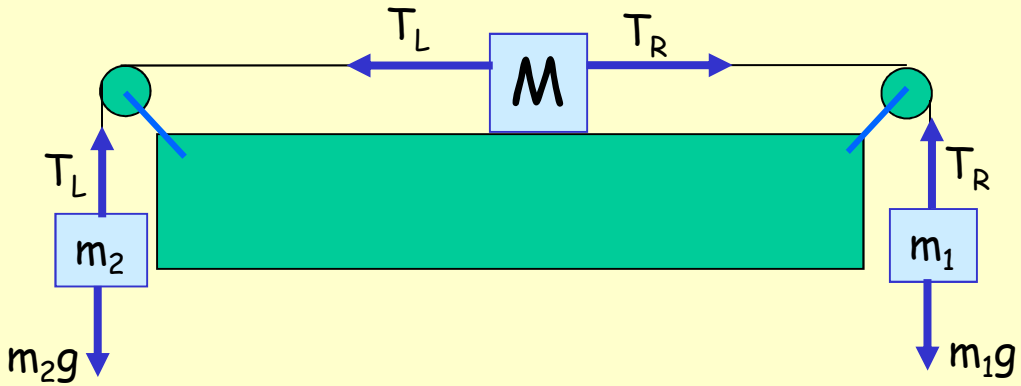
EXAMPLE: MULTI-BODY PROBLEMS

BB



Suppose $m_1 > m_2$

FREE-BODY DIAGRAMS



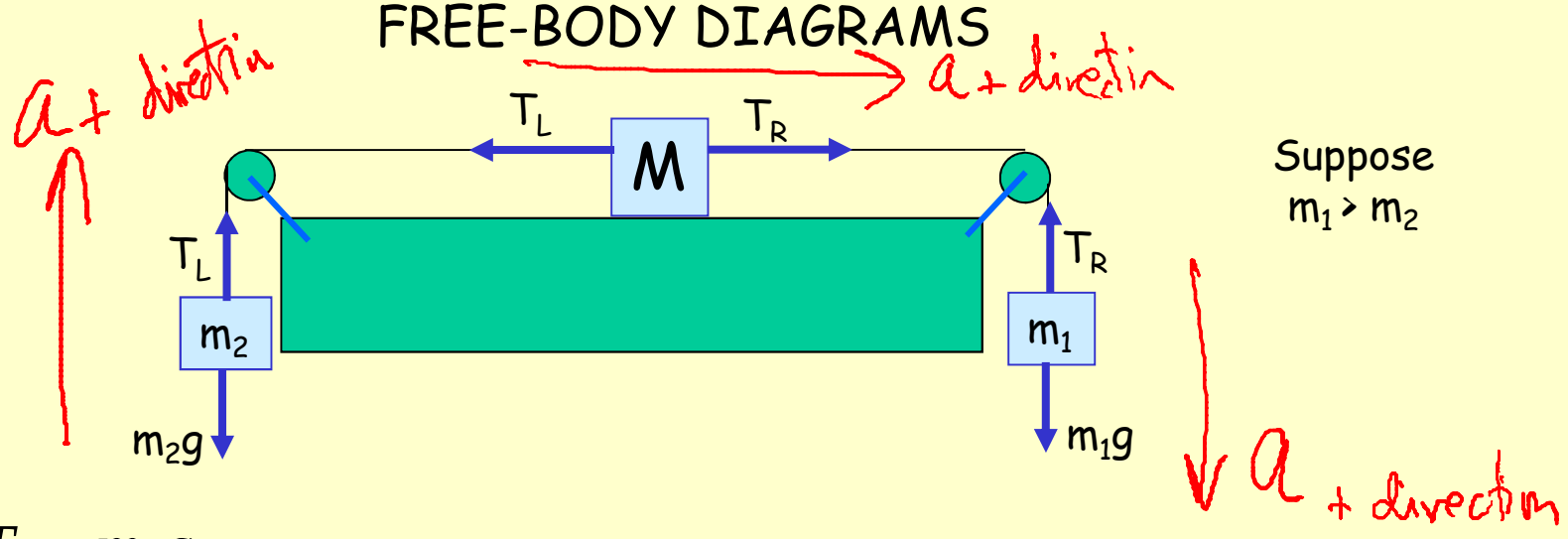
A) $T_L < m_2g$

B) $T_L = m_2g$

C) $T_L > m_2g$

SOLUTION

FREE-BODY DIAGRAMS



$$m_1 g - T_R = m_1 a$$

$$T_L - m_2 g = m_2 a$$

$$T_R - T_L = Ma$$

$$T_L - T_R = (m_1 + m_2)a - (m_1 - m_2)g$$

$$0 = (m_1 + m_2)a - (m_1 - m_2)g + Ma$$

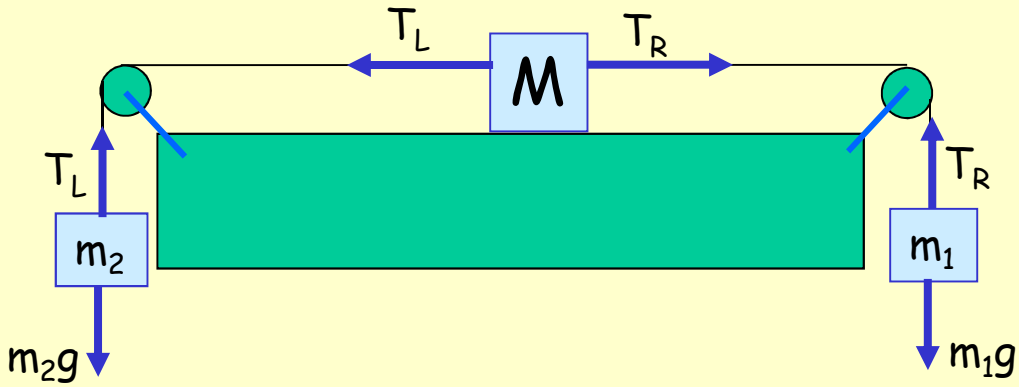
$$a = \frac{m_1 - m_2}{M + m_1 + m_2} g$$

$$T_R = m_1 g \left(\frac{M + 2m_2}{M + m_1 + m_2} \right) < m_1 g$$

$$T_L = m_2 g \left(\frac{M + 2m_1}{M + m_1 + m_2} \right) > m_2 g$$

SOLUTION

FREE-BODY DIAGRAMS



Suppose $m_1 > m_2$

$$T_R = m_1 g\left(\frac{M+2m_2}{M+m_1+m_2}\right) < m_1 g \qquad T_L = m_2 g\left(\frac{M+2m_1}{M+m_1+m_2}\right) > m_2 g$$

$$T_R - T_L = Mg\left(\frac{m_1-m_2}{M+m_1+m_2}\right)$$

$$T_R - T_L = (m_1-m_2)g\left(\frac{M}{M+m_1+m_2}\right)$$

The PLAN

WE WILL DISCUSS ALL OF THESE KINDS OF PROB LEMS

- Multi-Body Problems
- Symbolic Problems
- Math to English Problems
- Independent/Dependent Variables
- Static Friction

WE WILL BE CONCERNED WITH

HOW TO START
HOW TO SOLVE
WHAT IT MEANS