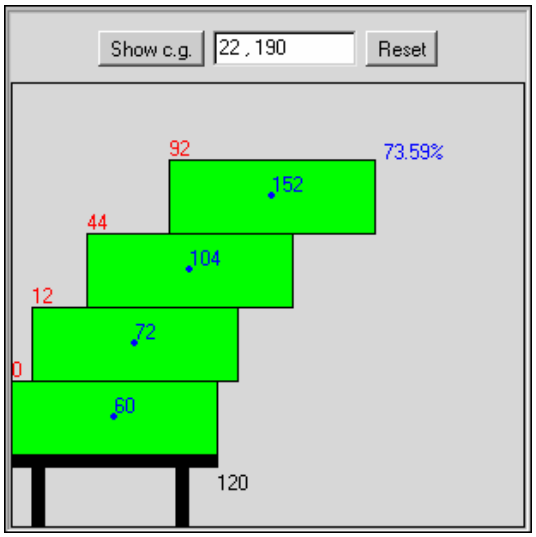
Worksheet for Exploration 13.4: The Stacking of Bricks



How can you stack four uniform bricks (or blocks or meter sticks) one on top of another so that they extend as far over a table as possible and yet remain stable? **Rules:** You can drag and move bricks horizontally with your mouse **(position is given in tenths of inches; hence each brick is a foot long)**. The stability of each brick is color coded:

- **green:** the brick is in stable equilibrium
- **yellow:** the center of gravity of the brick, or a group of bricks, is right above the edge of the supporting brick
- **red:** the brick is unstable; it will fall in real life.

The center of gravity for each brick is shown as a small blue dot. The current mouse position (relative to the top left edge of the table) is shown in the upper part of the animation in the *Text Field*. If you press "show c.g." button, the center of gravity for the brick subsystems (top brick, top two bricks, top three bricks and all four bricks, respectively) will be shown as a small circle with an arrow. The length of the arrow is proportional to the gravitational force for each balanced subsystem. In addition,

The left edge of each brick is in red
The position of the center of gravity of each brick is in blue
The position of the center of gravity is in black when "show c.g." is selected

a. What is the stability condition for an object overhanging a table?
   i. Hint: the "object" is the total mass sitting on the table.

b. How should each brick be positioned relative to the brick underneath it? Be explicit and refer to the center of gravity. Hint: start at the top and work down.

c. Can the top brick have its entire length beyond the edge of the table?

d. Challenge: come up with a mathematical description for the overhang of each individual brick and the total overhang.
    i. Once you have an expression you may be able to determine the farthest to the right that the top brick can be (if you have a large stack of bricks one on top of the other).