Lab 2

Measuring Motion

2.1 Procedure

There are several exercises and you will do them in different orders.

1. Measure the length of the hallway from end to end by pacing it off. Each person in the group should do this three times. Indicate the variation of each person and the variation between people. Devise a way to determine the distance in a more reliable unit. Submit your best guess for the actual distance. The group that gets closest to the right answer gets 5 extra points on their report. All groups that have the right value to within uncertainty also gets 5 extra points on their report.

2. One group at a time, collect 5 pennies. Go outside, up the stairs, to the large flat grassy area (the "quad"). Place all five pennies some place in the grass, all together and write out the location based on the number of paces. Your written instructions should be intended to help somebody actually find the pennies: indicate an "origin", choose a "coordinate system", and give specific clear instructions for where to walk. Your instructions must have at least one right-angle turn, but not more than three right-angle turns. All turns must be right-angles. Your group will have to secretly choose which lab-partner will be pacing off the steps and you are not allow to say *which* person it was. When you return to lab, give your instructions to the professor, who will make copies and distribute them. The assignment is for each group to collect one penny from each "treasure". At the end each group will go outside and find out how many pennies are missing from their buried treasure.

3. Go out in the hallway and find a corner at ground level (just above the vertically oriented bricks).

   - From this location, count five bricks over and fifteen bricks up. Mark that brick with a piece of chalk.

   If our count were off by ± 1 brick for every five bricks, then our measurements are actually 5 ± 1 brick and 15 ± 3 bricks.

   - Repeat your attempt to identify the same brick but this time go over four $(5-1)$ and up twelve $(15-3)$. This is the smallest error.
   - Repeat your attempt to identify the same brick but this time go over six $(5+1)$ and up eighteen $(15+3)$. This is the largest error.

   We might also make mixed errors where one is too large but the other is too small.

   - Repeat your attempt to identify the original brick but this time go over four $(5-1)$ and up eighteen $(15+3)$.
   - Repeat your attempt to identify the original brick but this time go over six $(5+1)$ and up twelve $(15-3)$.

   Identify the size of the region by finding the area of this region in terms of bricks^2, that is, multiply the width of bricks by the height of bricks in this region.

4. Use PASCO to measure your speed.

5. I have a horse who is 17.2 hands. Use the internet to find out if a 17-hand horse is large or small. Determine what this number measures. How many "hands" is your lab table? What is this number in the metric system? Each of these numbers should be accompanied by a measure of the precision.

2.2   Analysis

Determine the length of your pace and convert the pace measurement from your treasure map into meters. If your measurement might vary by one pace for every ten paces, what is the precision of your measurement?

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A PDF version might be found at motion.pdf (57 kB)
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