1. Suppose you measure the length and width of a rectangle, paying attention to how accurately you are measuring. Your results:

$$\text{width } = 3 \text{ feet } \pm .02\% \qquad \text{length } = 6 \text{ feet } \pm .03\%.$$

Notice that the margins of error have not been converted from percent to decimal yet they're just very very small margins of error.

   (a) Find the value of the ratio of the measured length to the measured width.

   (b) Find the error range for the ratio of the actual length to the actual width; that is, find a range of values that the *actual* ratio of length to width could fall in.

   Remember: the errors are percents, so you'll need to calculate what the actual error range is. Express your answer in the form: *(smallest possible value you found)* $\leq$ actual ratio $\leq$ *(largest possible value you found).*

   (c) What's the furthest off from the measured ratio the *actual* ratio could be? Express your answer as a percent: *The actual ratio could be no more than* _____*% off from the measured ratio."*

2. Consider a single house in Herculaneum, *The House of the Tuscan Colonnade*, also analyzed by the Watts. The floor plan is shown below.

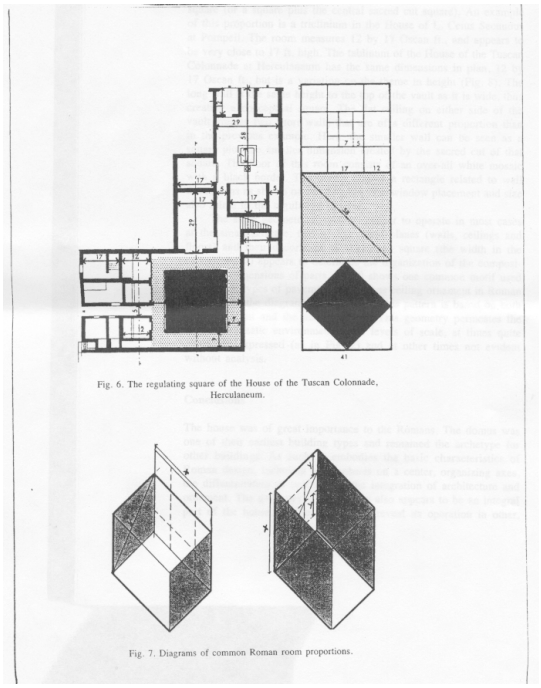

Fig. 6. The regulating square of the House of the Tuscan Colonnade, Herculaneum.

Fig. 7. Diagrams of common Roman room proportions.

The Watts measure the dimensions in Oscan feet [a] As you may or may not be able to see in the floor plan, the Watts found the following dimensions:
5
12
17
29
41

[a] The Oscans were an early Italic people who built the original walls and towers of Pompeii, and may have founded Herculaneum.

Find all ratios of these numbers that fall within the acceptance ranges of the Sacred Cut ratios that we developed in class.

Note: These acceptance ranges will be found on the web: OnCourse-Slides shown in class-2/7. *As discussed in class on 2/7, they assume that the measurements are no more than 2% away from what the architects intended, which lead to the ratios being no more than 4% off from the intended ratios.*

3. Suppose you are going to be testing several works of art and architecture to see whether your favorite ratio appears. You are assuming that your measurements will be within 1% of the actual lengths, and so, as we found in class, the ratios will be off from the actual ratio of the lengths by (roughly) no more than 2%. Find the *acceptance range* for your ratio, if your favorite ratio is:

   (a) The Golden Ratio, $(1 + \sqrt{5})/2$.

   (b) $(\sqrt{7} - \sqrt{5})/3$.

4. A Golden Ratio fanatic measures her box of Good Earth Vanilla Chai one morning and finds that the height of the box is 13 cm and the width is 7.9 cm. Is the ratio of the height to the width within the acceptance range for the Golden Ratio found in the Problem 3a?

5. You have read, in the excerpts from *The DaVinci Code*, that "my friends, each of you is a walking tribute to the Divine Proportion." In this exercise, you will explore whether *you* are a such a tribute to the Golden Ratio.

   Note: In order to make this problem less cumbersome, we will assume that your measurements are accurate to within 1%, so that you can use the Acceptance Range for the Golden Ratio that you developed in Problem 3a. A margin of error of only 1% is probably too small, if you are using a ruler rather than a measuring tape, so you may end up concluding some ratios are out of the acceptance range when with a more realistic margin of error they would in fact be within it.

   (a) Measure the following, and label your measurements very clearly. Centimeters would an easier choice.

      i. your height

      ii. the distance from your navel to the floor

      iii. the distance from your shoulder to your fingertips

      iv. the distance from your elbow to your fingertips

      v. the distance from your hip to the floor

      vi. the distance from your knee to the floor

   (b) *Height to belly button height:*

      i. Calculate the ratio of your measured height to the measured height of your belly button.

      ii. Does this ratio fall within the Acceptance Range for the Golden Ratio found in Problem 3a?

(c) *Arm length to fore-arm length:*

i. Calculate the ratio of your measured arm length to your measured fore-arm length.

ii. Does this ratio fall within the Acceptance Range for the Golden Ratio?

(d) *Leg length to height of knee:*

i. Calculate the ratio of your measured leg length to the measured height of your knee.

ii. Does this ratio fall within the Acceptance Range for the Golden Ratio?

(e) Draw some conclusions as to whether you believe *you* are the tribute to the Divine Proportion that Dan Brown's Robert Langdon claims you are.