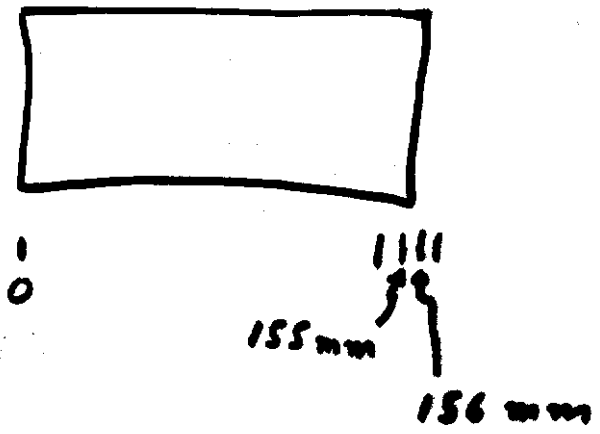
Measurement and Significant Figures

- All measurements involve some degree of precision

Example:
You and your friends would like to estimate down to the <u>tenth</u> of a millimeter the length a dollar bill



PERSON	MEASUREMENT
1	155.7 mm
2	155.3 mm
3	155.5 mm
4	155.3 mm
5	155.6 mm

4 significant figures

OPTIONAL PROCEDURE: FIND AVERAGE VALUE

$$\frac{155.7+155.3+155.5+155.3+155.6}{5} = \frac{777.4 \text{ mm}}{5} = \underbrace{155.48}$$

INCORRECT ANSWER

You can not get an average that is trustworthy to 0.01 mm from individual measurements that are good to only 0.1 mm

the results of any mathematical manipulation of a set of measurements can not be any more reliable than the least reliable measurement

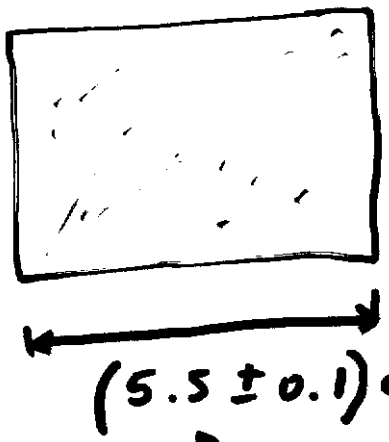
So, we decide (arbitrarily) to round the answer to 155.5 ← 4 significant figures

- In the previous example, you may wonder about the result of $\frac{777.4}{5}$

Shouldn't the result have just 1 significant figure?

No. The number 5 in the denominator does not come from a measurement. It is an exact number (in our example)

- Multiplication



Area = (5.5 cm)(6.4 cm)

= 35.2 cm^2 ✗ wrong answer

three significant figures

Area = 35 cm^2

Note: the latter answer reflects better the fact that the range of posible values for the area is between

(5.4 cm)(6.3 cm) = 34 cm^2

and

(5.6 cm)(6.5cm) = 36 cm^2