

### Homework #3: Units and Uncertainty

1. Approximately how long would a typical Hollywood movie be if you took it off the projector and unrolled it out to a straight line? (This is a Fermi Problem. Do not look up *anything* to help you estimate this. You should reason from what you know and make order of magnitude estimates for what you don't know. Make sure you explain each step in your logic in your answer. Give your answer to one significant figure.)
2. Pick some concept that you are familiar with from daily life and try to invent an operational definition for it. Be creative! Explain how your definition counts as an "operational definition."
3. Ford, problem P2.3 (p. 42)
4. Ford, problem P2.9 (p. 43)
5. In the lab, you measure four quantities:  $a = 5 \pm 1$  cm,  $b = 18 \pm 2$  cm,  $c = 12.2 \pm 0.5$  cm and  $m = 18 \pm 1$  g. Compute the following quantities:
  - a)  $a + b + c$
  - b)  $a + b - c$
  - c)  $a - b + m$
  - d)  $ma/b$
6. You measure the diameter of a sphere to be  $(3.25 \pm 0.03) \times 10^{-2}$  m. What is the volume of the sphere?
7. Look at the data you collected for your first lab. How small would a number in a given bin have to be before you should be suspicious that something weird was going on in that interval (like someone putting their hand in front of the detector)?
8. A pollster reports that candidate Smith has 49% of the vote, while candidate Jones has 48% of the vote. How small would the uncertainty in those numbers have to be (assume each has the same uncertainty) before you even *start* to think that candidate Smith might be winning?

**Due: Wednesday, September 16, 10:00 am**