

Høsten 2015

# FYS100 Fysikk

## Problems week 35,

Have a go at these:

First some problems from the book:

- 1.9, 1.10, 1.12
- 1.35, 1.38

**Additional Problem 1:** How many significant digits and decimals are there in the following numbers:

- 1
- 0.12
- 0.0034
- 117.8
- $\pi$

**Additional Problem 2:** Assume that you have measured two quantities  $a = 0.4$  and  $b = 0.2$  with an error of  $\Delta a = 0.1$  and  $\Delta b = 0.03$ , respectively. Here are some functions  $f(a, b)$  of  $a$  and  $b$ :

- $f(a, b) =: a + b; a - b; a/b; b/a; ab.$
- $f(a, b) =: a^2; a^3; a^2b.$
- $f(a, b) =: \log(a)$

Compute their value, and compute an estimate for the error in three ways:

1. Computing "worst case scenarios" (the extreme cases, where the errors on the input are the largest possible). Then use as the estimated error half the difference between the largest and smallest possible values of the output.

2. Computing (you may want to compare this with B.8 of the book)

$$\Delta f(a, b) = \frac{df}{da} \Delta a + \frac{df}{db} \Delta b. \quad (1)$$

3. Computing

$$\Delta f(a, b) = \sqrt{\left(\frac{df}{da} \Delta a\right)^2 + \left(\frac{df}{db} \Delta b\right)^2}. \quad (2)$$

Since we are not going to perform full error propagation in this course, we will stick to the rule of thumb: **As many significant digits in the output as the lowest number in the input. This will typically be 3.**