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**Measuring systems**

Problem set n° 11

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**Comparison of measured data**

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**Exercise 1 (Proximity detector)**

Two proximity detectors are set to go off at a distance  $D$ . They are subjected to  $N$  tests each. The average triggering distance of detector A is  $\bar{d}_A$  and that of detector B is  $\bar{d}_B$ . The manufacturer guarantees a standard deviation  $\sigma_A$  for detector A and  $\sigma_B$  for detector B. We allow a risk of error of 5%.

- a) Do detectors A and B present a significant systematic error?
- b) Are the average values they provide significantly different from each other?
- c) Is the average value provided by detector A significantly higher than that provided by detector B?

Numerical values:

$$D = 100 \text{ cm}$$

$$\bar{d}_A \pm \sigma_A = 101 \pm 3.97 \text{ cm}$$

$$N = 40$$

$$\bar{d}_B \pm \sigma_B = 99 \pm 2.98 \text{ cm}$$

**Exercise 2 (Accelerometers)**

Two accelerometers are positioned onto a horizontal table for measuring the acceleration of gravity. The first sensor gives  $\mu_1 \pm s_1$  and the second gives  $\mu_2 \pm s_2$ ; the results are obtained with a large number  $N$  of measurements.

Calculate the risk that we make an error if we claim the presence of a systematic error between the two sensors.

Numerical values:

$$\mu_1 \pm s_1 = 1.1 \pm 0.45 \text{ g}$$

$$N = 100$$

$$\mu_2 \pm s_2 = 0.96 \pm 0.29 \text{ g}$$