UNIVERSIDADE da MADEIRA

Experimental Science
P2: Basic statistics

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1. Purpose

- Obtain data for statistical treatment.

2. Experimental activity

2.1 Darts

2.1.1 Material

Used material: target sheet, darts, bostik.

2.1.2 Procedure

2.1.2.1 Safety rules

All students must be behind the throw line during throws.

If someone crosses the line, both throwers must stop throws immediately.

2.1.2.2 Throwing

1. The objective of each throw is to hit the rectangle with the number 7.
2. Each student should make 40 throws (don't forget to bring your own target to class!).
3. The throwing limit is marked on the floor at a distance of 2.5 m (look for a tape on the floor).
4. The target's highest edge should be aligned with the top of the thrower's head.
5. Throwing is done by two students at a time. These students are from different groups.
6. After each throw the thrower's group mate will register the dart position. Please keep your records in the throwing order.

2.1.2.3 Measurements

The dart positions are rounded up (e.g. a dart between lines 5.2 and 5.3 should be read as 5.3).

Darts hitting outside the target area should be discarded and not be repeated.

2.1.2.4 After the throws

After all throws are completed remove your target from the board and save it.

This procedure should be repeated by all the remaining group elements. Each group should register their results in an Excel spreadsheet available at the lab computer. This means each student should have his or her own result column.

The resulting file will then be available at the course's web site (LabInf).

2.2 Lead spheres

There is a container in the lab with an unknown number of lead spheres. The objective is to estimate the number of spheres it contains without actually counting them.

Given a sample it is possible to estimate the weight of a hypothetical sphere that best represents the population. Let's call it the standard sphere. This sphere has a mass equal to the sample masses mean.

Divide the total mass of spheres by the standard sphere mass to estimate the number of spheres in the container.

The goal of this exercise is to enquire the influence the sample size has on the accuracy of the total number estimate.

2.2.1 Material

Lead spheres container. Digital scale with a resolution bigger or equal to 100 g^{-1}.

2.2.2 Procedure

2.2.2.1 Measurements

All the student groups will have the same sample size. Each group will be asked to measure their sample's individual masses.

Verify the device's zero before making each measurement.

Try to place each sphere as gently as possible on the scale tray. It is a very sensible device and an excess pressure may decalibrate it.

Make all measurements with all but one open door. Try to avoid leaning on the lab table while measuring.

2.2.2.2 After the measurements

Make an estimate of the number of spheres in the container based on your sample. Each group should register the measurement results.

Each group should register their results in an Excel spreadsheet available at the lab computer. The resulting file will then be available at the course's web site (LabInf).

2.3 Sugar packets

There is a bag full of sugar packets in the lab. The objective is to estimate the number of packets it contains without actually counting them.

Given a sample it is possible to estimate the weight of a hypothetical sugar packet that best represents the population. Let's call it the standard packet. This sugar packet has a mass equal to the sample masses mean.

Divide the total mass of packets by the standard packet mass to estimate the number of packets in the bag.

The goal of this exercise is to enquire the influence the sample size has on the accuracy of the total number estimate.

2.3.1 Material

Sugar packets bag. Digital scale with a resolution equal to 10 g^{-1}.

2.3.2 Procedure

2.3.2.1 Measurements

All the student groups will have the same sample size. Each group will be asked to measure their sample's individual masses.

Verify the device's zero before making each measurement.

Try to place each packet as gently as possible on the scale tray. It is a very sensible device and an excess pressure may decalibrate it. There are 2 scales with the required resolution. Use only one of the scales.

2.3.2.2 After the measurements

Make an estimate of the number of packets in the bag based on your sample. Each group should register the measurement results.

Each group should register their results in an Excel spreadsheet available at the lab computer. The resulting file will then be available at the course's web site (LabInf).

2.4 Metals

There are 4 metal bars lettered from A to D in the lab. Each is made of a highly pure metal (almost all atoms are equal).

Estimate how many atoms are in each bar taking into account the atomic masses:

Metal	Massa atómica ($x10^{-23}$ g)
A	10.8566031 ± 0.0000001
B	4.4803893 ± 0.0000001
C	9.2732793 ± 0.0000001
D	10.5520602 ± 0.0000001