Probability experiments

TARGET GROUP
Students at secondary education; high school. Students of about 15-17 years old.

TOPIC
Probability and Simulation

PRIOR MATHEMATICAL KNOWLEDGE
Rational Numbers; percentages and decimals, ratio & proportion. Simple statistics; using tables and graphs to organize and display information.

PRIOR CALCULATOR EXPERIENCE
Basic Graphing Calculator experience, having used an APP before (know how to start an APP and knowing how to use the function keys)

Reasoning about probability is difficult. Especially because certain intuitions seem to be very evident, but they can be very wrong. For example, when asking for the probability of the outcomes of tossing a coin (head or tail) – assuming the coin is fair and not tricked – most people will quickly and confidently report back with the correct response ½. But the outcome of a single random toss of the coin is unpredictable. A famous French philosopher d'Alembert said "When a coin is tossed, it has forgotten what face came up the previous time it was tossed."

This can get complicated when you do an experiment. A first toss results in tail. What will be the result for the next toss? Now the reasoning can go into two directions. Some may follow d'Alembert, but others may think that on the average the number of tails and heads will be equal, so it is more likely that the other face – head – will show up.

The same difficulty in reasoning can appear when dealing with "a large number of tosses". When a large number of tosses are done the frequency of heads and tails will be equal. But again, what is a large number?

What we can say is that in the long run the relative frequency of an event approximates its probability as close as we want but nobody can tell us after how many trials.

To reflect on this problem we will analyze later the following two situations in detail:

- CHEATING AND NOT WINNING
  The idea is to toss a coin that is modified so many times that it becomes clear that the number of times heads show up is really more than the number of tails.
- I LIKE GRAPEFRUIT!
  1000 persons have given their opinion about liking or not liking grapefruit. Of these thousand persons, 55% said they like grapefruit. When from this population of 1000, a random sample of 100 persons is selected, how many will like grapefruit? 55? Are you sure?

But first we will start with some fair probability experiments.