Learn By Doing Activity

Scenario: Birthday Match

Background

Recall from the introduction to probability section the birthday problem, which was presented as an example of when probability is counterintuitive. In particular, recall that we asked: "What is the probability that at least 2 people out of a group of 60 will have the same birthday?" The answer, a 99.4% chance, was very surprising.

How about the probability of at least one "birthday match" in a group of 30 people?

At this point in the course, we do not have the tools needed to solve this problem, so the best we can do is to estimate this probability using relative frequency.

Comment

As before, to simplify things we will ignore leap years (i.e., we will assume that all years have 365 days) and we will assume that all days of the year are equally likely to be birthdays.

Plan

Using the simulation below, we will generate (with replacement) 30 birthdays. The group of 30 birthdays represents a group of 30 people. We will then observe whether any birthday is repeated (i.e., whether there is at least one birthday match in the group). To use the relative frequency idea, we will then repeat this process 20 times, and count how many of the 20 repetitions had at least one birthday match. This relative frequency will be our estimated probability of at least one birthday match in a group of 30 people.

To make this process easier, keep a tally of the number of times you have done the simulation. In addition to this tally, keep a tally of the number of times you got at least one birthday match. So, each time you run the simulation, you will update two tallies: the number of runs of the simulation and the number of times you got at least one match. The relative frequency will be the ratio of these two tallies. It will be our estimated probability of at least one birthday match in a group of 30 people.

Step 1: Type "30" into **Generate [ ] Birthdays** and press the **Start** button.

Notice that random birthdays are generated, then filed in the appropriate month and day. Look for an orange square; this indicates a match. At the bottom of the simulation you can see information on the number of birthdays and the number of matches.

Step 2: Record your results from the first run, then press the **Reset** button. You have now completed 1 of the 20 runs of the simulation.

Step 3: Press the **Start** button, then record your results for the second run of the simulation.

Step 4: Repeat steps 2 and 3 for another 18 runs.

Learn By Doing (1/1 point)

How many of your 20 samples had at least two people with the same birthday (i.e., how many matches)? What is the relative frequency of samples that had at least two people with the same birthday? (This is your estimated probability of at least one birthday match in a group of 30 people.)

Your Answer:

I got 23/30, 76.67%

Our Answer:
Since this is a simulation exercise, different students might get different answers. The TRUE probability is about 0.70, so hopefully your estimated probability is around this number. Note that since we used only 20 repetitions, we cannot expect our estimated probability to be too close to the true answer, but just a rough approximation.

Resubmit Reset

Learn By Doing (1/1 point)

If you have a room with 100 people, how unusual would it be to have no matches? Feel free to run another simulation to help you to answer this question.

Your Answer:

Highly highly highly unlikely

Our Answer:
Recall that with only 60 people the P(at least one match) was 0.994. Thus, it makes sense that if we have 100 people the probability of at least one match would be higher. This means the P(no matches) would be extremely low. In fact, it is about 0.000000303—very unlikely indeed!

Resubmit Reset