Ladybug Clockprob

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The statistical puzzle or problem is as follows: A ladybug lands on a clock face - on the 12. In one unit of time (e.g., 1 minute), the bug moves to the next number on the dial. Whether it goes "forward" (e.g., from 12 to 1) or "backward" (e.g., from 12 to 11) is random. The numbers the bug has visited are colored red. Question: What is the probability that the number 6 is the last number not yet colored red - in other words, that number 6 is the last number the ladybug visits for the first time?

1 Intuitive solution

All digits, except for 12, should have the same probability of being reached last by the ladybug. For the digit 12, it is impossible to be reached last; for all other digits - including 6 - this probability would therefore be $\frac{1}{11} = 0.09$.

2 Simulation

However, intuition can sometimes be incorrect because one might not have considered a trick - especially in tasks that are designed to be difficult or to outsmart intuition. The Monty Hall problem is an example of how intuition often misses something. In other cases, however, intuition can also be a very efficient problem-solving approach.

Whether an analytical solution, on the other hand, takes all important aspects into account is not guaranteed. After all, the intuitive solution is also analytical.

To verify an analytical solution (whether intuitive or not), we use an empirical method. Since we can hardly assume that the situation on which the task is based occurs in reality, we have to deliberately create it. Because the situation is fully described and no (post-) measurements have to be made, simulating the corresponding situation is adequate.

We set up a simulation here with $n = 1000$ observations (ladybugs). Each observation is a ladybug walk on the clock face, which ends when only one digit has not yet been reached by the respective ladybug. A dummy variable (sixlast) records whether the last untouched digit is 6 ($sixlast = 1$) or not ($sixlast = 0$).

Table 1: Distribution sixlast

sixlast	**Abs. freq.**	**Rel. freq.**
0	921	0.921
1	79	0.079
n	1000	

Table 2: Test of the residuals sixlast-1/11

Rho =	-0.04
Chi² =	1000.95
n =	1000
p (Chi²) =	0.48
p (alpha) =	0.113
Power =	0.26

The result of the simulation is that in 79 out of 1000 observations, the ladybug reaches the number 6 as the last unvisited number during its walk across the dial, which corresponds to a probability of 7.9 percent (table 1).

3 Testing the simulation result against intuition

Since the simulation is a random experiment with a finite number of runs (specifically $n = 1000$), we do not expect the results from intuition and simulation to be exactly the same - even if the intuition is correct. In this sense, the simulation is always correct, but it would only yield the exact result with $n = \infty$. Therefore, we test whether the deviation between intuition and simulation ($P\left(sixlast\right) - 0.09$) is at most as large as the expected inaccuracy of the simulation result.

Assuming that the deviation to be tested occurred systematically (table 2), an effect would manifest that could be described by its strength Rho. Here, $Rho = -0.04$, which is too weak to be considered a meaningful effect. Furthermore, the deviation is not statistically significant. Together with the very low power, the test results indicate that the tested deviation is merely due to an inaccuracy in the simulation results. In other words, our study suggests that the intuition is correct and that the ladybug reaches the number 6 (for the first time) last with a probability of 9%.