



## Problem of the Week

### Problem A and Solution

#### Rolling Dice

#### Problem

Asha and Naomi are rolling a six-sided die to determine who gets the larger half of a cookie that they are sharing. If Asha rolls a number less than 4, she will get the larger piece of the cookie. If Naomi rolls the number 4 or greater, she will get the larger piece. Who is more likely to win the larger piece of cookie?

Explain your thinking.

#### Solution

On a fair, six-sided die, we expect each of the numbers (1, 2, 3, 4, 5, 6) are equally likely to appear on any given roll. Asha is hoping that the numbers 1, 2, or 3 will appear; Naomi is hoping that the numbers 4, 5, or 6 will appear. Each is hoping for 3 different outcomes. Since they are both hoping for the same number of outcomes, and each of the outcomes is equally likely to happen, each has an equal chance of getting the larger piece of the cookie.





## Teacher's Notes

Assuming there is no effort to cheat, rolling dice provides random outcomes. We can predict that, in the long term, we expect the numbers 1, 2, and 3 will appear approximately half of the time. However, we can not accurately predict the outcome of a single roll; we can only make a guess.

Computers use random numbers in many applications such as games, simulations, and cryptography. In most cases, these applications would use a *pseudorandom number generator*. Numbers generated this way would appear random, but they are actually generated by a function. This can be useful in software development, because the programmer could repeatedly use the same sequence of random values during the testing process. The random number generator often requires a *seed*, to get it started. Starting with the same seed would produce the same sequence of numbers.

It is possible that someone could determine a pattern in pseudorandom numbers. This is not a serious problem in gaming or simulations, but could be important for cryptography applications that require true randomness to send secure messages. Computers can generate truly random numbers using hardware components. These components may measure naturally occurring phenomenon that has a random nature, and then convert that data into random numbers. Another technique samples human input values through the keyboard or mouse movements as a person uses another program, and records values that can be used as random numbers themselves, or as seeds for pseudorandom number generators.

Generally speaking, people are not good at generating random numbers. Ask a large group of people to pick a number between 1 and 100. How many picked even numbers? How many picked odd numbers? What are the most frequently picked numbers? Which numbers were not picked? See if you can find any patterns in the numbers people chose.

