Life is Not Fair

Computing probabilities in a space without equally likely outcomes

In many elementary statistics texts (including ours), there is a focus on understanding probability as applied to very well ordered settings where probabilities of all events are equally likely. But things aren't always so well balanced in the decisions you must make every day. For example, as you drive onto the interstate, there are two possible outcomes: (1) you have an accident or (2) you do not have an accident. If these outcomes were equally likely, I doubt you'd ever drive on the interstate! So here's an exercise that, although still contrived, moves our thinking a bit more toward reality.

A warped coin is tossed and a loaded die is rolled. For the coin, the probability of Heads, P(H) = 2/3. The probability of Tails then must be P(T) = 1/3. For the die, the probability of each odd number of spots is 1/9 and the probability of an even number is 2/9. In other words, P(1) = P(3) = P(5) = 1/9 and P(2) = P(4) = P(6) = 2/9.

1. One outcome of this probability experiment is "Heads on the coin and 1 on the die". If we denote that outcome by (H,1), then P(H,1) = 2/27. Explain why here:

   _____

   _____

2. Now list each of the possible outcomes and assign probabilities. Here's a start:

   (H,1) - 2/27 (H,2) - _____ (H,) - ____…

   (T,1) - ____ …

3. Using the probabilities you computed in #2, find the following:

   (a) Prob (Heads **and** > 4) _____ (i.e. the prob that the coin is heads and the die > 4)

   (b) Prob (Heads **or** > 4) _____

   (c) Prob (T **and** Odd) _____

   (d) Prob (5 on the die **and** the die is odd) _____

   (e) Prob (5 on the die **given that** the die is odd) _____

   (f) Prob (5 on the die **and** the die is even) _____

   (g) Prob (5 on the die **given that** the coin is H) _____