Independent vs. Dependent Events (Monday 05/20)

Independent Event

Example 1

Find the probability of flipping a coin twice and it landing on heads both times.

a) draw a tree diagram

1st flip 2nd flip

- H
  - H — HH
  - T — HT
- T
  - H — TH
  - T — TT

$\frac{1}{4}$

b) answer with multiplica.

P(Heads and Heads)

P(Heads) • P(Heads)

$\frac{1}{2} \cdot \frac{1}{2}$

$\frac{1}{4}$

Example 2

A six-sided cube is labeled with the numbers 1, 2, 2, 3, 3, and 3. Four sides are colored red, one side is white and one side is yellow. Find the probability.

a) Tossing 2, then 2 $\frac{2}{6} = P(2) \Rightarrow \frac{1}{3}$

$\frac{1}{3} \cdot \frac{1}{3} = \frac{1}{9}$

b) Tossing red, then white, then yellow

$\frac{4}{6} \cdot \frac{1}{6} \cdot \frac{1}{6} = \frac{4}{216} = \frac{2}{108} = \frac{1}{54}$

red white yellow

Dependent Events

Dependent Events

Example 1

There are 2 lemons and 1 lime in a bag. If you pull out two pieces of fruit, the probability change depending on the outcome of the first.

a) P(2 lemons)

$P(\text{lemon}) \cdot P(\text{lemon} \mid \text{lemon})$

$\frac{2}{3} \cdot \frac{1}{2} = \frac{2}{6} = \frac{1}{3}$

b) P(lime, then lemon)

$P(\text{lime}) \cdot P(\text{lime} \mid \text{lemon})$

$\frac{1}{3} \cdot 1 = \frac{1}{3}$

Example 2

Two number cubes are rolled — one red, and one blue. Explain why the events are dependent. Then find the indicated probability.

The red cube shows a 1, and the sum is less than 4.

$P(\text{Red} = 1) \cdot P(\text{Sum} < 4 \mid R = 1)$

$\frac{6}{36} = \frac{1}{6} \cdot \frac{2}{6} = \frac{2}{36} = \frac{1}{18} \left(\frac{1}{108}\right)$

You Try!

Two cards are drawn from a deck of 52. Determine whether the events are independent or dependent. Find the probability.

a) Selecting two hearts when the first card is replaced

P(heart) · P(heart) $\frac{13}{52} = \frac{1}{4}$

$\frac{1}{4} \cdot \frac{1}{4} = \frac{1}{16} = 6.3\%$

b) selecting two hearts when the 1st card is not replaced

P(heart) · P(heart | heart)

$\frac{13}{52} = \frac{1}{4} \cdot \frac{12}{51} = \frac{12}{204} = \frac{1}{17} = 5.9\%$

c) a queen is drawn, not replaced, and then a king is drawn

P(Queen) · P(Queen | king)

$\frac{4}{52} = \frac{1}{13} \cdot \frac{4}{51} = \frac{4}{663} = .6\%$