

10.5 Independent and Dependent Probability

Two events are independent if the occurrence of one event has no effect on the occurrence of 2nd event.

ex: flip coin, the flip coin again

Two events are dependent if the occurrence of one event affects the occurrence of 2nd.

ex: pick a card (keep the card), pick 2nd card

Probability of independent events:

$$P(A \text{ and } B) = P(A) \cdot P(B)$$

Probability of dependent events:

$$P(A \text{ and } B) = P(A) \cdot P(B|A)$$

B given A

Example 1: For a fundraiser, a class sells 150 tickets for a mall gift certificate and 200 raffle tickets for a booklet of movie passes. You buy 5 for each prize. What is the probability that you win both?

$$\frac{5}{150} \cdot \frac{5}{200} = \frac{1}{30} \cdot \frac{1}{40} = \frac{1}{1200}$$

independent

$$P(\text{win mall}) \cdot P(\text{movie})$$

What is the probability of winning the mall gift certificate, but not the movie passes?

$$\frac{5}{150} \cdot \frac{195}{200} = \frac{975}{30,000} = \frac{13}{400}$$

$$P(\text{mall}) \cdot P(\text{NOT movie})$$

What is the probability of winning neither?

$$\frac{145}{150} \cdot \frac{195}{200}$$

Example 2: Every morning a student in a class of 28 is randomly chosen to take attendance. What is the probability that the same student will be chosen 3 days in a row?

Bailey

$$\frac{1}{28} \cdot \frac{1}{28} \cdot \frac{1}{28}$$

Example 3: During each day of a 5 day week, an employee is randomly given 1 of 10 prizes. All prizes are available each day and 1 prize is \$500. What is the probability that an employee receives the \$500 at least once?

$$1 - \frac{9}{10} \cdot \frac{9}{10} \cdot \frac{9}{10} \cdot \frac{9}{10} \cdot \frac{9}{10}$$

NOT \$500

$$.41$$

41%

Example 4: In a recent survey at a football game, 50 of 75 males and 40 of 50 females interviewed said that they favored a new team mascot. If 1 male and 1 female selected at random were asked, what is the probability that both favor a new mascot?

indep.

$$1m \quad \rightarrow \quad 1f$$
$$\frac{50}{75} \quad \cdot \quad \frac{40}{50}$$

Example 5: The table shows the status of 200 registered college students. What is the probability that a randomly selected student:

	Part-time	Full-Time
Female	80	40
Male	60	20

a) is female?

$$\frac{120}{200}$$

b) is full-time given that the student is female.

$$\frac{40}{120}$$

Example 6: You randomly select 2 cards from a standard deck of cards. What is the probability that the first is a heart and the second is a club if:

a) you replace the first before selecting the second?

$$\frac{13}{52} \cdot \frac{13}{52} \quad \text{indep.}$$

b) no replacement?

$$\frac{13}{52} \cdot \frac{13}{51}$$

Example 7: Suppose your area has 8 different Internet Service Providers (ISP) and you and 3 friends randomly select your own. What is the probability that they are all different?

Example 8: On a manufacturing line, 20% of all items produced are defective. Although they are inspected before shipping, 10% are incorrectly classified. What percent of items will be classified as not defective?

$$\begin{array}{l}
 \text{def} - \text{cor.} \\
 \text{def} - \text{incor} \\
 \text{Ndef} - \text{cor} \\
 \text{Ndef} - \text{incor}
 \end{array}
 \quad
 \begin{array}{l}
 .2(.1) = .02 \\
 .8(.9) = .72
 \end{array}
 \quad
 \begin{array}{l}
 .02 \\
 .72 \\
 \hline
 74\%
 \end{array}$$