7.3

Independent and Dependent Events

Two events are <u>independent</u> if the occurrence of one has no effect on the occurrence of the other.

If A and B are independent events, then the probability that both A and B occur is:

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

This also works with 3 or more events:

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

A game machine claims that 1 in every 15 people win. What is the probability that you win ~~twice~~ three in a row?

$$\frac{1}{15} \cdot \frac{1}{15} \cdot \frac{1}{15}$$

You flip 3 coins: a quarter, a dime, and a nickel.

Find the probability that they are all "heads".

$$\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$$

You ~~flip~~ toss 3 coins: a quarter, a dime, and a nickel.
Find the probability of 1 "heads" and 2 "tails".

$$\frac{3}{8}$$

	Q	D	N
	H	H	H
	H	H	T
*	H	T	T
	T	T	T
*	T	T	H
	T	H	H
	H	T	H
*	T	H	T

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In a survey, 9 out of 11 men and 4 out of 7 women said they were satisfied with a product.

If the next three customers are two women and one man, what is the probability that they will all be satisfied?

$$\frac{4}{7} \cdot \frac{4}{7} \cdot \frac{9}{11}$$

$$\frac{4}{7} \cdot \frac{4}{7} \cdot \frac{9}{11}$$

$$P = \frac{144}{539}$$

$$P \approx 0.267$$

In a survey, 9 out of 11 men and 4 out of 7 women said they were satisfied with a product.

If 4 men are the next customers, what is the probability that they are all satisfied?

$$\frac{9}{11}\cdot\frac{9}{11}\cdot\frac{9}{11}\cdot\frac{9}{11}$$

$$\frac{9}{11}\cdot\frac{9}{11}\cdot\frac{9}{11}\cdot\frac{9}{11}$$

$$P = \frac{6561}{14641}$$

$$P \approx 0.448$$

In a survey, 9 out of 11 men and 4 out of 7 women said they were satisfied with a product.

If 4 men are the next customers, what is the probability that none are satisfied?

$$\frac{2}{11}\cdot\frac{2}{11}\cdot\frac{2}{11}\cdot\frac{2}{11}$$

$$\frac{2}{11}\cdot\frac{2}{11}\cdot\frac{2}{11}\cdot\frac{2}{11}$$

$$P = \frac{16}{14641}$$

$$P \approx 0.00109$$

In a survey, 9 out of 11 men and 4 out of 7 women said they were satisfied with a product.

If 4 men are the next customers, what is the probability that at least one of them is satisfied?

$$1-\left(\frac{2}{11}\right)^4$$

≥ 1

< 1

In a survey, 9 out of 11 men and 4 out of 7 women said they were satisfied with a product.

If 4 men are the next customers what is the probability that exactly 3 of them will be satisfied?

$${}_4C_3\cdot\frac{9}{11}\cdot\frac{9}{11}\cdot\frac{9}{11}\cdot\frac{2}{11}$$

In a survey, 9 out of 11 men and 4 out of 7 women said they were satisfied with a product.

If 4 men are the next customers, what is the probability that at least one of them is not satisfied?

$$1-\frac{9}{11}\cdot\frac{9}{11}\cdot\frac{9}{11}\cdot\frac{9}{11}$$

You roll two 6-sided dice and find the sum. Find the probability of…..

a) rolling a prime #

$$\frac{15}{36}$$

1,1	2,1	3,1	4,1	5,1	6,1
1,2	2,2	3,2	4,2	5,2	6,2
1,3	2,3	3,3	4,3	5,3	6,3
1,4	2,4	3,4	4,4	5,4	6,4
1,5	2,5	3,5	4,5	5,5	6,5
1,6	2,6	3,6	4,6	5,6	6,6

b) rolling twelve twice in a row

$$\frac{1}{36}\cdot\frac{1}{36}$$

Two events A and B are dependent events if the occurrence of one affects the occurrence of the other.

The probability that B will occur given that A has occurred is called the conditional probability of B given A and is written P(B/A).

If A and B are dependent events, then the probability that both A and B occur is:

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

You randomly select 2 cards from a standard 52-card deck. What is the probability that both cards are face cards (king, queen, or jack)?

a) you replace the first card before selecting the 2nd (with replacement)

INDEPENDENT

$\frac{12}{52} \cdot \frac{12}{52}$

b) you do not replace the first card (without replacement)

DEPENDENT

$\frac{\cancel{12}^{3}}{\cancel{52}_{13}} \cdot \frac{11}{\cancel{51}_{17}} = \frac{11}{(13)(17)}$

You randomly select 3 cards from a standard 52-card deck. What is the probability that the first card is a diamond, the second card is a heart, and the third card is a diamond……..

a) with replacement

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

♢ ♡ ♢

b) without replacement

$\frac{13}{52} \cdot \frac{13}{51} \cdot \frac{12}{50}$

♢ ♡ ♢

a bag contain 3 red marbles, 7 white marbles, and 5 blue marbles.

15 total

a) You draw 3 marbles, replacing each one before drawing the next. What is the probability of drawing a red, then a blue, and then another blue?

$\frac{3}{15} \cdot \frac{5}{15} \cdot \frac{5}{15} = \frac{1}{45}$

a bag contain 3 red marbles, 7 white marbles, and 5 blue marbles.

b) You draw 3 marbles, without replacing each one before drawing the next. What is the probability of drawing 3 white marbles?

$\frac{7}{15} \cdot \frac{6}{14} \cdot \frac{5}{13}$

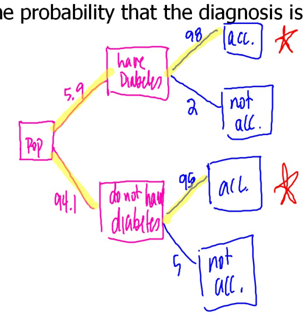
a bag contain 3 red marbles, 7 white marbles, and 5 blue marbles.

c) You draw 3 marbles, without replacing each one before drawing the next. What is the probability of drawing a red,then a blue, and then another blue?

$\frac{3}{15} \cdot \frac{5}{14} \cdot \frac{4}{13}$

5.9% of Americans have diabetes. A lab has developed a test that 98% accurate for people who have diabetes and 95% accurate for people who don't have it.

If a lab gives the test to a randomly selected person, what is the probability that the diagnosis is correct?



.059 (.98)

5.9(98) + 94.1(95)

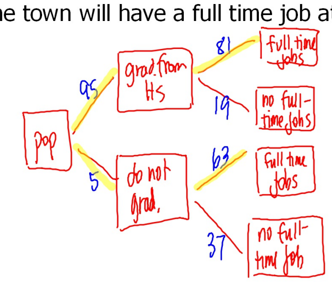
578.2 + 8939.5

9517.7

95.17%

In one town, 95% of the students graduate from HS. Suppose a study showed that at age 25, 81% of the HS graduates held full time jobs while only 63% of those who did not graduate held full time jobs.

What is the probability that a randomly selected student from the town will have a full time job at age 25?



.95(.81) + .05(.63)

.7695 + .0315

.801

80.1%