Notes 11.7: "And" Probabilities

"And" Probabilities

Two events are **independent** if the outcome of one event does **not** affect the probability of the other event. Two events are **dependent** if the outcome of one **does** affect the probability of the other event.

When finding the probability that event A will occur **and then** event B will occur, the rule is to multiply individual probabilities. The multiplication technique extends to situations involving two or more events occurring jointly. The probability that A and B occur together is:

Prob draw 4 or 5 card

$\frac{4}{52} + \frac{4}{52} = \frac{8}{52}$

P(A and B) = P(A) x P(B) for independent events

P(A and B) = P(A) x P(B/A) for dependent events

Prob draw 4 and then 5 w/o replace

$\frac{4}{52} \cdot \frac{4}{51} =$

*P(B/A) means "the probability of event B given that event A has occurred.

Ind

1) Find the probability that a 100-year flood (a flood with a 0.01 probability of striking in a given year) will strike a city in two consecutive years. Assume that a flood in one year does not affect the likelihood of a flood in the next year.

$P(A) \cdot P(B) = (.01)(.01) = .0001$

$\frac{1}{100} \quad \frac{1}{100} = \boxed{\frac{1}{10{,}000}}$

Ind

2) Suppose you toss three coins. What is the probability of getting three tails?

$\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = \boxed{\frac{1}{8}}$ $\quad P(T, T, T)$

Ind

3) Find the probability of rolling two sixes followed by one five on three tosses of a fair die.

$\left(\frac{1}{6}\right)\left(\frac{1}{6}\right)\left(\frac{1}{6}\right) = \boxed{\frac{1}{216}}$ $\quad P(6, 6, 5)$

Ind

4) Find the probability of drawing two hearts in a row from a standard deck of cards when the drawn card is returned to the deck each time.

$\frac{13}{52} = \frac{1}{4} \cdot \frac{1}{4} = \boxed{\frac{1}{16}}$ $\quad P(\heartsuit, B)$

Dep

5) The game of Bingo involves drawing labeled buttons from a bin at random, without replacement. There are 75 buttons, 15 for each of the letters B, I, N, G, O. What is the probability of drawing two B buttons in the first two selections?

$\frac{15}{75} \cdot \frac{14}{74} = \frac{210}{5550} = \boxed{\frac{7}{185}}$

6) A three-person jury must be selected at random from a pool of 12 people that has 6 men and 6 women. What is the probability of selecting an all-male jury?

$\frac{{}_6C_3}{{}_{12}C_3} = \frac{20}{220} = \boxed{\frac{1}{11}}$ $\quad \frac{6}{12} \cdot \frac{5}{11} \cdot \frac{4}{10} = \frac{1}{11}$

dep

7) Find the probability of drawing two hearts in a row from a standard deck of cards when the drawn card is not returned to the deck each time.

$\frac{1}{4} \cdot \frac{12}{51} = \frac{12}{204} = \boxed{\frac{1}{17}}$

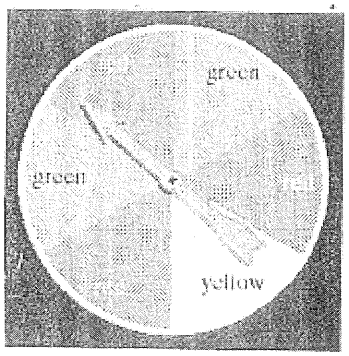
Dep

8) Find the probability of drawing a face card and then a 7 from a standard deck of cards when the drawn card is not returned to the deck each time.

$\frac{12}{52} \cdot \frac{4}{51} = \frac{48}{2652} = \boxed{\frac{4}{221}}$

P(F then 7)

9) The spinner below is equally probable that the pointer will land on any one of the six regions. If the pointer lands on a borderline, spin again.



red - 3
green - 2
yellow - 1
6

Ind a. If the pointer is spun twice, find the probability it will land on red and then green.

$\frac{3}{6} \cdot \frac{2}{6} = \frac{6}{36} = \boxed{\frac{1}{6}}$

Ind b. If the pointer is spun twice, find the probability it will land a color other than yellow each time.

$\frac{5}{6} \cdot \frac{5}{6} = \boxed{\frac{25}{36}}$

Ind c. If the pointer is spun three times, find the probability it will land on yellow, then green, and then green.

$\frac{1}{6} \cdot \frac{2}{6} \cdot \frac{2}{6} = \boxed{\frac{1}{54}}$

Ind d. If the pointer is spun three times, find the probability it will land on yellow, then red, and then green.

$\frac{1}{6} \cdot \frac{1}{2} \cdot \frac{1}{3} = \boxed{\frac{1}{36}}$

Independent

10) A coin is tossed and a die is rolled. Find the probability of getting

a. A head and an even number. $\frac{1}{2} \cdot \frac{3}{6} = \boxed{\frac{1}{4}}$

b. A tail and a number less than 3. $\frac{1}{2} \cdot \frac{2}{6} = \boxed{\frac{1}{6}}$

c. A head and a number greater than 6. $\frac{1}{2} \cdot 0 = \boxed{0}$

32 total

11) An ice chest contains 10 cans of Coke, 12 cans of Sprite, 6 cans of Diet Coke, and 4 cans of Gatorade. Suppose that you reach into the container and randomly select three cans in succession. You do not replace the soda. Find the probability of selecting: Dependent

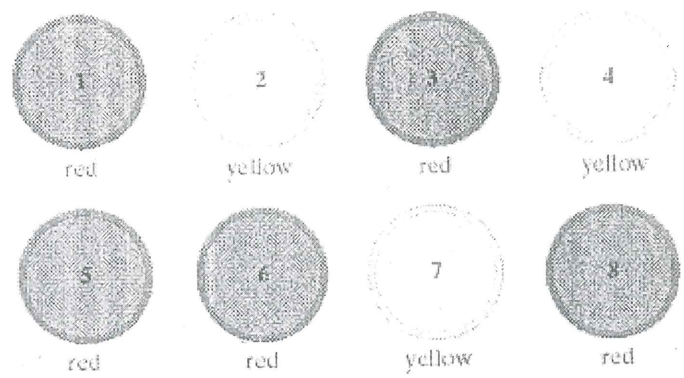
a. Three cans of Diet Coke. $\frac{6}{32} \cdot \frac{5}{31} \cdot \frac{4}{30} = \frac{120}{29760} = \boxed{\frac{1}{248}}$

b. A Coke, a Sprite, and then a Gatorade. $\frac{10}{32} \cdot \frac{12}{31} \cdot \frac{4}{30} = \frac{480}{29760} = \boxed{\frac{1}{62}}$

c. No Sprite. (3 cans) $\frac{20}{32} \cdot \frac{19}{31} \cdot \frac{18}{30} = \boxed{\frac{57}{248}}$

STOP

10) The numbered disks shown below are placed in a box and one disk is selected at random.



Find the probability of selecting

a. A 2, given that a yellow disk is selected. $\boxed{\frac{1}{3}}$

b. And even number, given that a red disk is selected. $\boxed{\frac{2}{5}}$

c. A red disk, given that en even number was selected. $\frac{2}{4} = \boxed{\frac{1}{2}}$

d. A yellow disk, given that the number selected is greater than 5. $\boxed{\frac{1}{3}}$

11) The table shows the outcome of car accidents in Florida for a recent year by whether or not the driver wore a seat belt. Use the date to answer the following questions:

CAR ACCIDENTS IN FLORIDA

	Wore Seat Belts	No Seat Belt	Total
Driver Survived	412,368	162,527	574,895
Driver Died	510	1601	2111
Total	412,878	164,128	577,006

a. Find the probability of surviving a car accident, given that the driver did not wear a seat belt.

$\boxed{\frac{162{,}527}{164{,}128}}$

b. Find the probability of wearing a seat belt, given that the driver did not survive the accident.

$\boxed{\frac{510}{2111}}$