11.6 Notes
"Not" and "Or" Probabilities, and Odds

Probability of an event NOT occurring: If the probability that an event A will occur is P(A), then the probability that the event A will **not** occur is **1-P(A).**

1) If the probability is 1/3 that it'll rain today, what's the probability that it won't rain today?

$1 - \frac{1}{3} = \frac{3}{3} - \frac{1}{3} = \boxed{\frac{2}{3}}$

2) What's the probability of not rolling a 5 on a single toss of a die?

$P(\text{not } 5) = 1 - P(5) = 1 - \frac{1}{6} = \boxed{\frac{5}{6}}$

3) If you are dealt one card from a standard 52-card deck, find the probability that you are not dealt a picture card.

$P(\text{not Picture}) = 1 - P(\text{picture}) = 1 - \frac{12}{52} = \frac{40}{52} = \boxed{\frac{10}{13}}$

4-5 The circle graph below shows the distribution, by age group, of the 191 million car drivers in the United States, with numbers rounded to the nearest million. If one driver is randomly selected from this population, find the probability that the person

4) is not in the 30-39 age group. $P(\text{not } 30\text{-}39) = 1 - P(30\text{-}39)$

$1 - \frac{40}{191} = \boxed{\frac{151}{191}}$

5) is less than 80 years old.

$P(<80) = 1 - P(\geq 80)$

$= 1 - \frac{6}{191} = \boxed{\frac{185}{191}}$

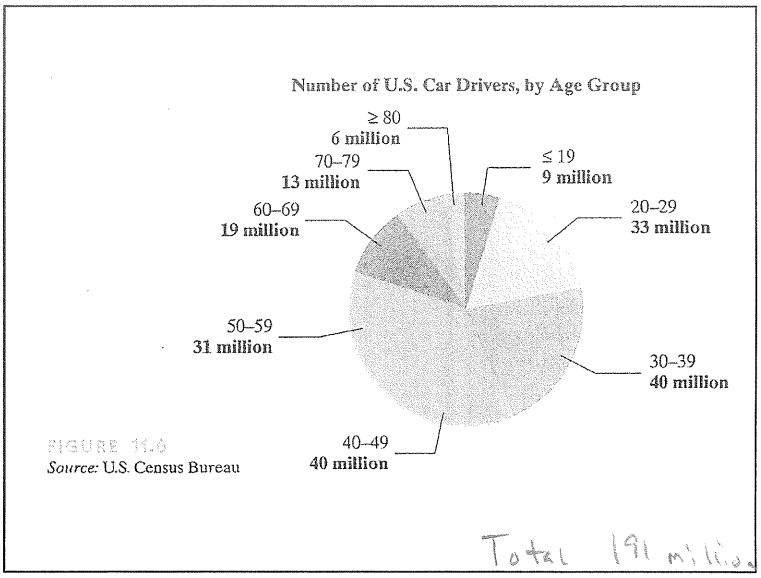


FIGURE 11.6
Source: U.S. Census Bureau

When two events **cannot** occur at the same time, they are said to be **mutually exclusive** events (or non-overlapping events). Two events are **overlapping** if they **can** occur at the same time.

Are these mutually exclusive or overlapping events?

a) The probability of rolling a 6 or an even number on one roll. overlapping
b) Picking a red card or a Jack from a standard deck of cards when you pick one card. overlap
c) Picking a face card or a 2 when drawing one card from a standard deck of cards. mutually exclusive
d) Probability of rolling a 6 or a 2 on one roll of a die. mutually exclusive

When finding the probability of event A **or** event B occurring, the rule is to **add** the individual probabilities and **possibly subtract**. The addition technique extends to situations involving two or more events. The probability that A or B will occur is:

P(A or B)= P(A) + P(B) for mutually exclusive events

P(A or B) = P(A) + P(B) – P(A and B) for overlapping events

Don't double Count

6) You roll a single die. What is the probability of rolling either a 2 or a 3? Mutually Exclusive

$P(2) + P(3)$

$\frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \boxed{\frac{1}{3}}$

Overlap

7) You roll a die once. What's the probability you roll a four or an even number? 1 2 3 (4) 5 6

$P(4) + P(\text{Even}) - P(4 \text{ and Even})$

$\frac{1}{6} + \frac{3}{6} - \frac{1}{6} = \frac{3}{6} = \boxed{\frac{1}{2}}$

8) You draw one card from a standard deck of cards. Find the probability of drawing either a picture card or a red 7.

Mut. Exc

$P(\text{face}) + P(\text{red 7})$

$\frac{12}{52} + \frac{2}{52} = \frac{14}{52} = \boxed{\frac{7}{26}}$

9) You draw one card from a standard deck of cards. Find the probability of drawing either a queen or a club.

Overlap

$P(Q) + P(\text{Club}) - P(Q \text{ and Club})$

$\frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{16}{52} = \boxed{\frac{4}{13}}$

10) You draw one card from a standard deck of cards. Find the probability of drawing either a 5 or a black card.

overlap

$P(5) + P(\text{black}) - P(5 \text{ and black})$

$\frac{4}{52} + \frac{26}{52} - \frac{2}{52} = \frac{28}{52} = \boxed{\frac{7}{13}}$

11) You select one person at random from a room with eight people: two Democratic men, two Republican men, two Democratic women, and two Republican women. What is the probability that you will select either a woman or a Democrat?

overlap

$P(W) + P(D) - P(W \text{ and } Dem)$

$\frac{4}{8} + \frac{4}{8} - \frac{2}{8} = \frac{6}{8} = \boxed{\frac{3}{4}}$

12) The mathematics department of a college has 9 male professors, 12 female professors, 4 male adjuncts, and 3 female adjuncts. If a person is selected at random from the group, find the probability that the selected person is:

28 total

a. An adjunct. $P(a) = \frac{7}{28} = \boxed{\frac{1}{4}}$

b. A professor or a male. $P(P_r) + P(M) - P(P_r, M)$

$\frac{21}{28} + \frac{15}{28} - \frac{9}{28} = \boxed{\frac{27}{28}}$

c. An adjunct or a female.

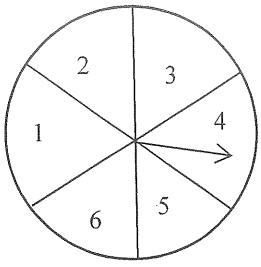
$\frac{7}{28} + \frac{15}{28} - \frac{3}{28} = \boxed{\frac{19}{28}}$

d. An adjunct or professor.

$P(A) + P(P_r)$

$\frac{7}{28} + \frac{21}{28} = \frac{28}{28} = \boxed{1}$

13-14 You spin the given spinner once.
Find the probability that the pointer will stop on:



13) an odd number or a number greater than 3.

1 2 3 4 5 6

overlap

$P(\text{odd}) + P(>3) - P(\text{odd}, >3)$

$\frac{3}{6} + \frac{3}{6} - \frac{1}{6} = \boxed{\frac{5}{6}}$

14) an even number or a number less than 3.

$P(\text{even}) + P(<3) - P(\text{even}, <3)$

$\frac{3}{6} + \frac{2}{6} - \frac{1}{6} = \frac{4}{6} = \boxed{\frac{2}{3}}$

STOP

HW 1-9 odd 13-45 odd

Odds and probability are NOT found the same way.

The **odds for** an event A= (in favor) $\dfrac{\text{number of ways A can occur}}{\text{number of ways A can't occur}}$

The **odds against** an event A= $\dfrac{\text{number of ways A can't occur}}{\text{number of ways A can occur}}$

15) What are the odds of rolling a 4 on a single die?

$\frac{4}{\text{not 4}} = \frac{1}{5}$ > sum = 6 1:5 1 to 5

16) What are the odds against rolling a number greater than 4 on a single die?

no greater than $\frac{4}{\text{greater than}} = \frac{4}{2} = \frac{2}{1}$

17) A single die is rolled. Find the odds in favor of rolling an even number less than 6.

even < 6 $= \frac{2}{4} = \frac{1}{2}$ (1) 2 (3) 4 (5) (6)

not even < 6

18) One card is randomly selected from a deck of cards. Find the odds:

a. In favor of drawing a 10. $\frac{10}{\text{not 10}} = \frac{4}{48} = \frac{1}{12}$

b. Against drawing a picture card.

$\frac{\text{not pic}}{\text{pic}} = \frac{40}{12} = \frac{10}{3}$

c. In favor of drawing a spade greater than 6 and less than 10.

7 8 9 $\frac{6 < \text{sp} < 10}{\text{not sp} 6 < \text{sp} < 10} = \frac{3}{49}$

19) The odds in favor of a hose winning a race are 6:1. What is the probability of the horse losing?

$\frac{\text{win}}{\text{lose}}$ $\frac{6}{1}$ total 7 P(losing) = $\frac{1}{7}$ $\frac{a}{\text{sm}}$

20) The probability that Johnny will do his homework is 2/11. What are the odds that he will do his homework?

P(hw) = $\frac{2}{11}$ ← hw ← total 9 dns $\frac{2}{9}$ ← hw ← no hw