2.4 – Adding Probabilities

"OR" means to ADD

Probability of Mutually Exclusive Events →

If two events, A and B, are mutually exclusive (two events cannot occur at the same time), then the probability of one event or another event is $P(A \text{ or } B) = P(A) + P(B)$

1st step in any "OR" problem is to determine "exclusive" or "inclusive".

Example 1: Complete each problem about finding the probability of mutually exclusive events.

a.) Keisha has a stack of 8 baseball cards, 5 basketball cards, and 6 soccer cards. If she selects a card at random from the stack, find the probability of the situations below. Total cards = 19

i.) P (baseball or soccer)
$= \frac{8}{19} + \frac{6}{19}$
$= \frac{14}{19}$ 73.7%

ii.) P (football or basketball)
$= \frac{0}{19} + \frac{5}{19}$
$= \frac{5}{19}$ 26.3%

b.) A card is drawn from a standard deck of cards. Determine the probability.

i.) P (6 or king)
$= \frac{4}{52} + \frac{4}{52}$
$= \frac{8}{52}$ 15.4%

ii.) P (red or black)
$= \frac{26}{52} + \frac{26}{52}$
$= \frac{52}{52}$ 100%

Probability of Inclusive Events →

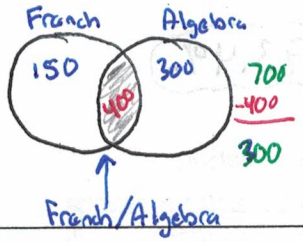
If two events, A and B, are inclusive (two events can occur at the same time), then the probability one event or another event is $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

How many times it occurs at the SAME TIME!

Example 2: Complete each problem about finding the probability of inclusive events.

a.) The enrollment at South High School is 1400. Total
Suppose 550 students take French, 700 take Algebra , and 400 take both French and Algebra.

i.) Draw a Venn Diagram to illustrate situation.



550
-400
150

ii.) P (French or Algebra)
$= \frac{550}{1400} + \frac{700}{1400} - \frac{400}{1400}$
$= \frac{850}{1400}$ 60.7%

b.) A card is drawn from a standard deck of cards. Determine the probability.

i.) P (queen or diamond)
$P(Q) + P(D) - P(QD)$
$= \frac{4}{52} + \frac{13}{52} - \frac{1}{52}$
$= \frac{16}{52}$ 30.8%

ii.) P (black or ace)
$P(B) + P(A) - P(BA)$
$= \frac{26}{52} + \frac{4}{52} - \frac{2}{52}$
$= \frac{28}{52}$ 53.8%

Example 3: Two cards are drawn from a standard deck of cards. Find each probability. Use nCr!

a.) P (2 kings or 2 black)
$P(2K) + P(2BlK) - P(2BK)$
$= \frac{{}_4C_2}{{}_{52}C_2} + \frac{{}_{26}C_2}{{}_{52}C_2} - \frac{{}_2C_2}{{}_{52}C_2}$
$= \frac{330}{1326}$ 24.9%
Inclusive

b.) P (both 8 or both jacks)
$P(2 8s) + P(2 Js)$
$= \frac{{}_4C_2}{{}_{52}C_2} + \frac{{}_4C_2}{{}_{52}C_2}$
$= \frac{12}{1326}$ 0.9%
Exclusive

c.) P (both 3's or both < 5)
$P(2 3s) + P(2 <5) - P(3 \text{ and } <5)$
$= \frac{{}_4C_2}{{}_{52}C_2} + \frac{{}_{12}C_2}{{}_{52}C_2} - \frac{{}_4C_2}{{}_{52}C_2}$
$= \frac{66}{1326}$ 5%
Inclusive

d.) P (2 face or 2 red)
$P(2 \text{ face}) + P(2 \text{ red}) - P(2 \text{ face}$
$= \frac{{}_{12}C_2}{{}_{52}C_2} + \frac{{}_{26}C_2}{{}_{52}C_2} - \frac{{}_6C_2}{{}_{52}C_2}$
$= \frac{376}{1326}$ 28.4%
Inclusive

Example 4: Determine whether the events are exclusive or inclusive. Then find the probability.

a.) There are 3 literature books, 4 algebra books, and 2 biology books on a shelf.
If a book is randomly selected, what is the probability of selecting a literature book or an algebra book?

Exclusive $P(\text{Lit}) + P(\text{Alg})$ $\frac{3}{9} + \frac{4}{9} = \frac{7}{9}$ 77.8%

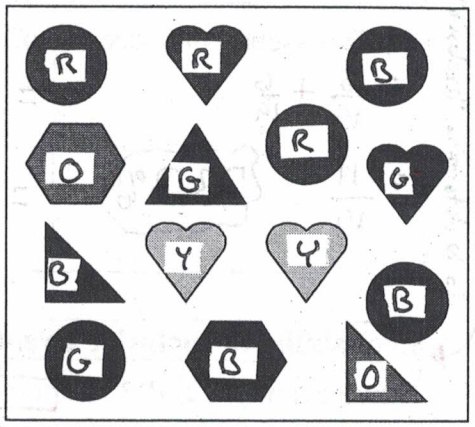
b.) A die is rolled. What is the probability of rolling a 5 or a number greater than 3?

Inclusive $P(5) + P(\#>3) - P(5 \text{ and } >3)$ $\frac{1}{6} + \frac{3}{6} - \frac{1}{6} = \frac{3}{6}$ 50%

c.) In the Math Club, 7 of the 20 girls are seniors, and 4 of the 14 boys are seniors. What is the probability of randomly selecting a boy or a senior to represent the club at a statewide math contest?

Inclusive $P(\text{boy}) + P(\text{senior}) - P(\text{boy and senior})$ $\frac{14}{34} + \frac{11}{34} - \frac{4}{34} = \frac{21}{34}$ 61.8%

d.) Jamie reaches into a dish and selects a token at random. Find the probability of each situation.



R:RED O:Orange Y: Yellow G:Green B: Blue

i.) What is the probability of Jamie picking a circle or heart token?

Exclusive $P(\bigcirc) + P(\heartsuit)$ $\frac{5}{14} + \frac{4}{14} = \frac{9}{14}$ 64.3%

ii.) What is the probability of Jamie picking a triangle or blue token?

Inclusive $P(\triangle) + P(\text{Blue}) - P(\text{Blue } \triangle)$ $\frac{3}{14} + \frac{4}{14} - \frac{1}{14} = \frac{6}{14}$ 42.9%

iii.) What is the probability of Jamie picking an orange or hexagon token?

Inclusive $P(\text{org}) + P(\hexagon) - P(\text{org } \hexagon)$ $\frac{2}{14} + \frac{3}{14} - \frac{1}{14} = \frac{3}{14}$ 21.4%

iv.) What is the probability of Jamie picking a blue heart or green triangle?

Exclusive $P(\text{blue } \heartsuit) + P(\text{Green } \triangle)$ $\frac{0}{14} + \frac{1}{14} = \frac{1}{14}$ 7.1%

v.) What is the probability of Jamie picking a red or yellow token?

Exclusive $P(\text{red}) + P(\text{yellow})$ $\frac{3}{14} + \frac{2}{14} = \frac{5}{14}$ 35.7%

e.) One tile with each letter of the alphabet is placed in a bag, and one is drawn at random.
What is the probability of selecting a vowel or a letter from the word EQUATION?

Inclusive $P(\text{vowel}) + P(\text{letter}) - P(\text{vowel})$

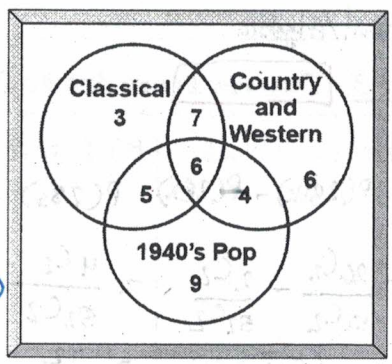
$5/26 + 8/26 - 5/26 = 8/26$ 30.8%

f.) There are 7 girls and 6 boys on the junior class homecoming committee.
A subcommittee of 4 people is being chosen at random to decide the theme for the class float.
What is the probability that the subcommittee will be 3 girls or 2 boys?

Exclusive $P(3 \text{ girls and } 1 \text{ boy}) + P(2 \text{ boys and } 2 \text{ girls})$

* nCr * $\frac{{}_7C_3 \cdot {}_6C_1}{{}_{13}C_4} + \frac{{}_6C_2 \cdot {}_7C_2}{{}_{13}C_4} = 525/715$ 73.4%

g.) The Venn Diagram below represents senior citizens and their music preferences.
The number of senior citizens surveyed was 60. Determine the probability of each situation.



a.) P (only Western or only Classical)

Exclusive $P(\text{only west}) + P(\text{only class})$

$\frac{6}{60} + \frac{3}{60} = \frac{9}{60}$ 15%

b.) P (Classical or 1940's Pop)

Inclusive $P(\text{class}) + P(1940) - P(\text{class and } 1940)$

$\frac{21}{60} + \frac{24}{60} - \frac{11}{60} = \frac{34}{60}$ 56.7%

c.) P (Classical and Western and 1940's Pop)

$P(\text{Classical and west and } 1940)$

$\frac{6}{60} \approx$ 10%

How many seniors satisfy all 3?