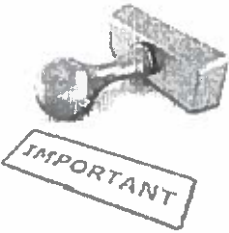


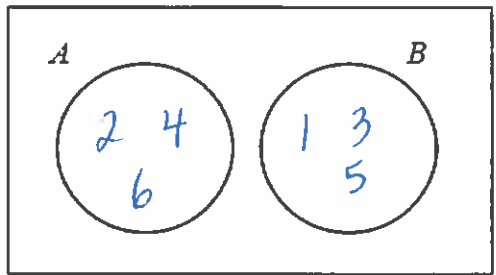
The Events "A or B", "A and B"



- The event *A or B* is said to occur if the event *A* occurs or if the event *B* occurs or if both events occur.
- The event *A and B* occurs if both event *A* and event *B* occur simultaneously.

Example (1):

Consider the experiment of rolling a die. Let event *A* be "an even number is thrown" and let event *B* be "an odd number is thrown." Complete the Venn diagram:



Determine the following probabilities:

$P(A) = \frac{3}{6} = \frac{1}{2}$
 $P(B) = \frac{3}{6} = \frac{1}{2}$
 $P(A \text{ or } B) = \frac{1}{2} + \frac{1}{2} = 1$
 $P(A \text{ and } B) = 0$ (No overlap!)

- Notice that the events *A*, *B* have no common outcomes.
- Notice that in the Venn Diagram the circle for *A* and the circle for *B* have no area of overlap.

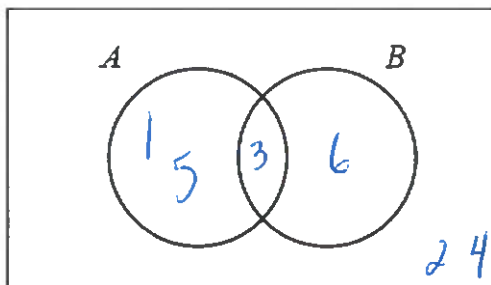
The events *A*, *B* are called mutually exclusive

Rule: $P(A \text{ or } B) = P(A) + P(B)$



Example (2):

Consider the experiment of rolling a die. Let the event A be "an odd number is thrown." Let event B be a "multiple of 3 is thrown." Complete the Venn diagram below:



Determine the following probabilities:

$$P(A) = \frac{3/6}{1/2} \quad P(B) = \frac{2/6}{1/3} \quad P(A \text{ or } B) = \frac{4/6}{2/3} \quad P(A \text{ and } B) = \frac{1/6}{1/6}$$

- Notice that the events A , B have common outcomes.
- Notice that in the Venn Diagram the circle for A and the circle for B have an area of overlap representing the event A and B .

The events A , B are not mutually exclusive.

Rule: $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) \quad 3/6 + 2/6 - 1/6 = 2/3$$

Example (3):

Classify the events in each experiment as either **mutually exclusive** or **non-mutually exclusive**:

- The experiment is rolling a die. The first event is rolling an even number and the second event is rolling a prime number. Non ME
- The experiment is playing a game of hockey. The first event is that your team scores a goal, and the second event is that your team wins the game. NON ME
- The experiment is selecting a gift. The first event is that the gift is edible and the second event is that the gift is an iPhone. ME

Example (4):

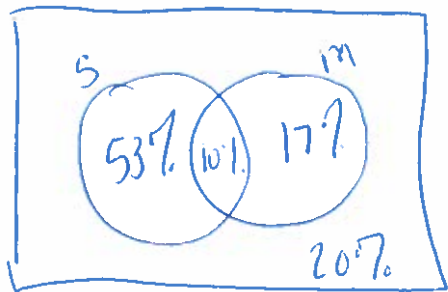
A class survey was conducted and had the following results:

63% of students play sports

27% of students play a musical instrument

20% play neither sports nor a musical instrument

Display the information above in a Venn diagram. Are the events mutually exclusive? Why or why not?



$63 + 27 + 20 = 110\%$ - (can only equal 100%!)
Therefore 10% overlap

Not mutually exclusive!

Example (5):

The probability that Dana will make the hockey team is $\frac{2}{3}$. The probability that she will make the swimming team is $\frac{3}{4}$. If the probability of Dana making both teams is $\frac{1}{2}$, determine the probability that she will make:

(i) at least one of the teams.

means $P(A \cup B)$ & very important

$$\begin{aligned} P(A \cup B) &= P(A) + P(B) - P(A \cap B) \\ &= \frac{2}{3} + \frac{3}{4} - \frac{1}{2} \\ &= \frac{8}{12} + \frac{9}{12} - \frac{6}{12} = \frac{11}{12} \end{aligned}$$

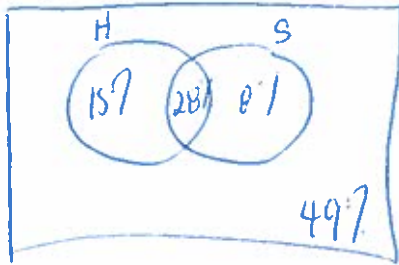
(ii) neither team.

means complement (outside of circle)

$$1 - \frac{11}{12} = \frac{1}{12}$$

Example 6: A car manufacturer keeps a database of all the cars that are available for sale at all the dealerships in Western Canada. For Model A, the database reports that 43% have heated leather seats, 36% have a sunroof and 49% have neither.

$$43 + 36 + 49 = 128\% \quad \text{so } 28\% \text{ overlap}$$



(A) Determine the probability of a Model A car at a dealership having both heated seats and a sunroof.

$$P(H \cap S) = 28\%$$

(B) Determine the probability of a Model A car having heated seats or leather seats.

$$P(H \cup S) = 15 + 28 + 8 = 51\%$$

$$\underline{\text{or}} \\ 43 + 36 - 28 = 51\%$$

Complete questions pg 174 - 3, 4, 5, 8, 9, 13, 14, 15