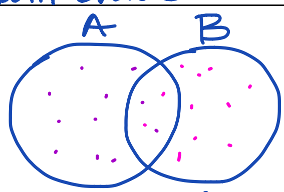
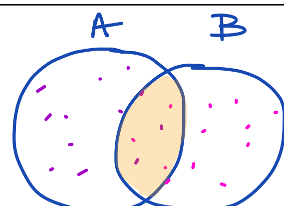
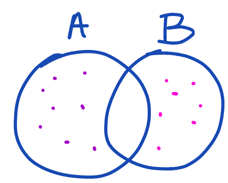
 Name: Key

10.4 PROBABILITIES OF DISJOINT AND OVERLAPPING EVENTS

Compound Events		
The union of event A and event B is all possible outcomes in both events.	The intersection of event A and B is only the outcomes in both events.	Sometimes the intersection of 2 events is empty.
 The union of A and B. Ex: The number of cards in the deck that are Kings and hearts	 The intersection of A and B. Ex: The intersection of the Kings and hearts is the King of hearts (it's both)	 Ex: The number of 10's and aces in the deck (can't be both)
Two events are overlapping if they have one or more outcomes in common.		Two events are disjoint if the have no outcomes in common.

Probability of Compound Events

If A and B are overlapping events, then the probability of A or B is:

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

If A and B are disjoint events, then the probability of A or B is:

P(A or B) = $P(A) + P(B)$

1. A six-sided die is rolled. What is the probability that the number rolled is less than 3 or greater than 5?

These events are dijoint

$P(<3 \text{ or } >5) = P(<3) + P(>5) = \frac{2}{6} + \frac{1}{6} = \frac{1}{2}$

2. A six-sided die is rolled. What is the probability of rolling a number greater than 4 or even?

These events are overlapping

$P(>4 \text{ or even}) = P(>4) + P(\text{even}) - P(>4 \text{ and even})$

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

3. Of 100 students surveyed, 92 own either a car or a computer. Also, 65 own cars and 82 own computers. What is the probability that a randomly selected student owns both a car and a computer?

we want to find: P(car and computer)

$P(\text{car or computer}) = P(\text{car}) + P(\text{computer}) - P(\text{car \& comp.})$

$\frac{92}{100} = \frac{65}{100} + \frac{82}{100} - P(\text{car \& Comp}) \rightarrow \frac{55}{100}$

4. A card is randomly selected from a standard deck of 52 cards. Find the probability of the given event:

a. Selecting an ace or an eight (disjoint)

$P(\text{Ace or } 8) = P(\text{ace}) + P(\text{eight})$

$= \frac{4}{52} + \frac{4}{52} = \frac{2}{13}$

b. Selecting a 10 or a diamond (overlapping)

$P(10 \text{ or diamond})$

$= P(10) + P(\text{diamond}) - P(10 \text{ \& diamond})$

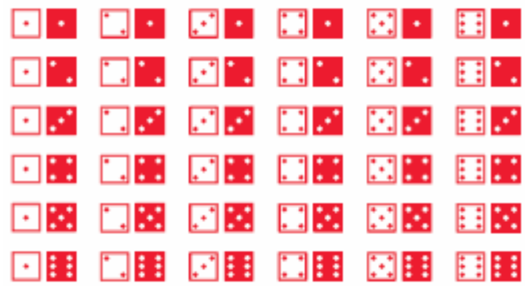
$= \frac{4}{52} + \frac{13}{52} - \frac{1}{52} = 4/13$

Probability of the Complement of an Event

The event $\bar{A}$ is the complement of event A and consists of all outcomes not in A.

The probability of the complement of A is $P(\bar{A})$ = $1 - P(A)$

5. When two six-sided dice are rolled, there are 36 possible outcomes, as shown. Find the probability of the given event.



a. The sum is not 8.

$P(\text{sum is not } 8) = 1 - P(\text{sum is } 8)$

$= 1 - \frac{5}{36} = \frac{31}{36}$

b. The sum is less than or equal to 10.

$P(\text{sum} \leq 10) = 1 - P(\text{sum} > 10)$

$= 1 - \frac{3}{36} = \frac{11}{12}$

6. There are 10 people at a dinner party. What is the probability that at least 2 people have the same birthday?

$P(\text{at least 2 people have same B-Day}) = 1 - P(\text{no one the same})$

$= 1 - \frac{365}{365} \cdot \frac{364}{365} \cdot \frac{363}{365} \cdots \frac{356}{365} = 1 - \frac{{}_{365}P_{10}}{365^{10}} = 1 - .8831 \approx .1169$

7. Find the probability that at least 2 people in this room have the same birthday.

$n = \#$ in room

$1 - \frac{{}_{365}P_n}{365^n}$