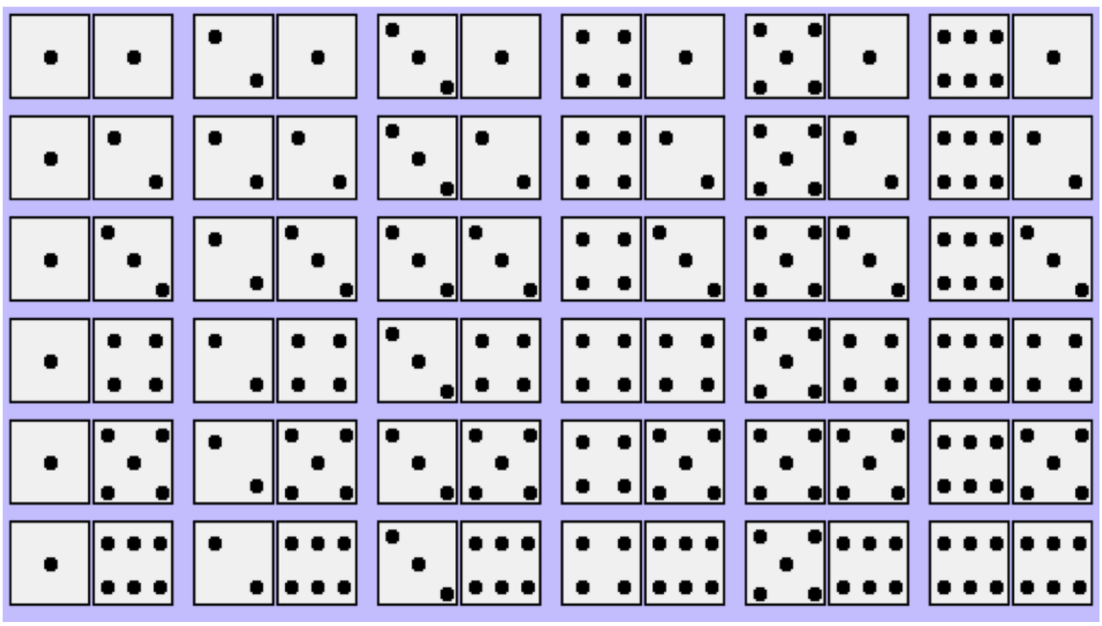
36 Possible Results with Two Dice



Multiple Event Probability

Mutually Exclusive Events

•Events are mutually exclusive if they cannot occur at the same time.

•They have no outcomes in common.

Consider the outcomes for drawing a single card from a standard deck of 52 playing cards. Are these events mutually exclusive?

1. Getting a 7 and getting a jack. Yes
2. Getting a club and getting a king. No
3. Getting a face card and getting an ace. Yes
4. Getting a face card and getting a spade. No

Given two mutually exclusive events A and B, the probability of A occurring or B occurring is:

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

e.g. A restaurant has 3 pieces of apple pie, 5 pieces of cherry pie, and 4 [pieces of pumpkin pie. If a customer selects a piece of pie for dessert, find the probability that it will be either cherry or pumpkin.

P(cherry or pumpkin) = P(cherry) + P(pumpkin)

= 5/12 + 4/12

= 9/12

Given two **non** mutually exclusive events A and B, the probability of A occurring or B occurring is:

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

e.g. A single card is drawn from a deck. Find the probability that it is a king or a club.

$$\begin{aligned} P(\text{king or club}) &= P(\text{king}) + P(\text{club}) - P(\text{king and club}) \\ &= 4/52 + 13/52 - 1/52 \\ &= 16/52 = 4/13 \end{aligned}$$

Try these ...

In a hospital unit there are 8 nurses and 5 physicians. 7 nurses and 3 physicians are female. If a staff person is selected at random, find the probability that the person is a nurse or is male.

Ask: are *nurse* and *male* mutually exclusive?

No. So...

P(nurse or male) = P(nurse) + P(male) – P(nurse and male)

= 8/13 + 3/13 – 1/13

= 10/13

On New Year's Eve, the probability of a person driving while intoxicated (duii) is 0.32, the probability of a person having a driving accident is 0.09, and the probability of a person having a driving accident while intoxicated is 0.06. What is the probability of a randomly chosen person driving while intoxicated or having an accident?

P(duii or accident)

$$= P(\text{duii}) + P(\text{accident}) - P(\text{duii and accident})$$
$$= 0.32 + 0.09 - 0.06$$
$$= 0.35$$

A dart is thrown at an open 12-month calendar and hits a day at random. Find the probability that it hit a weekend day.

At a political rally, there are 20 Republicans (10 female), 13 Democrats (8 female), and 6 independent (4 female). If a person is selected at random find these probabilities.

P(Dem. or Ind.) =

P(Rep. or female) =

P((male or Ind.) or Dem.) =

(answers on next page)

At a political rally, there are 20 Republicans (10 female), 13 Democrats (8 female), and 6 independent (4 female). If a person is selected at random find these probabilities.

P(Dem. or Ind.) = 19/39

P(Rep. or female) = 20/39 + 22/39 – 10/39 = 32/39

P((male or Ind.) or Dem.) =

(17/39 + 6/39 – 2/39) + 13/39 – 5/39 = 29/39

When rolling a single fair 6-sided die, find these probabilities.

P(roll an even number or a number less than 3) =

P(roll a number greater than 5 or less than 2) =

P(roll a prime number or an odd number) =

(answers on next page)

When rolling a single fair 6-sided die, find these probabilities.

P(roll an even number or a number less than 3) =

$$3/6 + 2/6 - 1/6 = \mathbf{4/6}$$

P(roll a number greater than 5 or less than 2) = **2/6**

P(roll a prime number or an odd number) =

$$3/6 + 3/6 - 2/6 = \mathbf{4/6}$$

Randomly select a golf ball from a bag containing 9 Titleists, 8 Maxiflites, and 3 Top-Flites.

P(picked a Titleist or a Maxflite) =

P(picked a Maxiflite or Top-Flite) =

P(picked a Top-Flite or not a Titleist) =

Randomly select a golf ball from a bag containing 9 Titleists, 8 Maxflites, and 3 Top-Flites.

P(picked a Titleist or a Maxflite) =

$$\frac{9}{20} + \frac{8}{20} = \frac{17}{20}$$

P(picked a Maxiflite or Top-Flite) =

$$\frac{8}{20} + \frac{3}{20} = \frac{11}{20}$$

P(picked a Top-Flite or not a Titleist) =

$$\frac{3}{20} + \frac{11}{20} - \frac{3}{20} = \frac{11}{20}$$

Three cable channels (6, 8, and 10) have quiz shows, comedies, and dramas. The number of each is shown in this table.

	Ch 6	Ch 8	Ch 10	
Quiz	5	2	1	8
Comedy	3	2	8	13
Drama	4	4	2	10
	12	8	11	31

If a show is selected at random, find these probabilities.

The show is a quiz show or shown on channel 8.

The show is a drama or a comedy.

The show is shown on channel 10 or a drama.

(answers on next page)

Three cable channels (6, 8, and 10) have quiz shows, comedies, and dramas. The number of each is shown in this table.

Type of Show	Ch 6	Ch 8	Ch 10	
Quiz	5	2	1	8
Comedy	3	2	8	13
Drama	4	4	2	10
	12	8	11	31

If a show is selected at random, find these probabilities.

The show is a quiz show or shown on channel 8. $\frac{14}{31}$

The show is a drama or a comedy. $\frac{23}{31}$

The show is shown on channel 10 or a drama. $\frac{19}{31}$

Draw a single card at random from a normal deck of 52 playing cards.

P(draw a heart or a club) =

P(draw an ace or a heart) =

P(draw an ace or a king or a queen or a jack) =

P(draw a club or a spade or a seven) =

P(draw a two and a spade) =

If the events are <u>independent</u> then:

$$P(A \text{ and } B) = P(A) \cdot P(B)$$

<u>Independent</u> means that A occurring has no affect on the probability of B occurring.

e.g. Toss a coin then roll a die.

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P(H) = 1/2

P(4) = 1/6

P(H and 4) = 1/2 * 1/6 = 1/12

	Roll of Die 1	2	3	4	5	6
H	H1	H2	H3	**H4**	H5	H6
T	T1	T2	T3	T4	T5	T6

Approximately 9% of men have red/green color blindness. If 3 men are selected at random, find the probability that all of them will have this type of color blindness.

If the events are dependent then:

$$P(A \text{ and } B) = P(A) \cdot P(B|A)$$

Dependent means that A occurring does affect the probability of B occurring.

$P(B|A)$ is "probability of B given A has already occurred"

This is conditional probability.

$P(B)$ is conditional on event A.

Urn Time!

Pick 2 marbles

URN

P(2R) =

P(2G) =

P(R then G) =

P(R and G) =

Pick 4 without replacement

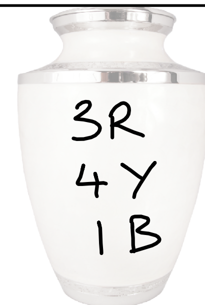
P(GWBW in this order) =

P(2G and 2W) =

P(at least 1B) =

URN

Pick 3 w/out replacement



URN

P(3 of one color)

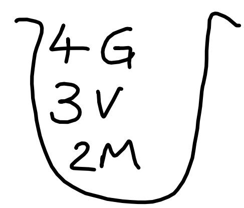
P(R then Y then B) =

P(1 of each color) :

P(at least 1 Y) =

P(R, R, B) =

Pick 3 w/out replacement



URN

URN

P(1 of each color) =

P(at least 2 M) =

P(at most 1 G) =

$0G\,3\overline{G}$ =

OR $1G\,2\overline{G}$ =

You ask the server to pick 2 pieces of fruit at random.

2 bananas
3 cherimoya
4 apples

Fruit Bowl

$P(2B) =$

$P(2\text{ different})$

$P(2\text{ same}) =$

$P(C, A) =$

Some random problems to test your mettle.

e.g. In your Halloween candy bag you have 12 Kit-Kats and 10 Milky-ways. What is the probability of picking out a Kit-Kat followed by a Milky-way?

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P(KK and MW) = P(KK) * P(MW | KK)

$$\frac{12}{22} \quad * \quad \frac{10}{21} \quad = \quad \frac{120}{462}$$

A hand of three cards is dealt from an ordinary deck of 52 playing cards. Find the probability of the following.

Getting three jacks.

Getting an ace, a king and queen in that order.

Getting a club, a spade and a heart in that order.

Getting three clubs.

A hand of three cards is dealt from an ordinary deck of 52 playing cards. Find the probability of the following.

Getting three jacks.

$$P(JJJ) = \frac{4}{52} * \frac{3}{51} * \frac{2}{50} = \frac{24}{132{,}600} \text{ or } \frac{1}{5525}$$

Getting an ace, a king and queen in that order.

$$P(AKQ) = \frac{4}{52} * \frac{4}{51} * \frac{4}{50} = \frac{64}{132{,}600} \text{ or } \frac{8}{16575}$$

Getting a club, a spade and a heart in that order.

$$P(♣♠♥) = \frac{13}{52} * \frac{13}{51} * \frac{13}{50} = \frac{2197}{132{,}600} \text{ or } \frac{169}{10200}$$

Getting three clubs.

$$P(♣♣♣) = \frac{13}{52} * \frac{12}{51} * \frac{11}{50} = \frac{1716}{132{,}600} \text{ or } \frac{11}{850}$$

The Calamity Assured Insurance Company found that 53% of the residents in Inundation City had homeowner's insurance with the company. Of these clients, 27% also had automobile insurance with the company. If a resident is selected at random, find the probability that the resident has both homeowner's and automobile insurance with the company.

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$$P(\text{Home and Auto}) = P(H) * P(A \mid H)$$

$$= 0.53 * 0.27$$

$$= 0.1431$$

In a shipment of 25 microwave ovens, 2 are defective. If two ovens are selected at random and tested, find the probability that both are defective.

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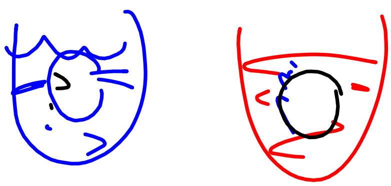
Let D1 = Oven 1 is defective, and
D2 = Oven 2 is defective, then

P(D1 and D2) = P(D1) * P(D2)

$$= \frac{2}{25} * \frac{1}{24} = \frac{2}{600} \text{ or } \frac{1}{300}$$

A red urn contains red W&Ws and a blue urn contains the same number of blue W&Ws. You take a number of red W&Ws from the red urn and mix them into the blue urn. You then take the same number of W&Ws from the blue urn and mix them back into the red urn.

If the probability of getting a blue W&W from the red urn is 20%, find the probability of getting a red W&W from the blue urn.



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