1. **Problem**
In a deck of strange cards, there are 559 cards. Each card has an image and a color. The amounts are shown in the table below.

	gray	green	teal	violet	white	Total
cat	14	15	18	17	11	75
dog	44	45	23	20	16	148
horn	36	22	25	12	38	133
pig	34	49	32	40	48	203
Total	128	131	98	89	113	559

(a) What is the probability a random card is violet given it is a dog?

(b) What is the probability a random card is both a cat and green?

(c) What is the probability a random card is white?

(d) What is the probability a random card is a cat given it is teal?

(e) What is the probability a random card is a dog?

(f) What is the probability a random card is either a dog or violet (or both)?

(g) Is a horn or a pig more likely to be white?

2. **Problem**
In a deck of strange cards, there are 271 cards. Each card has an image and a color. The amounts are shown in the table below.

	blue	indigo	white	Total
lamp	38	19	24	81
mop	32	27	17	76
shovel	14	18	21	53
tree	12	23	26	61
Total	96	87	88	271

(a) What is the probability a random card is a lamp?

(b) What is the probability a random card is blue given it is a tree?

(c) What is the probability a random card is a mop given it is indigo?

(d) What is the probability a random card is either a shovel or indigo (or both)?

(e) What is the probability a random card is blue?

(f) Is a mop or a shovel more likely to be white?

(g) What is the probability a random card is both a lamp and indigo?

3. **Problem**
A spinner has the probability distribution shown below.

x	$\Pr(x)$
5	0.36
15	0.2
18	0.25
30	0.19

(a) What is the probability of spinning 5? In other words, what is $\Pr(X = 5)$?

(b) What is the probability of spinning 15 or 30? In other words, what is $\Pr(X = 15 \text{ or } X = 30)$?

(c) If spinning twice, what is the probability of first spinning 15 and then spinning 30? In other words, what is $\Pr(X_1 = 15 \text{ and } X_2 = 30)$?

(d) What is the probability of spinning at most 15? In other words, what is $\Pr(X \leq 15)$?

(e) Determine the mean of the probability distribution by using $\mu = \sum x \cdot \Pr(x)$.

(f) Determine the standard deviation of the probability distribution by using $\sigma = \sqrt{\sum (x - \mu)^2 \cdot \Pr(x)}$.

4. **Problem**
A spinner has the probability distribution shown below.

x	$\Pr(x)$
2	0.12
13	0.66
27	0.1
29	0.12

(a) What is the probability of spinning 13? In other words, what is $\Pr(X = 13)$?

(b) What is the probability of spinning 2 or 27? In other words, what is $\Pr(X = 2 \text{ or } X = 27)$?

(c) If spinning twice, what is the probability of first spinning 2 and then spinning 27? In other words, what is $\Pr(X_1 = 2 \text{ and } X_2 = 27)$?

(d) What is the probability of spinning at least 13? In other words, what is $\Pr(X \geq 13)$?

(e) Determine the mean of the probability distribution by using $\mu = \sum x \cdot \Pr(x)$.

(f) Determine the standard deviation of the probability distribution by using $\sigma = \sqrt{\sum (x - \mu)^2 \cdot \Pr(x)}$.

5. **Problem**
Claude is buying a pizza. Claude still has to decide on a sauce and a type of crust. The shop carries 6 sauces and 3 types of crust. How many different combinations is Claude choosing between? Please make a **tree diagram**.

6. **Problem**
   Matilda is buying a pizza. Matilda still has to decide on a size and a topping. The shop carries 5 sizes and 3 toppings. How many different combinations is Matilda choosing between? Please make a **tree diagram**.

7. **Problem**
   Joe is shopping for shirts. Joe likes 10 of the shirts, but will only buy 4 of them. How many different combinations of shirts are possible?

8. **Problem**
   A designer is choosing a color pallette. There are 23 colors available, but the designer will only choose 5 colors for her pallette. How many pallettes are possible?

9. **Problem**
A company needs to select a president, a CFO, and a secretary. Each position will be held by a different person. The company is considering the same pool of 14 applicants for each position. How many configurations are possible?

10. **Problem**
A bike designer is choosing different colors for the fork, handlebars, and frame. There are 9 colors available. How many color configurations are possible?

11. **Problem**
Each trial has 0.53 probability of success. There will be 8 trials. We will measure the number of successes (but not worry about the exact sequence).

(a) Why is this a binomial distribution?
(b) What is the probability of getting exactly 3 successes? In other words, determine $\Pr(X = 3)$.
(c) What is the probability of getting exactly 2 successes? In other words, determine $\Pr(X = 2)$.
(d) What is the probability of getting more than 2 successes? In other words, determine $\Pr(X > 2)$.
(e) What is the probability of getting at least 2 successes? In other words, determine $\Pr(X \geq 2)$.
(f) What is the probability of getting less than 2 successes? In other words, determine $\Pr(X < 2)$.
(g) What is the probability of getting at most 2 successes? In other words, determine $\Pr(X \leq 2)$.
(h) Determine the mean number of successes.
(i) Determine the standard deviation of successes.

12. **Problem**
Each trial has 0.64 probability of success. There will be 9 trials. We will measure the number of successes (but not worry about the exact sequence).

(a) Why is this a binomial distribution?
(b) What is the probability of getting exactly 4 successes? In other words, determine $\Pr(X = 4)$.
(c) What is the probability of getting exactly 7 successes? In other words, determine $\Pr(X = 7)$.
(d) What is the probability of getting more than 7 successes? In other words, determine $\Pr(X > 7)$.
(e) What is the probability of getting at least 7 successes? In other words, determine $\Pr(X \geq 7)$.
(f) What is the probability of getting less than 7 successes? In other words, determine $\Pr(X < 7)$.
(g) What is the probability of getting at most 7 successes? In other words, determine $\Pr(X \leq 7)$.
(h) Determine the mean number of successes.
(i) Determine the standard deviation of successes.

1. (a) P(violet given dog) = 0.135
   (b) P(cat and green) = 0.0268
   (c) P(white) = 0.202
   (d) P(cat given teal) = 0.184
   (e) P(dog) = 0.265
   (f) P(dog or violet) = 0.388
   (g) P(white given horn) = 0.286 and P(white given pig) = 0.236, so a horn is more likely to be white than a pig is.
2. (a) P(lamp) = 0.299
   (b) P(blue given tree) = 0.197
   (c) P(mop given indigo) = 0.31
   (d) P(shovel or indigo) = 0.45
   (e) P(blue) = 0.354
   (f) P(white given mop) = 0.224 and P(white given shovel) = 0.396, so a shovel is more likely to be white than a mop is.
   (g) P(lamp and indigo) = 0.0701
3. Make a table (for parts d and e).

x	$\Pr(x)$	$x \cdot \Pr(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 \cdot \Pr(x)$
5	0.36	1.8	-10	100	36
15	0.2	3	0	0	0
18	0.25	4.5	3	9	2.25
30	0.19	5.7	15	225	42.75
		$\sum x \cdot \Pr(x) = 15$			$\sigma^2 = 81$
		$\mu = 15$			$\sigma = 9$

   (a) 0.36
   (b) 0.39
   (c) 0.038
   (d) 0.56
   (e) $\mu = 15$
   (f) $\sigma = 9$

4. Make a table (for parts d and e).

x	$\Pr(x)$	$x \cdot \Pr(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 \cdot \Pr(x)$
2	0.12	0.24	-13	169	20.28
13	0.66	8.58	-2	4	2.64
27	0.1	2.7	12	144	14.4
29	0.12	3.48	14	196	23.52
		$\sum x \cdot \Pr(x) = 15$			$\sigma^2 = 60.84$
		$\mu = 15$			$\sigma = 7.8$

(a) 0.66

(b) 0.22

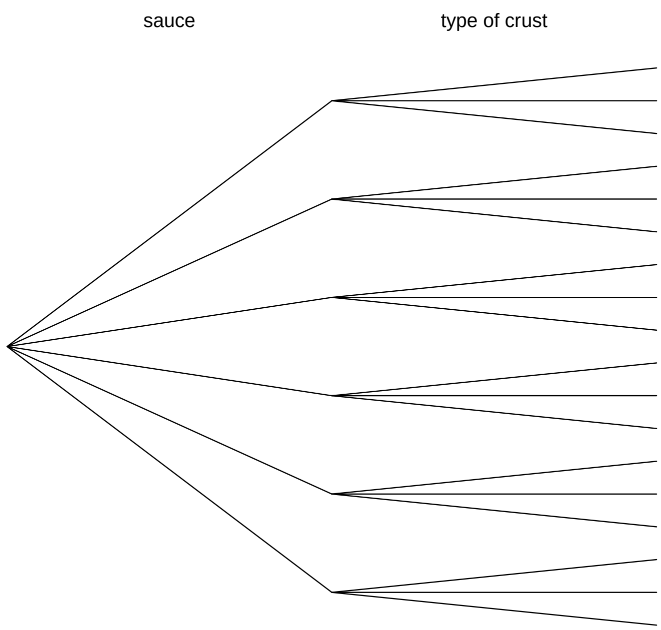
(c) 0.012

(d) 0.88

(e) $\mu = 15$

(f) $\sigma = 7.8$

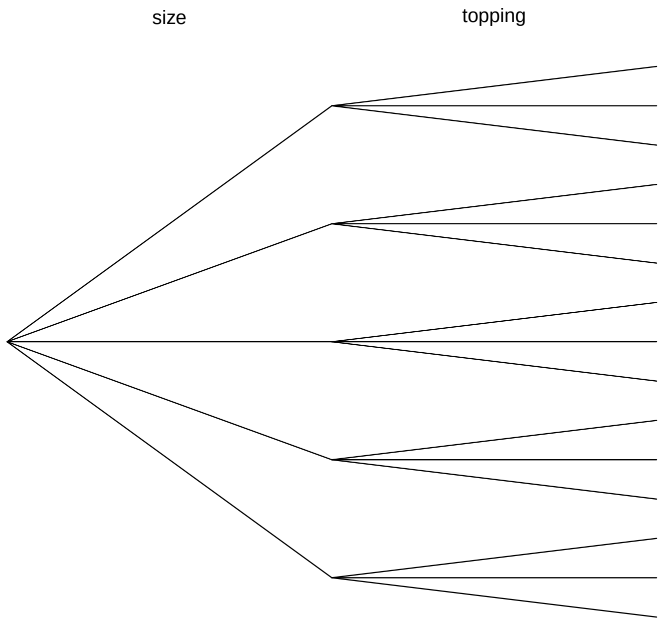
5. Make a tree.



Count the leaves (the nodes at the far right). In this case there are 18 leaves.

There are 18 combinations possible.

6. Make a tree.



Count the leaves (the nodes at the far right). In this case there are 15 leaves.

$$\boxed{\text{There are 15 combinations possible.}}$$

7. This scenario describes a combinations problem (order does not matter). We are considering the subsets of size 4 from a set of size 10.

$$_nC_r = \frac{n!}{(n-r)! \cdot r!}$$

$$n = 10$$

$$r = 4$$

$$_{10}C_4 = \frac{10!}{(10-4)! \cdot 4!}$$

$$= \frac{10!}{6! \cdot 4!}$$

$$= \frac{10 \cdot 9 \cdot 8 \cdot 7}{4 \cdot 3 \cdot 2 \cdot 1}$$

$$= \boxed{210}$$

8. This scenario describes a combinations problem (order does not matter). We are considering the subsets of size 5 from a set of size 23.

$$
\begin{aligned}
{}_nC_r &= \frac{n!}{(n-r)! \cdot r!} \\
n &= 23 \\
r &= 5 \\
{}_{23}C_5 &= \frac{23!}{(23-5)! \cdot 5!} \\
&= \frac{23!}{18! \cdot 5!} \\
&= \frac{23 \cdot 22 \cdot 21 \cdot 20 \cdot 19}{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1} \\
&= \boxed{33649}
\end{aligned}
$$

9. This scenario describes a permutations problem (order matters). We are considering the nonrepeating sequences of size 3 from a set of size 14.

$$
\begin{aligned}
{}_nP_r &= \frac{n!}{(n-r)!} \\
n &= 14 \\
r &= 3 \\
{}_{14}P_3 &= \frac{14!}{(14-3)!} \\
&= \frac{14!}{11!} \\
&= 14 \cdot 13 \cdot 12 \\
&= \boxed{2184}
\end{aligned}
$$

10. This scenario describes a permutations problem (order matters). We are considering the nonrepeating sequences of size 3 from a set of size 9.

$$
\begin{aligned}
{}_nP_r &= \frac{n!}{(n-r)!} \\
n &= 9 \\
r &= 3 \\
{}_9P_3 &= \frac{9!}{(9-3)!} \\
&= \frac{9!}{6!} \\
&= 9 \cdot 8 \cdot 7 \\
&= \boxed{504}
\end{aligned}
$$

11. (a) Each trial has TWO possible outcomes (which are mutually exclusive and exhaustive). Each trial has the same probability of success. We are interested in the total number of successes in a fixed number of trials.

    (b) $\Pr(X = 3) = {}_8C_3 \cdot 0.53^3 0.47^5 = 0.1912075$

    (c) $\Pr(X = 2) = {}_8C_2 \cdot 0.53^2 0.47^6 = 0.0847807$

    (d) $\Pr(X > 2) = 0.8913574$

    (e) $\Pr(X \geq 2) = 0.9761381$

    (f) $\Pr(X < 2) = 0.0238619$

    (g) $\Pr(X \leq 2) = 0.1086426$

    (h) Because this is a binomial distribution, $\mu = np$, so $\mu = 4.24$

    (i) Because this is a binomial distribution, $\sigma = \sqrt{npq}$, so $\sigma = 1.4116657$

12. (a) Each trial has TWO possible outcomes (which are mutually exclusive and exhaustive). Each trial has the same probability of success. We are interested in the total number of successes in a fixed number of trials.

(b) $\Pr(X = 4) = {}_9C_4 \cdot 0.64^4 0.36^5 = 0.1278212$

(c) $\Pr(X = 7) = {}_9C_7 \cdot 0.64^7 0.36^2 = 0.2051953$

(d) $\Pr(X > 7) = 0.1092123$

(e) $\Pr(X \geq 7) = 0.3144075$

(f) $\Pr(X < 7) = 0.6855925$

(g) $\Pr(X \leq 7) = 0.8907877$

(h) Because this is a binomial distribution, $\mu = np$, so $\mu = 5.76$

(i) Because this is a binomial distribution, $\sigma = \sqrt{npq}$, so $\sigma = 1.44$