1. **Problem**
   Aloysius is getting dressed, and still needs to pick a bracelet, a scarf, and a coat. Aloysius has 2 bracelets, 3 scarves, and 2 coats. How many different outfit combinations are possible? Please make a **tree diagram**.

2. **Problem**
   A committee is judging the performances of 13 different acrobats. The committee needs to assign 1st prize, 2nd prize, 3rd prize, 4th prize, and 5th prize. How many ways could the committee assign the prizes?

3. **Problem**
   Wilbur will invite 2 friends to a party. Wilbur has 18 different friends he is considering inviting. How many possibilities exist?

4. **Problem**
In a deck of strange cards, there are 413 cards. Each card has an image and a color. The amounts are shown in the table below.

| | black | blue | teal | Total |
|---|---|---|---|---|
| lamp | 13 | 30 | 10 | 53 |
| mop | 11 | 40 | 39 | 90 |
| needle | 35 | 14 | 37 | 86 |
| shovel | 29 | 50 | 38 | 117 |
| tree | 36 | 15 | 16 | 67 |
| Total | 124 | 149 | 140 | 413 |

(a) What is the probability a random card is either a lamp or black (or both)?

(b) What is the probability a random card is teal given it is a needle?

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

(d) Is a lamp or a needle more likely to be teal?

(e) What is the probability a random card is both a tree and teal?

(f) What is the probability a random card is a shovel?

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

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

| $x$ | $\Pr(x)$ |
|---|---|
| 4 | 0.12 |
| 12 | 0.34 |
| 18 | 0.11 |
| 24 | 0.14 |
| 26 | 0.15 |
| 30 | 0.14 |

   (a) What is the probability of spinning 4? In other words, what is $\Pr(X = 4)$?

   (b) What is the probability of spinning 4 or 12? In other words, what is $\Pr(X = 4 \text{ or } X = 12)$?

   (c) If spinning twice, what is the probability of first spinning 4 and then spinning 12? In other words, what is $\Pr(X_1 = 4 \text{ and } X_2 = 12)$?

   (d) What is the probability of spinning at most 18? In other words, what is $\Pr(X \leq 18)$?

   (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 $\sigma = \sqrt{\sum (x - \mu)^2 \cdot \Pr(x)}$.

6. **Problem**
Each trial has 0.59 probability of success. There will be 10 trials. We are interested in the probabilities associated with the number of successes.

   (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 8 successes? In other words, determine $\Pr(X = 8)$.

   (d) What is the probability of getting more than 8 successes? In other words, determine $\Pr(X > 8)$.

   (e) What is the probability of getting at least 8 successes? In other words, determine $\Pr(X \geq 8)$.

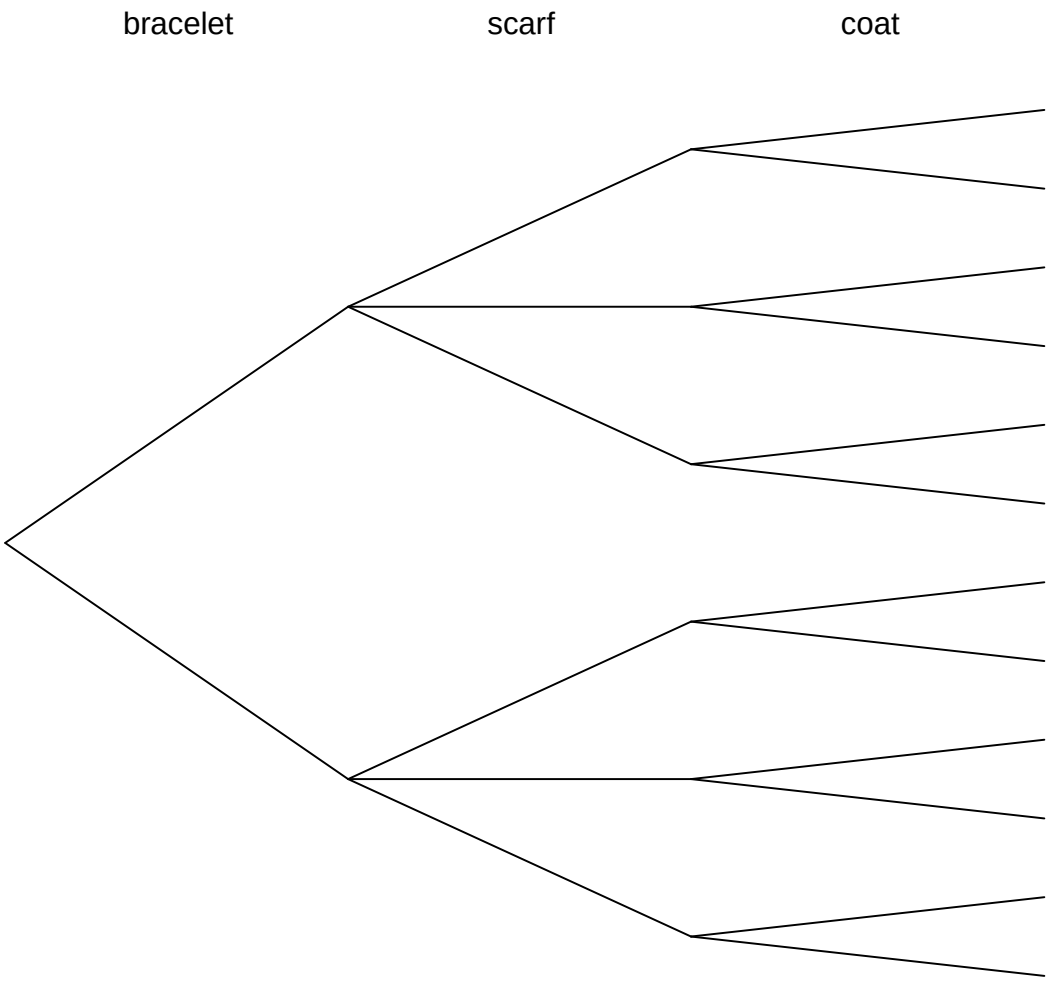
   (f) What is the probability of getting less than 8 successes? In other words, determine $\Pr(X < 8)$.

   (g) What is the probability of getting at most 8 successes? In other words, determine $\Pr(X \leq 8)$.

   (h) Determine the mean number of successes.

   (i) Determine the standard deviation of successes.

1. Make a tree.




Count the leaves (the nodes at the far right). In this case there are 12 leaves.

There are 12 combinations possible.

2. This scenario describes a permutations problem (order matters). We are considering the nonrepeating sequences of size 5 from a set of size 13.

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

$$ n = 13 $$

$$ r = 5 $$

$$ {}_{13}P_5 = \frac{13!}{(13-5)!} $$

$$ = \frac{13!}{8!} $$

$$ = 13 \cdot 12 \cdot 11 \cdot 10 \cdot 9 $$

$$ = \boxed{154440} $$

3. This scenario describes a combinations problem (order does not matter). We are considering the subsets of size 2 from a set of size 18.

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

$$ n = 18 $$

$$ r = 2 $$

$$ {}_{18}C_2 = \frac{18!}{(18-2)! \cdot 2!} $$

$$ = \frac{18!}{16! \cdot 2!} $$

$$ = \frac{18 \cdot 17}{2 \cdot 1} $$

$$ = \boxed{153} $$

4. (a) $P$(lamp or black) = 0.397

   (b) $P$(teal given needle) = 0.43

   (c) $P$(teal) = 0.339

   (d) $P$(teal given lamp) = 0.189 and $P$(teal given needle) = 0.43, so a needle is more likely to be teal than a lamp is.

   (e) $P$(tree and teal) = 0.0387

   (f) $P$(shovel) = 0.283

   (g) $P$(tree given blue) = 0.101

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

| $x$ | Pr($x$) | $x \cdot \Pr(x)$ | $x - \mu$ | $(x-\mu)^2$ | $(x-\mu)^2 \cdot \Pr(x)$ |
|---|---|---|---|---|---|
| 4 | 0.12 | 0.48 | -14 | 196 | 23.52 |
| 12 | 0.34 | 4.08 | -6 | 36 | 12.24 |
| 18 | 0.11 | 1.98 | 0 | 0 | 0 |
| 24 | 0.14 | 3.36 | 6 | 36 | 5.04 |
| 26 | 0.15 | 3.9 | 8 | 64 | 9.6 |
| 30 | 0.14 | 4.2 | 12 | 144 | 20.16 |
| | | $\sum x \cdot \Pr(x) = 18$ | | | $\sigma^2 = 70.56$ |
| | | $\mu = 18$ | | | $\sigma = 8.4$ |

   (a) 0.12

   (b) 0.46

   (c) 0.0408

   (d) 0.57

   (e) $\mu = 18$

   (f) $\sigma = 8.4$

6. (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) $\Pr(X = 3) = {}_{10}C_3 \cdot 0.59^3 0.41^7 = 0.0479981$

   (c) $\Pr(X = 8) = {}_{10}C_8 \cdot 0.59^8 0.41^2 = 0.1110699$

   (d) $\Pr(X > 8) = 0.0406295$

   (e) $\Pr(X \geq 8) = 0.1516993$

   (f) $\Pr(X < 8) = 0.8483007$

   (g) $\Pr(X \leq 8) = 0.9593705$

   (h) Because this is a binomial distribution, $\mu = np$, so $\mu = 5.9$

   (i) Because this is a binomial distribution, $\sigma = \sqrt{npq}$, so $\sigma = 1.5553135$