Birthday Problem
Some announcements

- Homework 4: Chapter 16 (1, 9, 11, 17, 19, 22, 30, 33, 35, 39, 57, 61, 64).
  
  Homework is due (officially) on Monday, March 7th. You may turn it in by Thursday, March 3 at 4pm for 5 bonus points.

- Homework 5: Chapter 16 (65, 66, 69, 71, 77). Read Chapter 17.

- Remember study sessions with Katie Greene (TA). Tuesday and Wednesday 7pm-9pm in Kirby 120.
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Today’s Goals

• Discuss classwork from Monday.
• The Birthday Game (fun with probability).
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This is 50 Cent.
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He’s going to party like it’s your birthday.
The Birthday Game

What is the probability that two people in the class have the same birthday?
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We will go by date, ignoring year and also ignoring leap day (sorry leap babies).
The Birthday Game

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Say we start with just two people. What is the probability that their birthdays are on different days?
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\[
P = \frac{365}{365} \times \frac{364}{365} \approx 99.73\%
\]
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The Birthday Game

What is the probability that three people have their birthdays, all on different days?

\[
P = \frac{365}{365} \times \frac{364}{365} \times \frac{363}{365} \approx 99.18\%.
\]

That's still pretty likely. What if we jump to 10 people?

\[
P = \frac{365}{365} \times \frac{364}{365} \times \cdots \times \frac{356}{365} \approx 88.31\%.
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\[ P = \frac{365}{365} \times \frac{364}{365} \times \cdots \times \frac{356}{365} \approx 88.31\% \]
The Birthday Game

21 people?

\[ P = \frac{365}{365} \times \frac{364}{365} \times \cdots \times \frac{345}{365} \approx 55.63\% \]
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We’re getting dangerously close to 50%.
The Birthday Game

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22 people?

\[ P = \frac{365}{365} \times \frac{364}{365} \times \cdots \times \frac{345}{365} \approx 52.43\% \]
The Birthday Game

21 people?

\[ P = \frac{365}{365} \times \frac{364}{365} \times \cdots \times \frac{345}{365} \approx 55.63\% \]

We’re getting dangerously close to 50%.

22 people?

\[ P = \frac{365}{365} \times \frac{364}{365} \times \cdots \times \frac{345}{365} \approx 52.43\% \]

So if everyone is here today, there’s about a 52% chance two people do not share a birthday, so about a 48% chance that two people do share a birthday.
The Birthday Game

This game works best in a class of about 30 people.

\[ P = \frac{365}{365} \times \frac{364}{365} \times \cdots \times \frac{336}{365} \approx 29.37\% \]
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\[ P = \frac{365}{365} \times \frac{364}{365} \times \cdots \times \frac{336}{365} \approx 29.37\% \]

In this case, there's over a 70% chance that two people share a birthday.