Announcements

- HW2 due Monday
- Lab 2 write-up due Monday as well
- Quick turn-around before the next lab, as it will also be Monday
  - Simulating odds in R
  - Write-up won't be due till the following Monday though to be clear
- Read Ch 5.1 for Wednesday

Warm Up

Determine the inner quartile range for the below sequence of numbers.

$$2, 3, 6, 8, 12, 23, 43, 44, 67$$

A) 12

B) 15

C) 37

D) 41

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Disjoint Outcomes

Disjoint outcomes: Can not happen at the same time. Said to be “mutually exclusive”.

- A single coin toss can not be a head and a tail
- A student can not pass and fail a class
- A single card from a deck can not be both Ace and King

Conversely, ***non-disjoint outcomes*** can happen at the same time.

Adding joints

If you want the odds of one disjoint outcome occuring ***or*** another disjoint outcome happening, the probabilities add.

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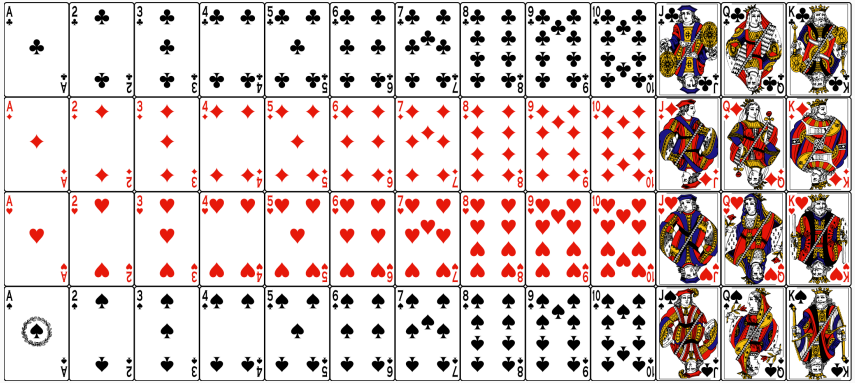
$$P(\text{Jack or } 3) = P(\text{Jack}) + P(3) = \frac{4}{52} + \frac{4}{52} = 0.154$$

Non-Disjoint Event Probabilities

What is the probability of drawing a jack or a red card from a well shuffled full deck?



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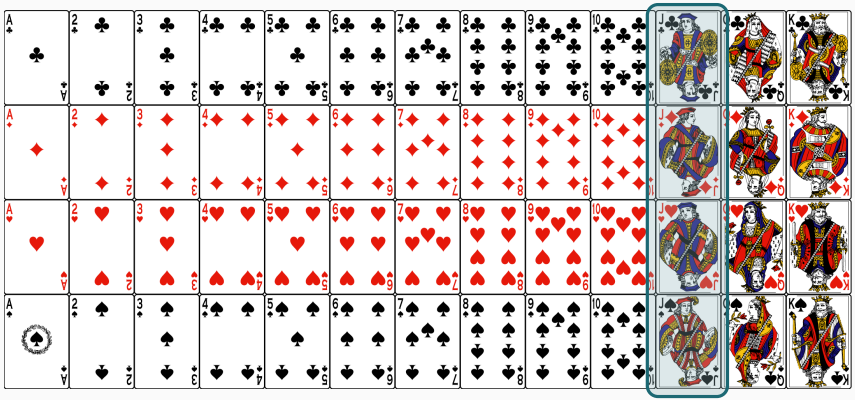

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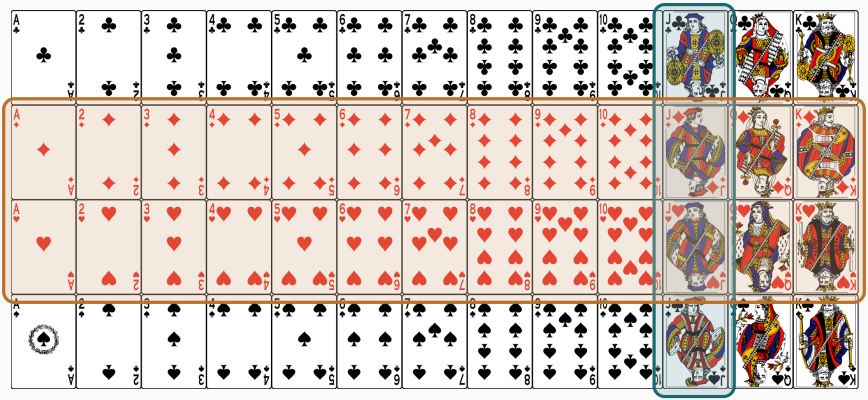

General Addition Rule

We need to subtract off some values to keep from double counting.
The result is the ***General Addition Rule***:

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The probability of drawing a Jack or a red card?

$$P(\text{Jack or Red}) = \frac{4}{52} + \frac{26}{52} - \frac{2}{52} = 0.538$$

Practice

What is the probability that a randomly sampled student thinks marijuana should be legalized or they agree with their parents political views?

A) $\frac{40 + 36 - 78}{165}$

B) $\frac{114 + 118 - 78}{165}$

C) $\frac{78}{165}$

D) $\frac{78}{188}$

	Share Parents' Politics		
Legalize MJ	No	Yes	Total
No	11	40	51
Yes	36	78	114
Total	47	118	165

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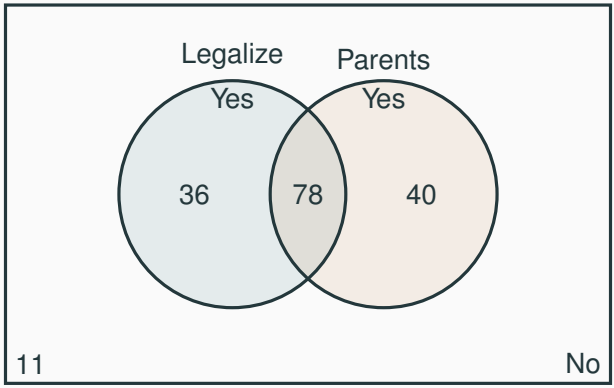
Venn and the Art of Motorcycle Riding

Using Venn diagrams can also be an effective way to convey information about disjoint (on non-disjoint) data.



Distributing Probabilities

A ***probability distribution*** lists all possible events and the probabilites with which they occur.

- The probability distribution for the gender of one child:

Event	Male	Female
Probability	0.5	0.5

- Probability distributions have rules:
  1. Events listed must be disjoint
  2. Each probability must be between 0 and 1
  3. Adding all probabilities must total to 1

Skittles Odds

Given the image to the right, lets construct a probability distribution for the colors of original skittles in my bag.

Color	Probability
Red	
Green	
Orange	
Purple	
Yellow	

Skittles Odds

Given the image to the right, lets construct a probability distribution for the colors of original skittles in my bag.

Color	Probability
Red	0.368
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Orange	
Purple	
Yellow	

Skittles Odds

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Color	Probability
Red	0.368
Green	0.263
Orange	
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Yellow	

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Yellow	0.053

Bestowing Complements

A ***sample space*** is the collection of all possible outcomes of a trial.

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Complementary events are two disjoint events whose probabilities add up to 1.

- Consider the skittles sample space of if the color starts with a vowel:

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- Looking at all the colors, the event: “Draw a red skittle” is complementary to the event “Draw anything but a red skittle”.

Practice

In a survey, 52% of respondents said they are Democrats. What is the probability that a randomly selected respondent from this sample is a Republican?

A) 0.48

B) more than 0.48

C) less than 0.48

D) can not calculate using information given

Independence

Two processes are ***independent*** if knowing the outcome of one provides no useful information about the outcome of the other.

- Knowing that a coin landed on heads on the first flip does not provide any useful information determining what the coin will land on in the second toss
- Knowing someone's eye color does not provide any useful information about their age
- But drawing an ace from a deck of cards does effect the odds of drawing a jack on the second draw (assuming you don't replace the ace)

Multiplication Rule

If A and B represent events from two independent processes, then

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

Or if you have multiple independent events,

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

Example

In my bag of skittles from earlier, assume I draw three skittles, replacing each back into the bag after each draw. What is the probability that I draw a red, green, and an orange skittle?

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$$\begin{aligned} P(\text{red and green and orange}) &= P(\text{red}) \times P(\text{green}) \times P(\text{orange}) \\ &= 0.368 \times 0.263 \times 0.158 \\ &= 0.015 \end{aligned}$$