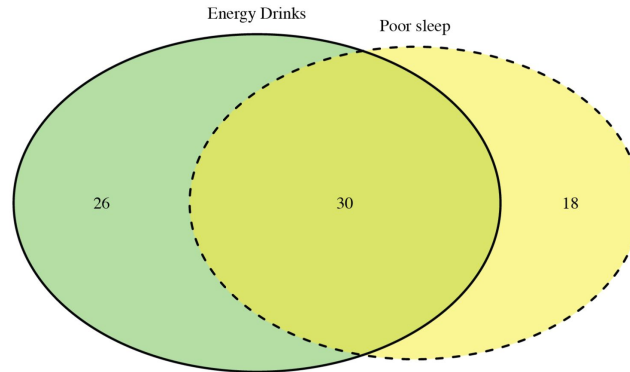


Sensitivity, Specificity, PPV, and NPV

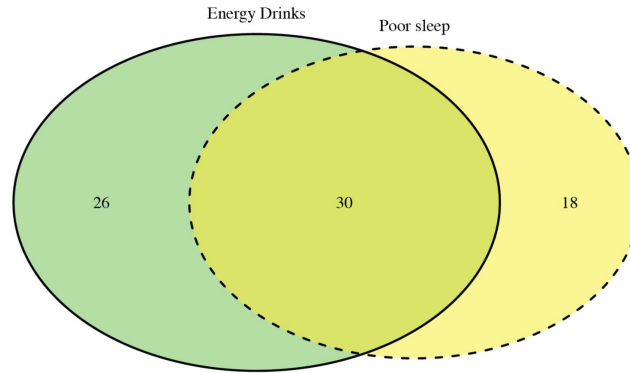
		Disease		Predictive Value	
		⊕	⊖		
Test	⊕	A True Positive (TP)	B False Positive (FP)	Positive Predictive Value (PPV) $\frac{TP}{TP + FP} = \frac{A}{A + B}$	Total Positive Results (A + B)
	⊖	C False Negative (FN)	D True Negative (TN)	Negative Predictive Value (NPV) $\frac{TN}{FN + TN} = \frac{D}{C + D}$	Total Negative Results (C + D)
Sensitivity & Specificity		Sensitivity $\frac{TP}{TP + FN} = \frac{A}{A + C}$	Specificity $\frac{TN}{FP + TN} = \frac{D}{B + D}$		
		All diseased patients (A + C)	All non-diseased patients (B + D)		

SU22 Midterm 2 Question 3

Pari and Sylvia are interested in the effect of energy drink consumption on sleep quality among UC students. They collect a random sample of 100 students at UC Berkeley and survey them. They ask if students consume at least one energy drink per week, and also administer a validated assessment of sleep quality, scores on this assessment are divided into two categories, poor quality sleep and adequate/good quality sleep. They present their findings using the Venn Diagram shown below.



SU22 Midterm 2 Question 3



1. Calculate the following probabilities:
 $P(\text{Energy Drinks})$
 $P(\text{Energy Drinks} \cup \text{Poor Sleep})$
2. Are Energy Drinks and Poor Sleep independent?

SU22 Midterm 2 Question 3 Solution

1. $P(\text{Energy Drinks}) = (26 + 30) / 100 = 0.56$
 $P(\text{Energy Drinks} \cup \text{Poor Sleep}) = (26 + 18 + 30) / 100 = 0.74$
2. To be independent $P(\text{Energy Drinks and Poor Sleep}) = P(\text{Energy Drinks}) * P(\text{Poor Sleep})$
 $P(\text{Energy Drinks and Poor Sleep}) = 30 / 100 = 0.3$
 $P(\text{Energy Drinks}) * P(\text{Poor Sleep}) = 0.56 * 0.48 = 0.27$
No they are not independent, $0.3 \neq 0.27$

SU22 Midterm 2 Question 1

A clinic is assessing whether to invest in a new breast cancer screening test that is different from the test they currently use. The clinic recruited you to analyze the accuracy of their current test given the data which is shown in the table below.

	Has Breast Cancer	Does not have Breast Cancer
Tests +	121	16
Tests -	35	341

1. Calculate the sensitivity and specificity of the clinic's current screening test. Present your answers as a percent and provide your answer rounded to one decimal place
2. Since breast cancer has the best outcome when detected early, we want to minimize the number of false negatives to ensure the best health outcome. Should the clinic invest in a test that is more sensitive or more specific? Explain why in 1 to 2 sentences.

SU22 Midterm 2 Question 1 Solutions

1. Sensitivity $P(\text{test} + \mid D +) = 121 / 156 = 77.6\%$
Specificity $P(\text{test} - \mid D -) = 341 / 357 = 95.5\%$
2. Sensitive test. Sensitivity indicates the ability to give a positive result when the individual is positive for the disease, thus minimizing the number of false negatives.

SU22 Midterm 2 Question 7

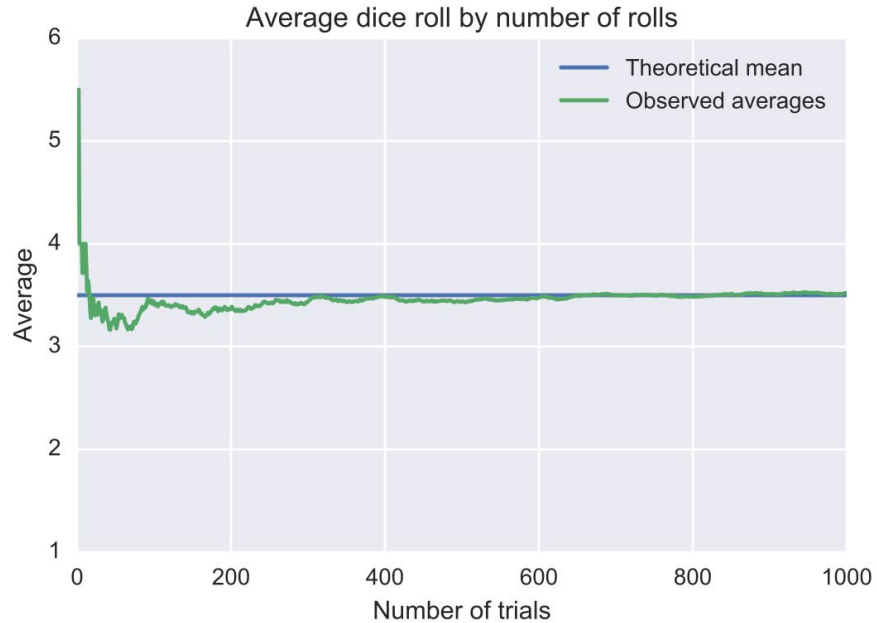
The athletic training department is interested in studying the number of head injuries acquired by football players in a local school district. It is known that every week, an average of 5 players experience a head injury. Assume that the head injuries are independent of each other, and that the chance a player has of receiving a head injury is the same each week.

1. What distribution is most appropriate to model the scenario?
2. What is the standard deviation of the distribution?
3. Write one line of code to calculate the probability that more than 10 players will acquire a head injury in a given week.

SU22 Midterm 2 Question 7

1. Poisson, average of 5 players is the constant rate and the events are independent of one another.
2. What is the standard deviation of the distribution? Standard deviation in poisson distribution is $\sqrt{\text{mean}/\text{rate}} = \sqrt{5}$
3. `ppois(q = 10, lambda = 5, lower.tail = F)` OR `1 - ppois(q = 10, lambda = 5)`

Law of Large Numbers



SU22 Midterm 2 Question 10

You have graduated from Berkeley and have a new job working as a research scientist. Your group is investigating whether a newly developed drug was helpful in decreasing systolic blood pressure of patients with hypertension compared to the standard of care. With the funding you had for this study, you were able to recruit 200 participants from UCSF. Your alternative hypothesis H_a is that this drug can decrease blood pressure by 5 mmHg. We know that the standard deviation of blood pressure in this population is 10mmHg.

Which one below call be your null hypothesis H_0 ?

- a. the drug can increase blood pressure by 5 mmHg
- b. there is no difference in blood pressure compared to the standard of care
- c. the drug effect is still unknown and we can't make a null hypothesis
- d. none of the above

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Based on the H_a and H_0 you chose from above, which of the descriptions below is correct?

- a. the alternative hypothesis is one-tailed
- b. the alternative hypothesis is two-tailed
- c. the alternative hypothesis can be either one- or two-tailed
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- a. setting alpha to a smaller value
- b. choosing a population with more variability in the outcome
- c. recruiting a larger sample size
- d. testing an alternative hypothesis

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