1. The Center for Disease Control has been monitoring the number of rabies outbreaks in Shasta County for the last 50 years. There is concern that the number of cases has increased over the last year. The average number of positive cases is 45, for every 1000 dead animals collected, with a standard deviation of 10. Positive cases exceeding 65, is considered to be abnormal. The researchers plan to randomly trap 100 different animals including, rodents, raccoons, and skunks. What is the probability that the average of the sample is above 0.065%?

2. A marine biology researcher has been observing a species of blue-green algae off the coasts of the island of Maui. Due to rapid urban development in the main Hawaiian Islands (Oahu, Maui, Hawaii Island) harmful chemicals reach the ocean through runoff. Fertilizers from farms and lawns cause eutrophication from the excess nutrients that create algal blooms that turn the water green and contaminate ocean waters. The researcher decides to test the amounts of Nitrogen levels in samples of blue-green algae around the island of Maui in an attempt to catch the algal blooms before they spread. Blue-green algae are considered hazardous if it contains more than 1000 ug/L in its structure. The researcher decides to collect 10 samples from 10 different locations off the coast of Maui each being 10 miles apart. What is the probability that the average amount of blue-green algae is over 1000 ug/L?

3. A recent study is underway to see if navel orange worm affects almonds trees. It has been known that navel orange worm will cause economic damage to an almond if not properly treated. Typically if an almond orchard is monitored by setting several traps out it can help to time the spraying for treatment, or it can tell a grower if treatment is needed at all. Damages caused by navel orange worm are usually kept to a minimum of no more than 5%. However, it has been noted that there could be some effective use by placing a trap every acer and letting that be the way the navel orange worm is managed. Essentially it would eliminate all spraying done to an almond orchard. Considering, two fields are monitored with the same conditions would it be plausible to keep the damage under 5% if there was no spraying done to the field?

4. Over the last 10 years solar companies have been installing solar on residential properties nationwide. A total of 200,000 residential homes were installed in 2013 and 2014. The average number of 265 watt panels per home is 20. These are able to produce enough energy to accommodate the entire electricity portion of the power used in each home. The standard deviation of panels per home is 4. Infinity Energy recently began working in Butte County and has installed on 30 homes. What is the probability that the number of panels per home is under 14 in Butte County?

5. A heavily impacted class "Intro To Psychology" nearly always has all of its 300 slots filled at the beginning of the semester. An attendance auditing team has spent 100 years tracking how many students attend at least 2 of the 3 lectures in week 9. Typically 200 students on average fulfill this requirement with a standard deviation of 50. A class is seen to be undetermined if only 140 students attend at least 2 of the 3 lectures in week 9. A new professor is assigned to teach this class for a 5 year period. The team wishes to conduct a 10 semester study to assess how determined the classes are during this professor's stint. Assuming students attendance in week 9 is normally distributed, what is the probability that the average amount of students who attended at least 2 lectures in week 9 is less than 140?

6. In the 4-6 Hands-On Science Lab, interns have 13 minutes to teach their labs and 2 minutes for extension and review. Over all the years, Tanya and Christl have tracked how long their interns take to teach the introduction section of the lab to the elementary students that visit. They found that, on average, interns take 5 minutes with a standard deviation of 2 minutes for the introduction of the lab. Since the "Hands-on" is highly stressed, there should be more time allocated doing things rather than talking about the subject (although that is also important). Teaching the introduction under 4 minutes is a very fast introduction. I work with 5 interns (so 6 interns total including me). Considering the sample size and assuming normal distribution, what is the probability that the average time of our introductions are under 4 minutes? (Note: These numbers are made-up numbers)

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pt(q=(4-5)/(2/sqrt(6)),df=5) #This is what I wanted it to come out to, whether it makes sense to us

## [1] 0.1376099
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This shows that 0.138 is the probability that one of us interns will teach the introduction of our lab under four minutes. I'm not sure if this is the correct answer but it makes sense that the probability would be pretty low because the students need a strong foundation of the subject to be able to understand what is going on in the lab. Interns would spend more than 4 minutes to develop the concept before they start the lab stuff.

7. A group of wildlife researchers have been monitoring Kokanee Salmon populations in Lake Tahoe for over 50 years. Last year one of the researchers felt one Salmon he was tracking was undersized. Typically this species of adult Salmon have an average of 14 inches with a standard deviation of 1 inch. An adult salmon is considered undersized when its length is less than 12.5 inches. The wildlife team plans to go out this year and trap and measure 10 different Kokanee Salmon to assess the health of the heard. Assuming the lengths are normally distributed, what is the probability the average length of this sample is less than 12.5 inches.

8. A few psychology students at Chico State are conducting a study to determine the stress levels that students have while taking midterms. Thirty students are randomly selected. The study shows a mean stress level of 7.8 and a standard deviation of 1.26. Assuming normal distribution, what is the probability that on the next exam that the stress level will be between 9 and 10?

9. Scientists are trying to study typical gestation in female grizzly bears Ursus Arctos Horribilis in Yellowstone National Park. Researchers have gestation data for the past 15 years on 20 radio collared female bears, data such as: gestation length, weight of the offspring, start & end date of gestation, and the number of offspring were gathered. The researchers notice that the gestation length often depends on the physical condition of the bear, normally the gestation length is around 200 days with a standard deviation of 25 days. If the gestation length exceeds 245 days the animal probably went through a significant amount of physical stress over the winter months. What is the probability that a random female bear from the greater Yellowstone National Park area will have a gestation length greater than 245 days?

10. There are an estimated 494 cities in the world with populations over 1 million. An organization in inquiring what proportion contributes the most annual per capita release of carbon dioxide in order to focus their research efforts on climate change mitigation. The mean of these cities is 45 metric tons of CO2 per capita per year. The standard deviation is 11 metric tons of CO2 per capita per year.The research group samples the carbon emissions of 40 cities by using atmospheric detectors and computes the data into metric tons of CO2 per capita by referencing population census data. If we assume the emission of CO2 per year for these cities is normally distributed, what is the probability that the sample will contain cities with emissions higher than 70 metric tons of CO2 per person per year?

11. An amateur beer-brewing club has been testing the alcohol content of their oatmeal stout beer for the past 10 years to find the optimum ratio of alcohol to flavor content. A fellow beer crafter (who has only been with the club for a year or so) felt that the groups' darker beer was a little weak. While looking over the brewing data of years past, they conclude that the average alcohol content is around 8.5% with a standard deviation of $\pm$ 1.5%. In order for the beer to even be considered an oatmeal stout, the beer must have an average percentage of 8.2%. When the findings are brought up to the rest of the club, they get the group to decide to measure the alcohol percentage of 10 of their previously made beer batches to confirm this finding. Presuming that the alcohol percentages are normally distributed, what is the probability that the average alcohol percentage is around 8.2%?

12. A particular upper division STEM course has completed a midterm. The exam is graded out of 100 points. The average score is 68 points with a standard deviation of 16 points. A random group of 10 students are discussing their grade on the midterm. Assuming the midterm grades are normally

distributed, what is the probability that that random group of ten students achieved an average score of at least 90%?

13. A group at the Butte Humane Society is monitoring the stray cat litter sizes in Chico for the past 10 years. ?Last year one of the researchers felt that she had a large number of cases of extremely large kitten litters last year. Typically a healthy cat will on average produce 4 live kittens with a standard deviation of 1. A cat that produces more than 6 live kittens is considered to be an extremely large litter. The group plans on going out this year and observing at least 20 cat births in Chico and assess the numbers of stray cat birthing rates in Chico. Assuming that the litter size is a normal distribution what is the probability that the average litter size of the sample will be 6?

14. In professional tennis, the number of matches a player wins in a calendar year correlates with his or her world ranking. For the past ten years, the average number of matches won for the top 4 men's players is 62 matches, with a standard deviation of 6 matches. Excellent performance is considered winning more than 68 matches. The sports statistician wants to research match wins for players ranked 5-10 who may still have excellent performance, despite their ranking. Assuming the data is normally distributed, what is the probability that the average number of wins for these players is greater than 68?

15. Concerns Over Childhood Cancer Age Incidence: County Public Health researchers have begun to notice that over the past 10 years the age of children diagnosed with cancer has decreased steadily to an average of 3.5. Many of researchers suspect that the decrease in diagnosis age is due to the groundwater pollution from the fracking drill rigs within the local foothills and mountains. Nationwide the average age of children diagnosed with cancer is 6 with a standard deviation of 2. They feel there is compelling evidence to suggest this trend is correlated with the rise in fracking drill pollution of groundwater. The researchers wish to bring this information to the county supervisors' board in order to propose a referendum against fracking within their county. Assuming the ages are normally distributed, what is the probability that the average age of a child diagnosed with cancer is going to be under 3.5? Do they have a reasonable case?

16. The average person is recommended to get at least 8 hours a night. A researcher is taking a random poll of 100 people to see if they get the recommended amount of sleep. A national poll says that the average amount of Americans get 6.59 hours of sleep with a standard deviation of 1.72 hours. What is the probability that researcher finds that the average amount of hours of sleep these people get are above 8 hours? The number of hours of sleep per night is normally distributed.

17. A veterinary research team wants to review the effects of the new anesthesia drug SleepyKitty on the heart rate of cats. The average heart rate of all cats during surgery is 132 bpm, with a standard deviation of 12bpm. The new drug seems to be causing tachycardia (faster than normal heart rate) in some surgical patients. Cats are considered to be experiencing tachycardia when their heart hate is above 150 bpm. The research team reviews the surgical monitoring records from 50 surgeries involving cats who were anesthetized with SleepyKitty. Assuming the heart rates of these surgical patients are normally distributed, what is the probability that a cat who is anesthetized with SleepyKitty will have developed tachycardia?

18. The foxtail pine tree is a species of conifer trees endemic only to the Klamath Ranges in Northern California and Southern Oregon. There has been studies done to figure out why this species is slowly being restricted to higher elevations where there is a drastic change in soil pH and lower temperatures. In a long term study researchers have been monitoring the seedling succession for the past 100 years. In the past 2 decades the researchers have seen a decline in seedling succession. In a typical year, there is an average of 14 new seedlings with a standard deviation of 3 seedlings present every year within a area of 100ft2. An area is considered in decline if there is less than 7 seedlings per 100ft2. The recent research team members plans to go out this year and count the amount of new seedlings in a total of 1,000 ft2 to assess the seedling sucession. Assuming that the count of new seedlings is normally distributed, what is the probablity that the average count of successful seedlings of this sample is under 7 seedings per 100ft2?