STA 2023 Honors Ripol **Name ____________________________**

Fall 2011 Exam 2 **UF ID# ____________________________**

FORMULAS : Binomial Porportion $\hat{p}$: mean = p stdev = $\sqrt{\frac{p(1-p)}{n}}$

Sample Mean $\overline{X}$: mean = μ stdev = $\frac{\sigma}{\sqrt{n}}$

1. Are horoscopes accurate? Professional astrologers prepared individualized horoscopes for 83 adults. Each participant was then shown three horoscopes: the one prepared for them, and two others that were randomly chosen from those prepared for other participants. Each adult had to select the one that was prepared for them. Of the 83 subjects, 28 chose correctly.

a) State the assumptions necessary for the validity of a confidence interval and for a significance test. Are they satisfied? Explain. (8 pts)

b) Construct and Interpret a 93% CI for the true proportion of adults that would recognize their own horoscope. (12 pts)

c) Use this study's results to find the approximate sample size needed to estimate p to within 0.07 with 95% confidence. (6 pts)

d) Conduct a significance test to see if people recognize their horoscopes with a higher probability than if they were randomly guessing. Show all the steps in the right order.

(14 pts)

2. In the big STA 2023 course, students are allotted one hour for each try of the online quizzes, and typically take the longest on their first try. How long do they take on average? A random sample of 35 students gave a 95% Confidence Interval for the average time it takes students to complete their first try of the quiz of (19.09, 26.19) minutes. For each of the following statements, determine if they are True or False.

(10 pts)

The probability that μ is between 19.09 and 26.19 minutes is .95	a) True b) False
The margin of error of this interval is 7.1 divided by 2.	a) True b) False
95% of all samples will have averages between 19.09 and 26.19 minutes.	a) True b) False
We are 95% confident that it takes students, on average, between 19.09 and 26.19 minutes to complete their first try at the quiz.	a) True b) False
95% of all students take between 19.09 and 26.19 minutes on their first try of the quiz.	a) True b) False

3. As part of a class project, 17 UF students were randomly selected and asked how many hours they spend exercising on a typical week. The data appears below:

12 10 4 7 1.5 10 6 4 1.5 2 8 3 15 14 15 2 3

a) Let X be the number of hours each person exercises. What can you say about the distribution of X? Explain. (5 pts)

b) Let $\overline{X}$ be the average number of hours of exercise by students in the sample. What can you say about the distribution of $\overline{X}$? Explain. (5 pts)

c) Construct a 95% confidence interval for μ. (8 pts)

d) Interpret the confidence interval, paying special attention to the assumptions. (5 pts)

4. Studies show that **85%** of high school students use their cell phones during school hours. We will select a random sample of 500 high school students and find the probability that more than **90%** in the sample use their cell phones during school hours.

a) Are the bold numbers parameters or statistics? Explain. (3 pts)

b) What is the sampling distribution of the statistic? Explain. (4 pts)

c) Find the probability a that more than 90% in the sample use their cell phones during school hours. (10 pts)

5. Studies show that, during school hours, high school students send an average of **1.6** text messages an hour with a standard deviation of **1.2**. We will take a sample of the phone records of 200 teenagers for one hour and compute the average number of text messages sent. Find the probability that the mean number of text messages in the sample is greater than 1.8. (10 pts)

STA 2023 Honors **4th period** **Name** ________________________

Fall 2008 **Exam 2** **UF ID#** ____________________

FORMULAS : Binomial Porportion $\hat{p}$: mean = p stdev = $\sqrt{\frac{p(1-p)}{n}}$

Sample Mean $\overline{X}$: mean = μ stdev = $\frac{\sigma}{\sqrt{n}}$

1. When studying the Sampling Distribution of the sample proportion with simulations, there were three quantities we could change: p=population proportion, n=sample size, N= number of simulations done. Which of them is primarily responsible for: (4 pts)

   a) the symmetry of the distribution? __________
   b) the gaps in the graph of the distribution? __________

2. When studying the Sampling Distribution of the sample mean with simulations, there were three things we could change: shape of the original distribution, n=sample size, N= number of simulations done. Which of them should be increased to see: (4 pts)

   a) the center of the distribution of x-bar getting closer and closer to mu? _________
   b) the spread of the distribution of x-bar getting smaller and smaller? ___________

3. Two days before the elections, the state of Florida was too close to call. A FOX News poll had 50% for John McCain vs 49% for Barack Obama, with a margin of sampling error of 3%.

a) About how many people participated in this survey? (8 pts)

b) Final election results in Florida had 51% of voters selecting Obama. What is the probability that a random sample of 1000 voters would predict a win for him? (10 pts)

4. On NW 22 st, just north of University Avenue, the speed limit is 25mph. There is an electronic device that displays the speed of approaching cars. The following are the traveling speeds (in mph) for a sample of 9 cars on a recent afternoon:
29 25 28 23 24 23 25 27 26

a) Construct a 95% confidence interval for the average speed of cars at this stretch of the road. (10 pts)

b) Interpret your results, including a statement about any assumptions you need to make and how likely they are to be satisfied. (8 pts)

c) Name two things you could do to get a narrower interval. (4 pts)

5. A survey conducted last year for a class project randomly selected students living in Hume hall and asked them if they had a job. 11 out of 29 female students answered yes. Construct a 92% confidence interval for the parameter and interpret your results. (14 pts)

6. In the months and days leading up to this election there have been many polls with sometimes conflicting results. Part of the reason for this is the definition each polling organization uses to determine if a respondent is a “likely voter”. Not everyone who is registered to vote does so, and polling organizations like to give more weight to the answers of those who are more likely to vote. Traditionally, older, white people are much more likely to vote than young people or minorities, but this election was expected to be different. The Gallup Polls decided to use two different models this year - the traditional model that determines “likely voters” by past voting behavior, and an expanded model that includes more in those groups that were not as likely to vote before.

The Gallup Expanded Poll had determined, on the days leading up to the election, that 11% of all likely voters were Black. However, exit polls conducted on election day found 13% of actual voters were Black (2318 Black voters out of 17834 people interviewed nationwide). Conduct a significance test to determine if even the Expanded poll was too low in its predictions.
(16 pts)

7. Jan's All You Can Eat Restaurant charges \$8.95 per costumer. Restaurant management finds that its expense per customer, based on how much the customer eats and the expense of labor, has a mean of \$8.20 and standard deviation of \$3. Suppose the 100 customers on a particular day have the characteristics of a random sample from their customer base.

a) Is the distribution of the restaurant's expense per customer Normal? Explain. (4 pts)

b) Is the distribution of the restaurant's sample mean expense per customer for that day Normal? Explain. (4 pts)

c) Find the mean and standard error of the sampling distribution of the restaurant's sample mean expense per customer. (4 pts)

d) Find the probability that the restaurant makes a profit that day, with the sample mean being less than \$8.95. (10 pts)

STA 2023 Honors 4th period Name ___________________________________

Fall 2007 Exam 2 UF ID# ___________________

FORMULAS

Binomial Porportion $\hat{p}$: mean = p stdev = $\sqrt{\frac{p(1-p)}{n}}$

Sample Mean $\overline{X}$: mean = μ stdev = $\frac{\sigma}{\sqrt{n}}$

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1. Election Polls.

a) Interpretations– True or False.

A Rasmussen Reports national telephone survey of voters, conducted October 19-21, 2007, found that comedian Stephen Colbert is preferred by 13% of voters as an independent candidate challenging Democrat Hillary Clinton and Republican Rudy Giuliani. The data was used to construct a 95% CI: (0.11, 0.15). (6 pts)

___ We are 95% confident that, if the presidential election were today, and voters had to choose between those three candidates, Colbert would get more than 10% of the vote.

___ The margin of error of the confidence interval is 0.04.

___ A 99% confidence interval constructed with the same data will include 0.15.

___ We are 95% confident that the average voters in the population who prefer Colbert over Clinton and Giuliani is between 0.11 and 0.15.

___ 95% of voters believe the proportion of voters in the population who prefer Colbert over Clinton and Giuliani is between 0.11 and 0.15.

___ We are 95% confident that the proportion of voters in the population who prefer Colbert over Clinton and Giuliani is between 0.11 and 0.15.

b) Show how the margin of error was computed for the following news story. (6 pts)

Poll: Giuliani Ahead in Florida by The Associated Press – Oct 10, 2007

Giuliani's edge over Thompson remains slim, though Romney has gained slightly since September. Only 14 percent of the state's Republicans think Giuliani has clinched the nomination. The telephone poll, done by Quinnipiac University, was conducted from Oct. 1-8 and involved telephone interviews with 345 Republicans, and has a sampling margin of error of plus or minus 3.7 percentage points.

2. A random sample of 10 girls of age 5 is taken within the City of Gainesville and their weights are measured. The sample mean is 46 pounds and the standard deviation is 2 pounds.

a) In this study, what is the parameter we want to estimate? Denote this quantity by a symbol and explain what the symbol stands for in this problem. (4 pts)

b) Construct a 95% confidence interval for the parameter of interest. Interpret your results. (12 pts)

c) What assumptions have you made for the above confidence interval to be valid? Are they likely to be satisfied? Explain. (4 pts)

d) If we wanted to estimate the parameter with confidence level 95% and a margin of error of 0.2s pound, how many girls should be sampled? (6 pts)

3. A publishing company is interested in the percentage of U.S. adults that have read at least one novel in the last month. A random sample of size 500 is taken from the subscription list of magazines published by the company. It turns out that 326 people in the sample have read a novel in the past month.

a) Are the sample results biased considering the interest of the publishing company? Explain. (4 pts)

b) Calculate the sample proportion. What quantity (denote by p) does the sample proportion estimates without bias? (4 pts)

c) Conduct a significance test to investigate if p is greater than 60%. Interpret your results. (14 pts)

d) Construct a 95% confidence interval for p. Interpret your results. (12 pts)

4. The average sleeping time per day for the entire student population at UF is 7.8 hours, and the standard deviation is 1.2 hours. We now take a random sample of 36 UF students.

a) Calculate the probability that the sample mean will be within 15 minutes (0.25 hours) of the population mean. (8 pts)

b) Is the problem above part of Probability or Statistics? Explain. (4 pts)

5. What value of n would guarantee a good Normal approximation for the distribution of p-hat if:

a) p = 0.50 (2 pts)

b) p = 0.99 (2 pts)

c) p = 0.01 (2 pts)

d) Compare your answers to parts b and c above. Why is there such a relationship between them? (2 pts)

6. What determines the sample size needed for:

a) the distribution of p-hat to be Normal? (4 pts)

b) the distribution of x-bar to be Normal? (4 pts)

STA 2023 Honors **Name** ____________________________________

Spring 2007 Exam 2 **UF ID#** ____________________

1. It is known that 30% of all calls coming into a telephone exchange are long-distance calls. Find the probability that, of the next 200 calls that come into the exchange, at least 28% will be long-distance calls. (15 pts)

2. A national survey collected information, among other things, on the average annual expenditure for entertainment per person. For those under 25 years of age, this average is reported to be between $826 and $1030, with confidence coefficient .95. For each of the following statements, determine if they are True or False. (18 pts)

__ 95% of all people under 25 years of age spend, on average, between $826 and $1030 on entertainment each year.

__ We are 95% confident that the average amount spent on entertainment per year by people under 25 is more than $1000.

__ In repeated sampling, 95% of all sample means computed from samples of the same size will be between $826 and $1030.

__ In repeated sampling, 95% of all intervals computed from samples of the same size will contain the true population mean.

__ The interval (826, 1030) was produced by a technique that captures the population mean 95% of the time.

__ The true mean annual entertainment expenditure for all people under 25 is exactly $928.

__ The sample mean annual entertainment expenditure for people under 25 is exactly $928.

__ A 99% confidence interval constructed with the same data will include $1000.

3. Can dogs detect cancer? A recent medical study tried to verify, scientifically, the long-held belief that dogs have a special ability to sense when something is wrong with us. In the study, the dogs (all regular pets) were trained to discriminate between urine from patients with bladder cancer and urine from people who were healthy, or had ordinary diseases. Each dog was presented with one urine sample from a bladder cancer patient, placed at random among six control (non-cancer) samples. A success was recorded each time a dog correctly identified the bladder cancer urine, which happened 22 times out of 54 trials. The study reports a success rate of 41% vs a 14% success rate expected by chance.

a) Where does the dogs' success rate of 41% come from? (3 pts)

b) Where does the 14% success rate expected by chance come from? (3 pts)

c) Check the assumptions necessary for the validity of the statistical inference procedures. (5 pts)

d) Conduct a significance test to determine if the dogs' success rate is significantly higher than 14%. Interpret your results. (15 pts)

e) Construct a 95% confidence interval for the dogs' success rate in the population. Interpret your results. (15 pts)

4. The University of Florida Alcohol and Drug Survey conducts yearly surveys on the attitudes, knowledge and behaviors of students regarding drug and alcohol use. According to the 2002 survey, UF students consume an average of 4 alcoholic drinks per week. A random sample of 20 “greek” students (those who belong to a fraternity or sorority) found that they consumed, on average, 6.816 alcoholic drinks per week. The standard deviation was 5.075.

a) Construct a 95% confidence interval for the average alcohol consumption of “greek” students in the population. Interpret. (15pts)

b) What are the assumptions necessary for this test to be valid? Do they seem to be satisfied? Explain. (5 pts)

c) If we wanted to estimate the average alcohol consumption of “greek” students in the population with a margin of error of 1 drink, and confidence level 95%, how many “greek” students should be sampled? Use 7 for the standard deviation. (6 pts)

More Practice Questions for Exam 2

1. The Gainesville Sun (3/16/05), reports that the average price for regular gas in Florida reached a record high Monday afternoon at $2.08 per a gallon, according to the American Automobile Association's Daily Fuel Gauge Report. The average price in Gainesville and surrounding Alachua County is believed to be even higher than that. A sample of 8 gas stations in the area had a mean of $2.1109. Use s = 0.0432.

a) What is the sampling distribution of the sample mean, and what assumptions do we need to make about the data collected?

b) Construct a 98% Confidence Interval for the average price of gas in Alachua County. Interpret your interval.

2. The number of flaws per square yard of carpet material varies with mean 1.6 flaws per square yard and standard deviation 1.2 flaws per square yard. An inspector samples 200 square yards of the material, records the number of flaws in each square yard, and computes the average. Find the probability that the mean number of flaws per square yard in the inspector's sample is greater than 1.8 flaws.

3. A researcher looking for evidence of extrasensory perception (ESP) tests 500 subjects using a large stack of cards. Each card has, on one side, one of the following five symbols: ● ★ ■ ♥ ♦. The researcher brings each subject into a room and, after shuffling the cards well, selects one from the stack (without letting the subject see it) and asks the subject to identify the symbol on the card. After repeating this experiment many times, the proportion of correctly identified cards for each subject is computed.

a) Suppose one person correctly identifies 18 out of 50 cards. Construct a 93% confidence interval for p= the true proportion of correct answers this person would have if he was shown an infinite number of cards.

b) For the same subject, test the null hypothesis that the subject was guessing vs the alternative that the subject has ESP.

c) Suppose we test each subject's ability using α=.01 and in four of the 500 cases the result is to reject the null hypothesis. Can we conclude those four people have ESP? Explain.

d) What would "increasing n" mean in this problem?

4. A researcher wants to estimate the proportion of defective items in a shipment. He wants his estimate to be accurate to within 1% of the truth, with 95% confidence. How many items should he test if:

a) he believes the proportion of defectives is no more than 10%?

b) he has no clue what the proportion of defectives is?

5. Answer the following questions (briefly):

a) What is the difference between a parameter and a statistic?

b) What is the difference between Probability and Statistics?

6. According to the website goodplasticsurgery.com, the average cost of rhinoplasty (nose job) in 2003 was $4,500. A random sample of rhinoplasties in 2005 was used to construct a 95% confidence interval for the average price this year: (4755, 4935). (16 pts)

_____ 95% of rhinoplasties in 2005 cost between $4755 and $4935.

_____ We are 95% confident that the average price of rhinoplasties has increased since 2003.

_____ 95% of all samples will have average cost between $4755 and $4935.

_____ A 90% confidence interval for μ constructed with the same data will include $4500.

_____ The average cost of all rhinoplasties in 2005 will be $4845.

_____ The margin of error of the confidence interval given is $90.

_____ In this story, $4500 is a parameter.

7. According to a story in the Gainesville Sun (3/15/05), “purity rings” or “chastity rings” are a growing trend for celibate teens, with the number of Web sites and shops selling them exploding over the last decade. Sociologists have found that 13% of American adolescents have made a virginity pledge, often motivated by religious faith and by government-funded abstinence programs. We will assume here that the trend is equally popular in Gainesville as in the rest of the country. If we sample 200 random adolescents in Gainesville, what is the probability that more than 15% of them have made a virginity pledge?

8. Researchers are designing a study to determine if the age of the victim is a factor in reported scams. The researchers are testing to determine if more than half of all reported scams victimize the elderly. They randomly sample 350 reported scams over the past 10 years from the Better Business Bureau archives, and note that, for 287of them, the victim is over 65 years old.

Match the following symbols with the correct number on the right:

_____ p	a) 0.50
_____ p-hat	b) 65
_____ p_0	c) 287
_____ x	d) 350
_____ n	e) 0.820
	f) 0.816
	g) unknown

Minitab reports the p-value for this test to be 0.00. Which of the following is the best interpretation of the results?

a) Minitab made a mistake, since we can never be 100% confident of our results.
b) We are very confident that most scams involve elderly victims.
c) We are very confident that most reported scams involve elderly victims.
d) We are very confident that most scams do not involve elderly victims.

9. Americans watch an average of 26.36 hours of TV per week, with a standard deviation of 38.5 hours. If we take a random sample of 250 Americans and measure their TV viewing habits, what is the probability that the average number of hours in our sample is less than 20?

10. Nutritionists recommend monitoring the intake of fat for a variety of health reasons, including weight control. For male, middle-aged Americans, the distribution of X= daily fat intake is said to have a mean of 37 grams and a standard deviation of 32 grams. We will select a random sample of 45 male, middle-aged Americans and measure their fat intake.

a) Is the original distribution Normal? Explain.

b) Is the distribution of the sample mean Normal? Explain.

c) What is the probability that the average fat intake for our sample of male, middle-aged Americans is less than 30 grams?

11. Researchers studying iron deficiency in infants examined infants who where following different feeding patterns. One group of 26 infants was being breast-fed. At 6 months of age, these children had mean hemoglobin level **12.9** grams per 100 milliliters of blood. According to the medical literature, hemoglobin levels for 6 month old infants have an average of **12.5** grams per 100 milliliters of blood. Assume the sample standard deviation is 1.6**.**

a) Are the two numbers in bold parameters or statistics? Explain.

b) Construct a 95% confidence interval for the mean hemoglobin level of breast-fed infants.

c) Interpret your interval.

12. About 12% of Americans aged 18-24 are high school dropouts. We select a random sample of 100 Americans in this age group and count X, the number of dropouts in the sample.

a) What is the distribution of X? Explain.

b) What is the distribution of p-hat? Explain.

c) Use the sampling distribution of p-hat to find the probability that 15 or less of the people in our sample are high school dropouts.

13. A researcher wants to estimate the average number of daily users of a computer server. He wants his estimate to be within 1000 people of the true mean, with 95% confidence. He estimates the standard deviation to be around 5000.

a) How many days should he sample?

b) The researcher selects a random sample, and constructs a 95% confidence interval for the average number of daily users of this computer server: (6581, 9221). Determine if each of the following statements are True or False.

_____ The probability that μ is included in a 95% confidence interval is .95.

_____ The probability that μ is between 6581 and 9221 is .95.

_____ 95% of all samples will have averages between 6581 and 9221 users.

_____ On 95% of all days, the server has between 6581 and 9221 users.

_____ A 99% confidence interval for μ constructed with the same data will include 9,000.

14. When asked to explain the meaning of "statistical significance", two students gave the following explanations. For each one, explain briefly if they are essentially correct or not, and why.

a) Statistical significance at the $\alpha = 0.05$ level means that there is only a probability 0.05 that the null hypothesis is true.

b) Saying that results are statistically significant tells us that they cannot easily be explained by chance variation alone.

Multiple Choice Questions

1. You take a random sample from some population and form a 96% confidence interval for the population mean, μ. Which quantity is guaranteed to be in the interval you form?
a) 0 b) μ c) $\bar{x}$ d) .96

2. Suppose you conduct a significance test for p using α=.10 and your p-value is .184. Which of the following should be your conclusion?
a) accept H_O
b) accept H_A
c) Fail to reject H_A
d) Fail to reject H_O

3. Which of the following is a true statement about probabilities?
a) A probability can be negative.
b) Probabilities must be less than one half
c) A probability cannot be greater than 1.
d) You can never have a probability of 0.

4. Decreasing the sample size, while holding the confidence level the same, will do what to the length of your confidence interval?
a) make it bigger
b) make it smaller
c) it will stay the same
d) cannot be determined from the given information

5. Decreasing the confidence level, while holding the sample size the same, will do what to the length of your confidence interval?
a) make it bigger b) make it smaller
c) it will stay the same d) cannot be determined from the given information

6. If you increase the sample size and confidence level at the same time, what will happen to the length of your confidence interval?
a) make it bigger b) make it smaller
c) it will stay the same d) cannot be determined from the given information

7. Which of the following is a property of the Sampling Distribution of $\bar{x}$?
a) if you increase your sample size, $\bar{x}$ will always get closer to μ the population mean.
b) the standard deviation of the sample mean is the same as the standard deviation from the original population σ
c) the mean of the sampling distribution of $\bar{x}$ is μ, the population mean.
d) $\bar{x}$ always has a Normal distribution.

8. Which of the following is true about p-values?
a) a p-value must be between 0 and 1.
b) if a p-value is greater than 0.01 you will never reject H_O.
c) p-values have a N(0,1) distribution
d) None of the above statements are true.

9. What should be the value of z* used in a 93% confidence interval?
a) 2.70
b) 1.40
c) 1.81
d) 1.89

10. "What are the possible values of x-bar for all samples of a given n from this population?" To answer this question, we would need to look at the:
a) test statistic
b) z-scores of several statistics
c) standard normal distribution
d) sampling distribution
e) probability distribution of x

11. Why do we use inferential statistics?
a) to help explain the outcomes of random phenomena
b) to make informed predictions about parameters we don't know
c) to describe samples that are normal and large enough (n>30)
d) to generate samples of random data for a more reliable analysis

12. A 95% confidence interval for the mean number of televisions per American household is (1.15, 4.20). For each of the following statements about the above confidence interval, choose true or false.
a) The probability that μ is between 1.15 and 4.20 is .95.
b) We are 95% confident that the true mean number of televisions per American household is between 1.15 and 4.20.
c) 95% of all samples should have x-bars between 1.15 and 4.20.
d) 95% of all American households have between 1.15 and 4.20 televisions.
e) Of 100 intervals calculated the same way (95%), we expect 95 of them to capture the population mean.
f) Of 100 intervals calculated the same way (95%), we expect 100 of them to capture the sample mean.

13. Which of the following is <u>not</u> a property of the t distribution?
a) has fatter tails than a Z distribution
b) it is symmetric and mound shaped
c) it is centered at zero
d) as the degrees of freedom increase it becomes less like a Z distribution.

14. When are p-values negative?
a) when the test statistic is negative.
b) when the sample statistic is smaller than the hypothesized value of the parameter
c) when the confidence interval includes only negative values
d) when we fail to reject the null hypothesis
e) never

15. When doing a significance test, a student gets a p-value of 0.003. This means that:
I. Assuming Ho is true, this sample's results were an unlikely event.
II. 99.97% of samples should give results which fall in this interval.
III. We reject Ho at any reasonable alpha level.
a) II only b) III only c) I and III d) I, II, and III

Questions 16 – 18 Researchers are concerned about the impact of students working while they are enrolled in classes, and they'd like to know if students work too much and therefore are spending less time on their classes than they should be. First, the researchers need to find out, on average, how many hours a week students are working. A survey of 200 students provides a sample mean of 7.10 hours worked with a standard deviation of 5 hours.

16. Construct a 95% confidence interval based on this sample.
   a) (6.10, 8.10)
   b) (6.41, 7.79)
   c) (6.57, 7.63)
   d) (7.10, 8.48)

17. Suppose that this confidence interval was (6.82, 7.38). Which of these is a valid interpretation of this confidence interval?
   a) There is a 95% probability that the true average number of hours worked by all UF students is between 6.82 and 7.38 hours.
   b) There is a 95% probability that a randomly selected student worked between 6.82 and 7.38 hours.
   c) We are 95% confident that the average number of hours worked by students in our sample is between 6.82 and 7.38 hours.
   d) We are 95% confident that the average number of hours worked by all UF students is between 6.82 and 7.38 hours.

18. We have 95% confidence in our interval, instead of 100%, because we need to account for the fact that:
a) the sample may not be truly random.
b) we have a sample, and not the whole population.
c) the distribution of hours worked may be skewed
d) all of the above

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FORMULAS

Binomial Porportion $\hat{p}$: mean = p stdev = $\sqrt{\frac{p(1-p)}{n}}$

Sample Mean $\overline{X}$: mean = μ stdev = $\frac{\sigma}{\sqrt{n}}$

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