AP Statistics: True or False?

26.

You get on a train which costs $10 a ride. There is no conductor checking tickets but there are plain-clothed officers assigned to the train to check on random passengers. If any are found without a ticket, they are arrested and fined heavily. The chances of being chosen to have a ticket check is 2%. If the cost of the fine is $500, it is not worth it to ride for free and gamble that you will not be checked.

Solution

26.

You get on a train which costs \$10 a ride. There is no conductor checking tickets but there are plain-clothed officers assigned to the train to check on random passengers. If any are found without a ticket, they are arrested and fined heavily. The chances of being chosen to have a ticket check is 2%. If the cost of the fine is \$500, it is not worth it to ride for free and gamble that you will not be checked.

Your point of view: X how much you gain by gambling

X	10	$-t$
$p(X)$	0.98	0.02

$$\mu_X = 10(0.98) - t(0.02) = 0 \Rightarrow 0.02t = 9.8 \Rightarrow t = 490$$

If the fine is more than \$490, it is not worth it to gamble.

True (many cities have this type of arrangement and the cost of the fine is so high that the gamble is not worth it.)

AP Statistics: True or False?

27.

In a pet shop with many fish tanks, at feeding time, the average amount of time it takes for a tank to receive food is 18 minutes, 30 seconds with a standard deviation of 6 minutes, 45 seconds. Because of the layout of the store with many tanks clustered together and others far apart as well as different fish having different feeding requirements, the distribution of these times is approximately normal. The probability that a tank chosen at random containing 5 fish will be fed within the first 15 minutes of feeding time is about 30%.

Solution

27.

In a pet shop with many fish tanks, at feeding time, the average amount of time it takes for a tank to receive food is 18 minutes, 30 seconds with a standard deviation of 6 minutes, 45 seconds. Because of the layout of the store with many tanks clustered together and others far apart as well as different fish having different feeding requirements, the distribution of these times is approximately normal. The probability that a tank chosen at random containing 5 fish will be fed within the first 15 minutes of feeding time is about 30%.

The number of fish in the tank is irrelevant. This is simply a normal distribution problem:

$\text{normalcdf}(0,15,18.5,6.75) \approx 29.9\% \approx 30\%.$

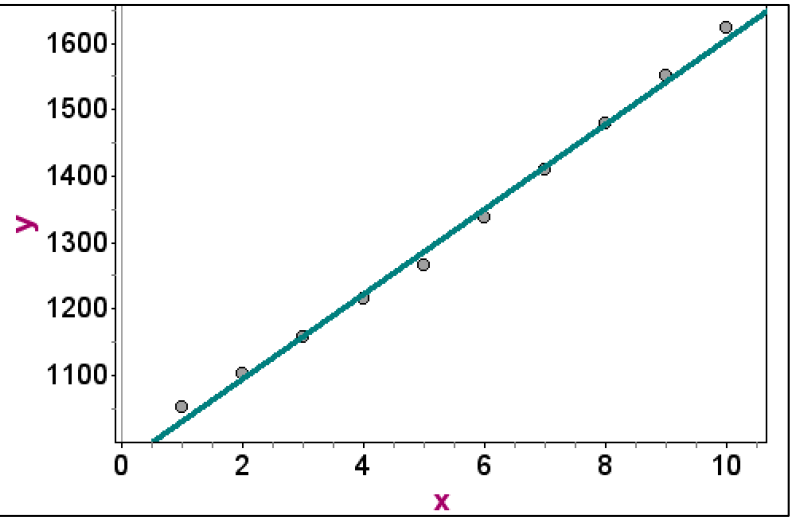
True

AP Statistics: True or False?

28.

A set of data points (x, y) appears below along with the graph of the Least-Squares Regression Line which is $\hat{y} = 63.9x + 967, r^2 = 1.00$. The predicted value of y when $x = 20$ is 2245.

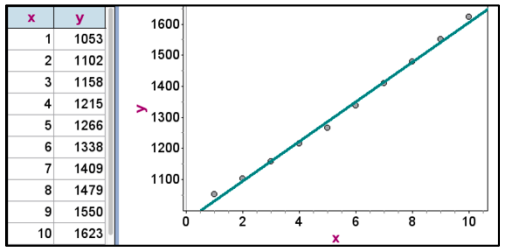
x	y
1	1053
2	1102
3	1158
4	1215
5	1266
6	1338
7	1409
8	1479
9	1550
10	1623



Solution

28.

A set of data points (x, y) appears below along with the graph of the Least-Squares Regression Line which is $\hat{y} = 63.9x + 967, r^2 = 1.00$. The predicted value of y when $x = 20$ is 2245.



x	y
1	1053
2	1102
3	1158
4	1215
5	1266
6	1338
7	1409
8	1479
9	1550
10	1623

It appears that a line is a good fit, especially with $r = 1$.
But there appears to be a pattern to the residuals with the first few above the curve, then the next few below the curve and then the next few above the curve again. To check this out, we check to see if the y values are increasing by a common value.

$1002 - 1053 = 51 \quad 1158 - 1102 = 56 \quad 1215 - 1158 = 57 \ldots 1623 - 1550 = 73$

It appears that the differences are increasing.

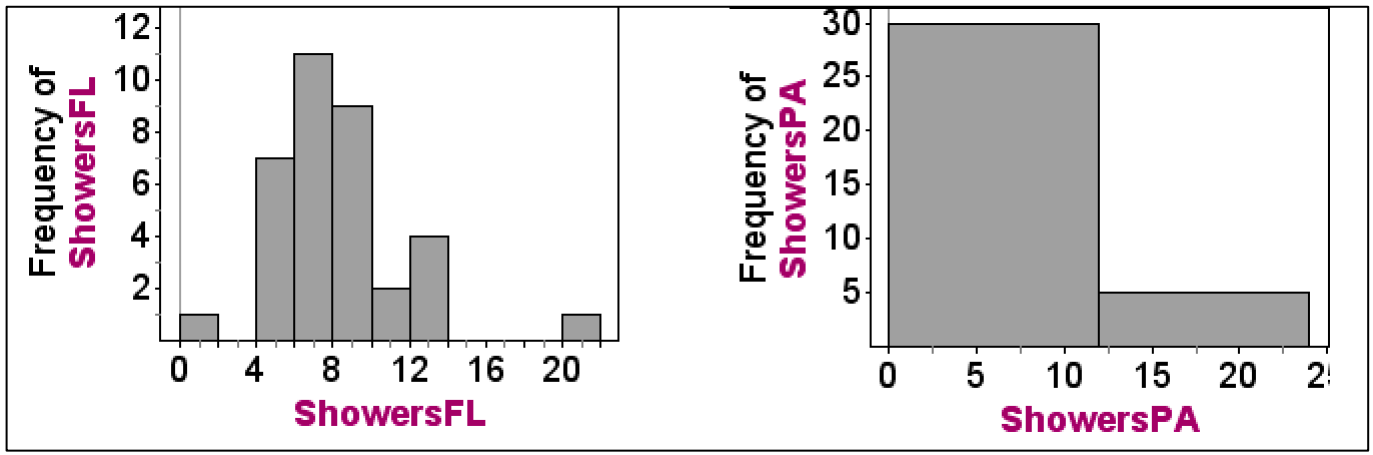
$$\frac{1102}{1053} = 1.046 \quad \frac{1158}{1102} = 1.051 \quad \frac{1210}{1158} = 1.045$$

It appears that the ratios are quite similar so the data is exponential.
Trying to use the linear equation to determine the value of y when $x = 20$ would significantly under-approximate the real value.
False

AP Statistics: True or False?

29.

35 randomly selected people were polled in Florida and Pennsylvania as to the number of showers they take weekly. The results are shown in the two histograms below. This evidence shows that the Florida data has a greater standard deviation than the Pennsylvania data.



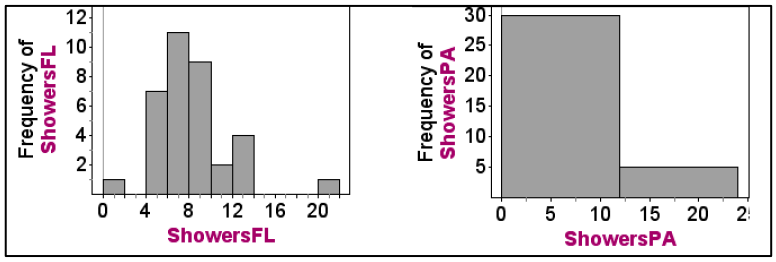
Solution

29.

35 randomly selected people were polled both in Florida and Pennsylvania as to the number of showers they take weekly. The results are shown in the two histograms below. This evidence shows that the Florida data has a greater standard deviation than the Pennsylvania data.

It is impossible to tell without seeing the data. Comparisons of this nature are only possible if the bin width of the histograms are the same and even then, only in obvious cases can standard deviations be compared. In fact, the data in the two histograms are the same.

False



AP Statistics: True or False?

30.

In a large apartment complex, 40% of the residents follow the recycle program rather than throwing everything in the trash. A letter is sent to all residents warning them that if they don't recycle, they could be fined. A month later, the building managers observe a sample of residents to see if the warning letter had any effect. Both statements are true:

I. This is an observational study.

II. The appropriate hypothesis test is a 1-proportion z-test.

Solution

30.

In a large apartment complex, 40% of the residents follow the recycle program rather than throwing everything in the trash. A letter is sent to all residents warning them that if they don't recycle, they could be fined. A month later, the building managers observe a sample of residents to see if the warning letter had any effect. Both statements are true:

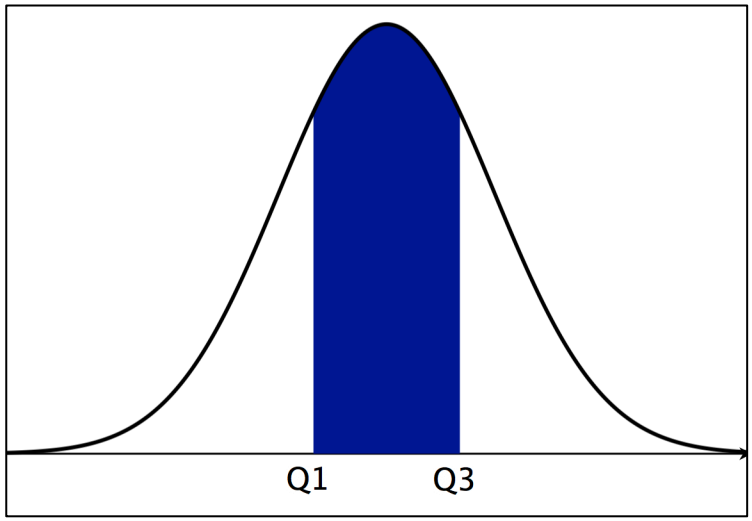
I. This is an observational study.
II. The appropriate hypothesis test is a 1-proportion z-test.

It certainly is a 1-proportion z-test with $H_0 : \rho = 0.4$ and $H_a : \rho > 0.4$
But it is an experiment, not an observational study. The letter is the treatment and the goal is to find whether it had an effect on resident's behavior. (note that it would be more effective to send some residents the letter and others not).
False

AP Statistics: True or False?

31.

The distribution of times it takes to takes to shop in a supermarket is approximately normal with a mean of 33 minutes and a standard deviation of 6 minute, 30 seconds. The shaded region in the figure below represents the percentage of people who take between 26 minutes, 30 seconds and 39 minutes, 30 seconds to shop in this market.



Solution

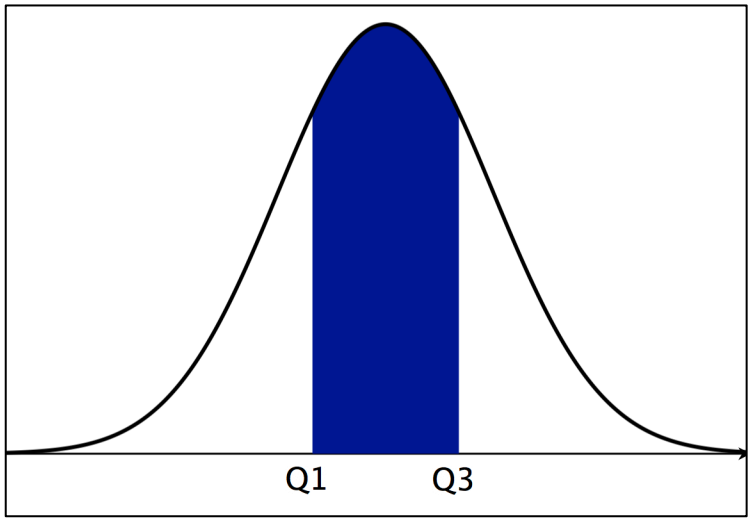
31.

The distribution of times it takes to takes to shop in a supermarket is approximately normal with a mean of 33 minutes and a standard deviation of 6 minute, 30 seconds. The shaded region in the figure below represents the percentage of people who take between 26 minutes, 30 seconds and 39 minutes, 30 seconds to shop in this market.

Q1 represents the 25th percentile. To find it, use invnorm $(0.25,33,6.5) = 28.6$

Q3 represents the 75th percentile. To find it, use invnorm $(0.75,33,6.5) = 37.4$

False



AP Statistics: True or False?

32.

Researchers in a drug company are doing human trials on a vaccine to combat COVID-19. In deciding their goals, they conclude that they want to use a hypothesis test for the vaccine's effectiveness with a high degree of statistical power. This means that if their formula is not effective, they want to be sure as possible before they use promote it as a vaccine.

Solution

32.

Researchers in a drug company are doing human trials on a vaccine to combat COVID-19. In deciding their goals, they conclude that they want to use a hypothesis test for the vaccine's effectiveness with a high degree of statistical power. This means that if their formula is not effective, they want to be sure as possible before they promote it as a vaccine.

The hypotheses are: $\begin{cases} H_0 : \text{the vaccine is not effective for COVID-19} \\ H_a : \text{the vaccine is effective for COVID-19} \end{cases}$

A type I error is concluding the vaccine is effective when it isn't.

A type II error is concluding the vaccine is not effective when it is.

Power = 1 – the probability of a type II error

If power is high, the probability of a type II error is low.

That means that if they really do have an effective vaccine, they need to be as confident as possible that it works.

False

AP Statistics: True or False?

33.

Prime time for watching TV is between 8 PM and 11 PM.
A survey was done among TV viewers and the 95% confidence interval for the mean number of hours that viewers watch TV during prime time is $\left[1.87, 2.26\right]$. It is possible to use this information to perform a one-sample *t*-test to conclude that the average number of hours that a viewer watches TV may be 2.25 hours.

Solution

33.

Prime time for watching TV is between 8 PM and 11 PM.
A survey was done among TV viewers and the 95% confidence interval for the mean number of hours that viewers watch TV during prime time is $[1.87, 2.26]$. It is possible to use this information to perform a one-sample t-test to conclude that the average number of hours that a viewer watches TV may be 2.25 hours.

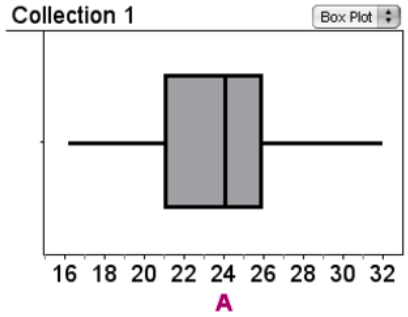
Since the 95% CI was found, a hypothesis test can be performed under the same conditions. Since the α level is 0.05 and the CI is 95%, the conditions are the same. The test looks like this: $\begin{cases} H_0 : \mu = 2.25 \\ H_a : \mu \neq 2.25 \end{cases}$

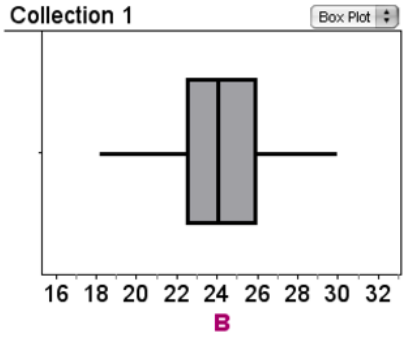
That means that all the values in the CI are plausible values for μ.
So we would not reject the null hypothesis and conclude that there is no evidence that the average number of hours a view watches TV is not 2.25. That does doesn't mean it is though. The key word is "may."
True

AP Statistics: True or False?

34.

I play a game 60 times using strategy A that has probability of winning of 40%. I then switch to strategy B that has a 20% higher probability of winning than A but I play it 20 fewer times. If I do this for a large number of days the boxplots representing the number of times I win each day are appropriately labeled A and B.

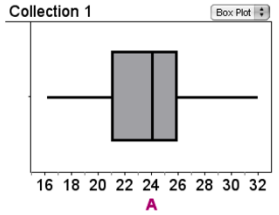


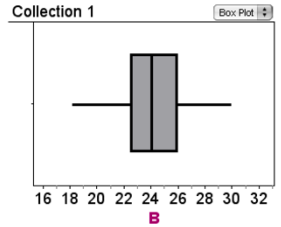


Solution

34.

I play a game 60 times using strategy A that has probability of winning of 40%. I then switch to strategy B that has a 20% higher probability of winning than A but I play it 20 fewer times. If I do this for a large number of days the boxplots representing the number of times I win each day are appropriately labeled A and B.





The game results will have a binomial distribution.

$\mu=np, \sigma=\sqrt{np(1-p)}$

$\mu_A = 60(0.4) = 24 \quad \mu_B = 40(0.6) = 24$

The center of distribution appears to be the same.

$\sigma_A = \sqrt{60(0.4)(0.6)} \quad \sigma_B = \sqrt{40(0.6)(0.4)}$

Since $\sigma_A > \sigma_B$, the spread in boxplot A should be greater than the spread in boxplot B. It appears to be.

True

AP Statistics: True or False?

35.

A COVOD-19 study shows that people now wash their hands an average of 6.8 times a day with a standard deviation of 2.2. Assuming a normal distribution, the probability that a group of 25 random people will wash their hands on average between 6 and 8 times a day will be at least 10% higher than that of a group of 10 random people.

Solution

35.

A COVOD-19 study shows that people now wash their hands an average of 6.8 times a day with a standard deviation of 2.2. Assuming a normal distribution, the probability that a group of 25 random people will wash their hands on average between 6 and 8 times a day will be at least 10% higher than that of a group of 10 random people.

Since the distribution is normal, we can apply the central limit theorem without having to worry about sample size: Using the calculator:

$\text{normalcdf}\left(6,8,6.8,2.2/\sqrt{10}\right)=0.833$ $\text{normalcdf}\left(6,8,6.8,2.2/\sqrt{25}\right)=0.962$

$0.962-0.833=0.129\geq 0.10$

True

AP Statistics: True or False?

36.

Ralph bowls in two leagues, the Thunderbirds and the Raccoons. He averages a score of 150 in each league. In the Thunderbirds, his average is at the 40th percentile while in the Raccoons, his average is at the 70th percentile.
If a bowler is chosen at random from each league, the probability that one or both will have an average equal to or higher than Ralph's is 90%.

Solution

36. Ralph bowls in two leagues, the Thunderbirds and the Raccoons. He averages a score of 150 in each league. In the Thunderbirds, his average is at the 40th percentile while in the Raccoons, his average is at the 70th percentile.
If a bowler is chosen at random from each league, the probability that one or both will have an average equal to or higher than Ralph's is 90%.

If Ralph is at the 40th percentile in the Thunderbirds, the probability that a random bowler will have a higher average is 60%. If Ralph is at the 70th percentile in the Raccoons, the probability that a random bowler will have a higher average is 30%. $60\% + 30\% = 90\%$ but we must subtract the possibility that they both have scores above 150 which is $(0.6)(0.3) = 18\%$. So the probability that one or both will have an average equal to or higher than Ralph is $90\% - 18\% = 72\%$.
False

AP Statistics: True or False?

37.

A supermarket sells on average of 54.5 bags of a premium coffee a day with a standard deviation of 10.6 bags. The company then changes the formula and places "new and improved" on the bag. They then take a random sample of 30 days over the next half-year and check coffee sales. Averaging 57.7 bags a day would give the minimum evidence at the 5% level that the new and improved coffee sells better.

Solution

37.

A supermarket sells on average of 54.5 bags of a premium coffee a day with a standard deviation of 10.6 bags. The company then changes the formula and places "new and improved" on the bag. They then take a random sample of 30 days over the next half-year and check coffee sales. Averaging 57.7 bags a day would give the minimum evidence at the 5% level that the new and improved coffee sells better.

Since the population standard deviation is given, this is a one-sided z-test.

It can be done by finding the z-score. $z = \dfrac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \dfrac{57.7 - 54.5}{10.6/\sqrt{30}} = 1.654.$

The corresponding p-value is approximately 0.05.

This can also be be found on the calculator: $\text{invNorm}(0.95, 0, 1) \approx 1.645.$

OR the entire thing can be done on the calculator as a z-test.

$\mu_0 = 54.5, \sigma = 10.6, \bar{x} = 57.7, n = 30$

$\begin{cases} H_0 : \mu = 54.5 \\ H_a : \mu > 54.5 \end{cases} \Rightarrow z = 1.654, p = 0.049$

True

AP Statistics: True or False?

38.

When given a choice at a barbecue, 60% of kids normally prefer hamburgers to hot dogs. If a random sample of 100 kids were taken, the probability that 55 or fewer will prefer hamburgers can be approximated by finding the probability

$$p\left(z < \frac{0.55 - 0.6}{\sqrt{\frac{(0.6)(0.4)}{100}}}\right)$$

Solution

38.

When given a choice at a barbecue, 60% of kids normally prefer hamburgers to hot dogs. If a random sample of 100 kids were taken, the probability that 55 or fewer will prefer hamburgers can be approximated by finding the probability

$$p\left(z < \frac{0.55-0.6}{\sqrt{\frac{(0.6)(0.4)}{100}}}\right)$$

This is a binomial distribution as kids prefer hamburgers or hot dogs.
There are 100 trials. We want 55 or fewer successes. The calculation is
$\text{binomialcdf}(100, 0.6, 55)$

But since that is not asked, the probability can be approximated using a normal distribution with mean 0.6 and st. dev. of a proportion is $\sqrt{\frac{p(1-p)}{n}}$.

The calculation is: $\text{normalcdf}\left(0, 0.55, 0.6, \sqrt{\frac{(0.6)(0.4)}{100}}\right)$

True

AP Statistics: True or False?

39.

Out of 1,000 children taken at random, 2% have a peanut allergy.
A blood test is used to try and confirm it, but it is not always accurate.
For those with the allergy, the test that confirms it is 90% accurate.
For those without the allergy, the test that confirms it is 95% accurate.
If you complete the table, you will find that the probability of
a false positive (choosing someone who tests positive for the peanut allergy but doesn't have it) is 73%.

	Tests Yes	Tests No	Total
Has peanut allergy			
No peanut allergy			
Total			1000

Solution

39.

Out of 1,000 children taken at random, 2% have a peanut allergy.
A blood test is used to try and confirm it, but it is not always accurate.
For those with the allergy, the test that confirms it is 90% accurate.
For those without the allergy, the test that confirms it is 95% accurate.
If you complete the table, you will find that the probability of
a false positive (choosing someone who tests positive for the peanut allergy but doesn't have it) is 73%.

	Tests Yes	Tests No	Total
Has peanut allergy			
No peanut allergy			
Total			1000

	Test Yes	Test No	Total
Peanut allergy	18	2	20
No peanut allergy	49	931	980
Total	67	933	1000

$$P(\text{No peanut allergy} \mid \text{Test Yes}) = \frac{49}{67} \approx 73\%$$

True

AP Statistics: True or False?

40.

You are a racing bicylist and like to go on long rides.
We are not sure whether to carry a tire-patching kit
and a bike pump on one of your rides. You make a judgement
based on the null hypothesis that you will not get a flat
tire. The ramifications of the following errors are:

Type I error: Getting a flat tire with no way to fix it.
Type II error: Needlessly carrying extra weight slowing you down.

Solution

40.

You are a racing bicylist and like to go on long rides.
We are not sure whether to carry a tire-patching kit
and a bike pump on one of your rides. You make a judgement
based on the null hypothesis that you will not get a flat
tire. The ramifications of the following errors are:

Type I error: Getting a flat tire with no way to fix it.
Type II error: Needlessly carrying extra weight slowing you down.

They are reversed.
A Type I error is rejecting H_0 when H_0 is true. In this case, you do not get a flat tire. You reject this and carry the kit and pump, needlessly as it turns out. (However you did have piece of mind throughout the ride.)
A Type II error is rejecting the alternative hypothesis when the alternative is true. In this case, the altenative hypothesis is that you will get a flat tire. But you reject that and don't carry the kit. You get the flat tire and cannot fix it. (what you were worried about)
False

AP Statistics: True or False?

41.

The first 4 integer powers of 3 $\{1, 3, 9, 27\}$ has mean $\mu = 10$ and standard deviation $\sigma = 10.25$. If I sample 3 numbers from this set with replacement, I create a sampling distribution with N possibilities, each with its own mean. The sampling distribution has mean μ_x and standard deviation σ_x. The values of the following variables are:

$N = 64, \mu_x = 10, \sigma_x = 3.42$

Solution

The first 4 integer powers of 3 $\{1, 3, 9, 27\}$ has mean $\mu = 10$ and standard deviation $\sigma = 10.25$. If I sample 3 numbers from this set with replacement, I create a sampling distribution with N possibilities, each with its own mean. The sampling distribution has mean μ_x and standard deviation σ_x. The values of the following variables are:

$N = 64, \mu_x = 10, \sigma_x = 3.42$

The size of the sampling distribution is $4^3 = 64$.

The Central Limit Theorem says the mean of the sampling distribution is the same as the mean of the population so $\mu_x = 10$. But the standard deviation of the sampling distribution is the standard devation of the population divided by the square root of the sample size: $\sigma_x = \frac{10.25}{\sqrt{3}} = 5.92$.

41. False

AP Statistics: True or False?

42.

Whether or not people stop or go through a yellow light is being surveyed. On one day, 50 random drivers are chosen and whether or not they stop on yellow at a particular intersection is monitored. Both these statements are true:

I. Choosing the first 50 cars seen is as likely as choosing any other set of 50 cars in the population of cars that go through that intersection.

II. The percentage of drivers in the sample who go through the yellow light at that intersection will always be very similar if not equal to the percentage of drivers in the population of cars that go through the yellow light.

Solution

42.

Whether or not people stop or go through a yellow light is being surveyed. On one day, 50 random drivers are chosen and whether or not they stop on yellow at a particular intersection is monitored. Both these statements are true:

I. Choosing the first 50 cars seen is as likely as choosing any other set of 50 cars in the population of cars that go through that intersection.

II. The percentage of drivers in the sample who go through the yellow light at that intersection will always be very similar if not equal to the percentage of drivers in the population of cars that go through the yellow light.

I is true. Choosing the first 50 cars is extremely unlikely but it is just as likely as choosing any other group of cars.

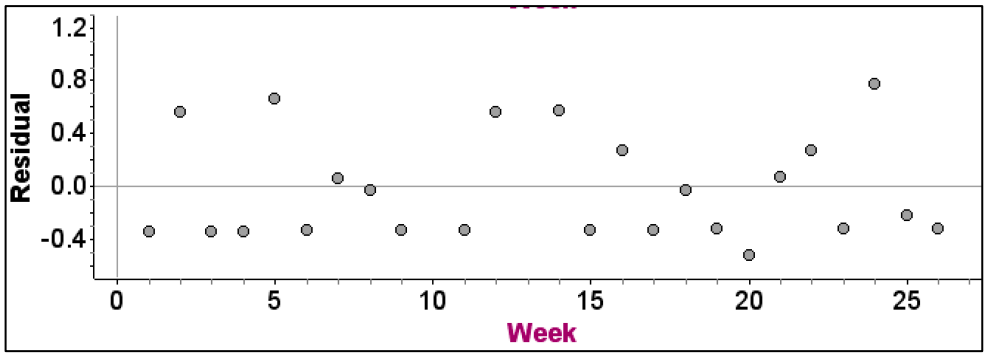
II is not necessarily true. We hope it is true because our hypothesis tests make judgements based on our belief that the percentage of the population will be the same as the percentage of the sample. But there is no guarantee.

False

AP Statistics: True or False?

43.

As an experiment, Marci bought the exact same items at a market every week. If x represents the time in weeks and y represents the price of the items and linear regression was performed on x vs. y, the standard deviation of x is 7.6, the standard deviation of y is \$1.37 and $r = 0.89$. A residual plot is below. All of this information allows us to claim that there is fairly good evidence that the average price increase is about \$0.16 a week



Solution

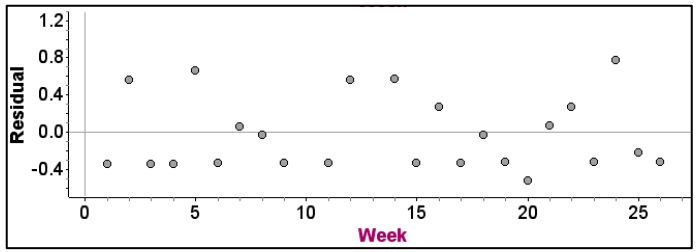
43.

As an experiment, Marci bought the exact same items at a market every week. If x represents the time in weeks and y represents the price of the items and linear regression was performed on x vs. y, the standard deviation of x is 7.6, the standard deviation of y is \$1.37 and $r = 0.89$. A residual plot is below. All of this information allows us to claim that there is fairly good evidence that the average price increase is about \$0.16 a week.

Using the formula $m = r\left(\frac{s_y}{s_x}\right), m = 0.89\left(\frac{1.37}{7.6}\right) = \$0.16$

The slope of the LSRL represents the change in y for one unit change in x. No pattern to the residual plot states that the best model is a linear one. The r value of 0.89 is fairly good evidence that the average price increase is about \$0.16 a week.

True



AP Statistics: True or False?

44.

At a catered lunch, 62% of people have coffee while the rest have lemonade. 70% of the coffee drinkers use an artificial sweetener while 40% of the lemonade drinkers use an artificial sweetener. If a person is chosen at random and uses an artificial sweetener, the chances that the person is a coffee drinker is greater than 3 chances out of 4.

Solution

44.

At a catered lunch, 62% of people have coffee while the rest have lemonade. 70% of the coffee drinkers use an artificial sweetener while 40% of the lemonade drinkers use an artificial sweetener. If a person is chosen at random and uses an artificial sweetener, the chances that the person is a coffee drinker is greater than 3 chances out of 4.

Since coffee and lemonade are disjoint events, and there is no indication that having a drink and using an artifical sweetener are dependent,

$P(\text{coffee \& AS}) = (0.62)(0.7) = 0.434 \quad P(\text{lemonade \& AS}) = (0.38)(0.4) = 0.152$

$$P(\text{coffee} \mid \text{AS}) = \frac{0.434}{0.434 + 0.152} = \frac{0.434}{0.586} = 74.1\% \leq 75\%$$

OR

	AS	Total
Coffee	434	620
Lemonade	152	380
Total	586	1000

False

AP Statistics: True or False?

45.

Researchers are looking into the relationship between the weight of young boys and how often they wet the bed. The relationship is $B = -0.105W + 7.35,\ r^2 = 0.892,$ where W is average weight of the boy and B is the average number of times they wet the bed weekly.

The results of the research is that a strong negative linear association exists between weight and bed-wetting in young boys with a common response variable present.

Solution

45.

Researchers are looking into the relationship between the weight of young boys and how often they wet the bed.
The relationship is $B = -0.105W + 7.35,\ r^2 = 0.892,$
where W is average weight of the boy and B is the average number of times they wet the bed weekly.

The results of the research is that a strong negative linear association exists between weight and bed-wetting in young boys with a common response variable present.

Given the slope to be negative, the relationship is negative.
That makes $r = -\sqrt{.892} = -0.944$ so the association is strong. But the weight doesn't cause boys to wet the bed more. The common response is age. Younger boys are lighter and will wet the bed more. Older boys are heavier and will wet the bed less.
True

AP Statistics: True or False?

46.

The managers of a large company need to select 40 workers to be in a TV commercial. They randomly assign each worker a 3-digit number from 000 to 999. Men are given the numbers 000 - 459 while women are given the numbers 580 - 999. A table of random digits is used to choose 3-digit numbers. If the assignment of numbers to the workers is based on a probability sample, the number of women in the group selected to make the commercial is most likely to be 19.

Solution

46.

The managers of a large company need to select 40 workers to be in a TV commercial. They randomly assign each worker a 3-digit number from 000 to 999. Men are given the numbers 000 - 459 while women are given the numbers 580 - 999. A table of random digits is used to choose 3-digit numbers. If the assignment of numbers to the workers is based on a probability sample, the number of women in the group selected to make the commercial is most likely to be 19.

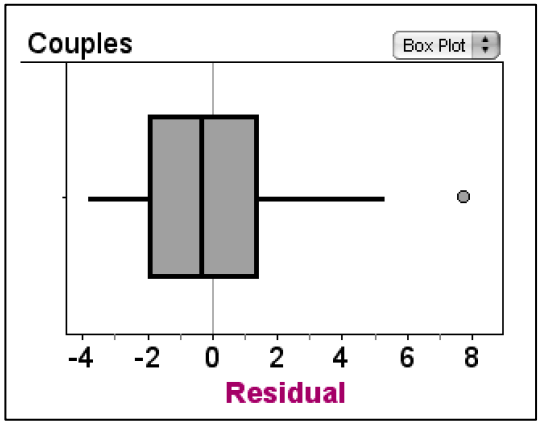
Based on the numbers, there are $459-0+1=460$ men and $999-580+1=420$ women in the company. The probability of choosing a woman is $\frac{420}{880}$. So the expected number of women is $40\left(\frac{420}{880}\right)=19.09\approx 19$

True

AP Statistics: True or False?

47.

A survey of 26 couples was made comparing the age of the husband and wife. The scatterplot below along with the LRSL is shown. If the residuals for this relationship are computed, a boxplot of their distributions cannot possibly be the one that is shown.



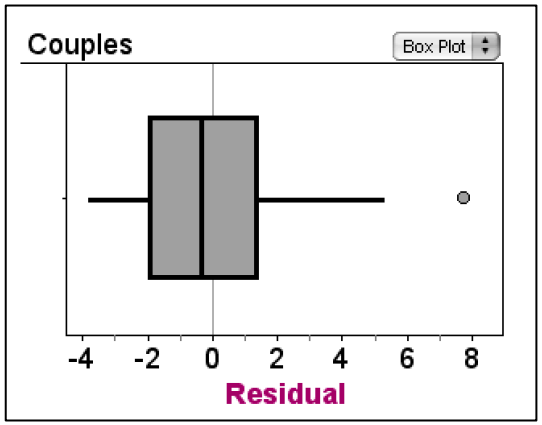
Solution

47.

A survey of 26 couples was made comparing the age of the husband and wife. The scatterplot below along with the LRSL is shown. If the residuals for this relationship are computed, a boxplot of their distributions cannot possibly be the one that is shown.

14 of the 26 points are clearly above the line meaning the majority of the residuals (observed data – predicted data) are positive. In this boplot, since the median is about –0.5, the majority of residuals are negative. Also the one outlier is about 8 meaning that there should be a point 8 units above the line.

True (boxplot is for the incorrect residual calculation as predicted – observed)



AP Statistics: True or False?

48.

Palm Beach County, FL has a population of 1.5 million people and on April 20, there were 2,150 people in that county who had COVID-19. We expect that most of them are quarantining so the chance of encountering one is close to zero. But with this virus, people can have it and not know it and be able to spread it to others. Assuming that the same number of people who had COVID-19 are asymptomatic (having COVID-19, but walking around not knowing it), the approximate probability of being in a movie theatre with 250 other people, with at least one of them having COVID-19 is about 30%.

Solution

48.

Palm Beach County, FL has a population of 1.5 million people and on April 20, there were 2,150 people in that county who had COVID-19. We expect that most of them are quarantining so the chance of encountering one is close to zero. But with this virus, people can have it and not know it and be able to spread it to others. Assuming that the same number of people who had COVID-19 are asymptomatic (having COVID-19, but walking around not knowing it), the approximate probability of being in a movie theatre with 250 other people, with at least one of them having COVID-19 is about 30%.

The probability of someone having COVID-19 is $\frac{2150}{1500000} \approx 0.00143$.

So the probability of someone not having COVID-19 is $\left(1 - \frac{2150}{1500000}\right)$.

Since with random people, having COVID-19 is mostly independent, the probability that all 250 will not have the virus is $\left(1 - \frac{2150}{1500000}\right)^{250} \approx 0.699$

So the probability that at least one person has the virus is $1 - 0.699 \approx 30\%$.

True $\left(\begin{array}{l}\text{this explains why social distancing is so important. If 2,000 people were on} \\ \text{a beach, the probability that at least one person has the virus is about 94\%.}\end{array}\right)$

AP Statistics: True or False?

49.

Those of us who own cats know that they occasionally throw up hairballs. A company that has a hairball medication on the market has developed a newer medication that will supposedly reduce hairballs. There is some concern, however, that whether a cat is a longhair or shorthair will change the effectiveness of the medication. If a randomized block exam is used, testing how the average number of hairballs a day changes based on medication, a two-sample *t*-test is appropriate with the blocking factor as whether the medication was the old or new one.

Solution

49.

Those of us who own cats know that they occasionally throw up hairballs. A company that has a hairball medication on the market has developed a newer medication that will supposedly reduce hairballs. There is some concern, however, that whether a cat is a longhair or shorthair will change the effectiveness of the medication. If a randomized block exam is used, testing how the average number of hairballs a day changes based on medication, a two-sample t-test is appropriate with the blocking factor as whether the medication was the old or new one.

The test is correct but the blocking factor is not. Since we don't want the study to be biased on whether the cat is a shorthair or longhair, that is the blocking factor. The longhair cats randomly receive one of the medications and the average number of hairballs a day is measured for each med and since the population standard deviation is not known, a two-sample t-test is used. The same can be done on shorthairs.

False

AP Statistics: True or False?

50.

A movie theatre sells a large container of popcorn with an average of 54 ounces and a standard deviation of 1.6 ounces. The manager wishes to fill n cups with a margin of error of no more than 0.5 ounces with 95% confidence. He needs to fill at least 40 cups.

Solution

50.

A movie theatre sells a large container of popcorn with an average of 54 ounces and a standard deviation of 1.6 ounces. The manager wishes to fill n cups with a margin of error of no more than 0.5 ounces with 95% confidence. He needs to fill at least 40 cups.

$$1.96\left(\frac{1.6}{\sqrt{n}}\right) < 0.5$$

$$\sqrt{n} > \frac{1.96(1.6)}{0.5} = 6.27$$

$$n > 39.34 \Rightarrow n = 40$$

True