

Homework Due IN CLASS Tuesday Oct 24.

1. Suppose a poll is taken on an important and controversial proposal. The results of the poll are that 54% of the sample is in favor of the proposal. However, the margin of error at the 95% confidence level is 0.12 or 12%. So the pollsters can only state with 95% confidence that between 42% and 66% of the population is in favor of the proposal.

The news papers don't like this. They want to know if the proposal is supported by a majority. They call the pollster and request that the poll be re-done more accurately. The pollster says "Well, that will cost you! We will probably have to decrease the margin of error down to about 4%. That means we will have to increase our sample size by a factor of ..."

What factor must the sample size increase by to reduce the margin of error from 12% to 4%? Justify your answer.

Answer: You could compute the necessary sample sizes since $1/\sqrt{n} = \text{margin of error}$ so $n = 1/(\text{margin of error})^2$. However, since we want to reduce the margin of error by a factor of 3, we must increase the sample size by a factor of 9 because $\sqrt{9} = 3$, so $1/\sqrt{9n}$ is one third as large as $1/\sqrt{n}$.

2. Suppose you get your dream job advising a politician.

- (a) Your boss the politician is running for re-election. They receive the report of a poll of 400 likely voters which has your boss receiving 54% of the vote. Your boss says "Oh goody! I'm sure to win!"

Explain what the result of the poll really means (so be polite, but honest).

Answer: Well, actually, the margin of error is $1/\sqrt{400} = 0.05$ or five percent. so we are only 95% confident that your percentage is between 49% and 59%. So, actually, we are not even 95% confident you will win...

- (b) The next day another poll is released of 1000 likely voters which has your boss receiving 54% of the vote. Again your boss says "Oh, I heard what you said yesterday, but now I'm am sure I'm going to win!!"

Again, explain to your boss what the results of the poll really mean.

Answer: Well, while the margin of error is now smaller, $1/\sqrt{1000} = 0.03$ or 3%, so we are 95% confident that your percentage is between 51% and 57%, we are, at this point, on 95% confident you will win.

3. You have been hired by a casino to check for cheating. You notice that in one game that uses dice, the number 2 seems to come up very frequently. You review the video for an entire evening of play and you see that in 1200 rolls (600 rolls of 2 dice each time), the number 2 came up 275 times. Do you think this is convincing evidence that the dice are “loaded” so that the number 2 appears more often than would otherwise be expected?

Answer: The probability of getting a roll of 2 is $1/6$ (equally likely outcomes model), so over 1200 rolls, you would expect to get about 200 2's. The margin of error over 1200 rolls is $1/\sqrt{1200} = 0.029$ or about 3%, and 3% of 1200 is about 36. So, with 95% confidence, we expect between 165 and 235 2's in 1200 rolls. So the 275 rolls is very suspicious.

4. Suppose in the previous problem the number 3 came up 230 times. Do you think this is convincing evidence that the dice are loaded so that the number 3 also come up more often than would otherwise be expected?

Well, by the calculation above, 230 is within the 95% confidence interval for 2's out of 1200 rolls. So we are not as suspicious.

5. You decide to find out what BU student think about a particular issue. You are going to take a poll of a sample of 100 BU students. Suppose you learn that 20% of BU students live in West Campus dorms, so when you pick your sample you make sure that 20% of those you pick live in West Campus dorms. Have you used the Equally likely outcomes model to pick your sample? Why or why not?

Answer: No. The Equally likely outcome model says that every smaple of n students is possible (and as likely as every other sample)—so even those samples with no West Campus students are possible. Requiring representation by West Campus means you are not using the Equally likely outcomes model to pick your sample.