1. It is a family tradition: your professor goes to Las Vegas every year for Thanksgiving. A new casino has opened and they are offering a modified roulette game that has 40 different numbers that are on a large wheel. The wheel is spun and one number is selected at random when the wheel stops. To play, you bet \$4 and you get to choose 4 different numbers. If the wheel lands on any one of your four numbers, you win \$10. If the wheel does not land any one of your 4 numbers but on any one of 8 "special numbers" you do not win or lose any money. However, if the wheel lands on any one of the remaining numbers (neither the 4 you chose nor the 8 special numbers), you lose your bet of \$4.

Ch. 16 a. Please calculate the expected value of this game. (5 points)

OUTCOME	+10	0	−4
PROBABILITY	$\frac{4}{40} = .10$	$\frac{8}{40} = .20$	$\frac{28}{40} = .70$

$$\mu = \sum_{i=1}^{n} x_i p_i$$

outcome probability

$$E.V. = \mu = (10)(.10) + (0)(.20) + (-4)(.70)$$

$$= 1 + 0 + -2.80 = \boxed{-1.80}$$

Ch. 16 b. Please calculate standard deviation of this game. (10 points)

$$\sigma = \sqrt{\sum_{i=1}^{n} (x_i - \mu)^2 (p_i)} \text{ so}$$

$$\sigma = \sqrt{(10 - -1.80)^2(.10) + (0 - -1.80)^2(.20) + (-4 - -1.80)^2(.70)}$$

$$= \sqrt{17.96}$$

$$\approx \boxed{4.24}$$

c. Suppose your professor decides to spend $100 by placing a total of 25 bets and she loses a total of $5. Assume that you can treat her 25 bets as if they were a random sample of size 25, that the bets are independent, and you can assume the 25 bets are a large enough sample.

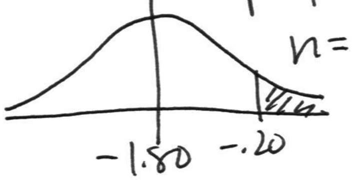
Ch. 18

Your professor's mother is a serious gambler and she decides to play too but she spends $144 by placing a total of 36 bets (you can treat her 36 bets as a random sample of size 36 and it is also large enough and independent). However, she lost a total of $16.

Please calculate the chance that your professor could lose 5 or fewer dollars after playing this game 25 times and that her mother could lose 16 or fewer dollars after playing the same game 36 times. Please show all of your work and then answer this question – based on your calculations, which is the luckier lady? (Let us define "lucky" as having had the smaller <u>chance</u> of losing as little money or less than what they loss, not necessarily which lady had the lower dollar amount lost) Please show your work (20 points)

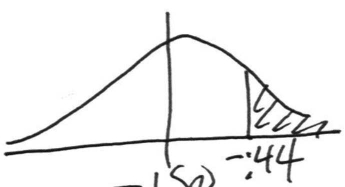
If the prof. has a TOTAL loss of −5 she had an AVERAGE loss of −5/25 = −.20 and her mom lost −16 so her average is −16/36 = −.444

so the professor's sampling distribution is



$$z = \frac{X - \mu}{\sigma/\sqrt{n}} = \frac{-.20 - -1.80}{4.24/\sqrt{25}} = +1.89$$ so area is .0294

and her mom's sampling distribution is



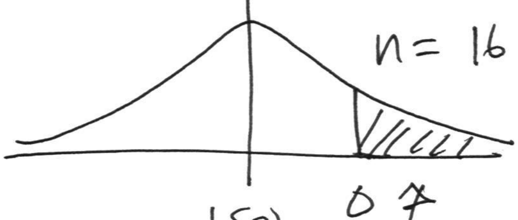
$$z = \frac{-.444 - -1.80}{4.24/\sqrt{36}} = 1.92$$ so area is .0274

mom is luckier

d. After hearing all of this talk about gambling, you decide to spend $64 and place 16 bets (Assume that you can treat your 16 bets as if they were a random sample of size 16 and you can assume the 16 bets are a large enough sample and the bets are independent). What is your chance of walking away with your original $64 or even more money after making 16 bets at this game? (10 points)

Ch. 18

If you walk away w/o losing your average is $0 per bet so your sampling distribution is



$$z = \frac{X - \mu}{\sigma/\sqrt{n}}$$

$$= \frac{0 - -1.80}{4.24/\sqrt{16}} \approx +1.70$$

So the chance is .0446 (shaded area)

Form S Form S Form S

2. A recent psychological study selected 1,024 Americans ages 17-64 at random. Of these, 121 were students enrolled in universities and colleges across the U.S. Among the students, the study revealed that 7 percent felt suicidal; 64 percent felt hopeless; and 50 percent felt depressed. Twelve of the 121 were currently in therapy. However, 22 percent reported feeling happy. The average age of college students in this study was 22.6 years with a standard deviation of 7.1 years.

Universities and colleges across the U.S. have previously reported an average 15 percent increase (the standard deviation was 5%) in the number of students receiving psychological services. Furthermore, 61 percent of students felt hopeless and 45 percent felt depressed. The average age of college students nationally is 23.4 years with a standard deviation of 5.6 years. Age is not normally distributed.

Ch. 19

(a) Given the information above, is it possible to construct a 98% confidence interval for the population percentage (or population proportion) of college students who have felt suicidal?

YES NO (circle one, one point)

If your answer is "yes", please construct the confidence interval in the space below. If your answer is "no", please briefly explain why it is not possible. If you circle "no" but decide to construct a confidence interval anyway in an attempt to cover your bases, you will receive a zero for your efforts. (nine points)

① $np = 121 \times .07 = 8.47 < 10$ so $np < 10$

② Therefore the Central Limit Theorem is not applicable and our sampling distribution won't be normal, can't use z

Ch 19

(b) Given the information above, is it possible to construct a 98% confidence interval for the population percentage (or population proportion) of college students who reported feeling happy? (10 points)

$np > 10$

$nq > 10$

random sample not too large

YES NO (circle one, one point)

If your answer is "yes", please construct the confidence interval in the space below. If your answer is "no", please briefly explain why it is not possible. If you circle "no" but decide to construct a confidence interval anyway in an attempt to cover your bases, you will receive a zero for your efforts. (nine points)

$$\hat{p} \pm z^* \left(\sqrt{\frac{\hat{p}\hat{q}}{n}}\right) \Rightarrow .22 \pm 2.33\sqrt{\frac{(.22)(.78)}{121}} \Rightarrow .22 \pm .088$$

Ch. 18

(c) What is the chance that for a new sample of size 121 students, the average percentage increase in the number of students receiving psychological services will be within ±1 percent of the reported population average of 15 percent? (10 points)

$\mu = 15$ $\sigma = 5$ so $z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$

$$z_{16} = \frac{16 - 15}{5/\sqrt{121}} = +2.20$$

$$z_{14} = \frac{14 - 15}{5/\sqrt{121}} = -2.20$$

area between ± 2.20 is $.9722$

Ch. 20

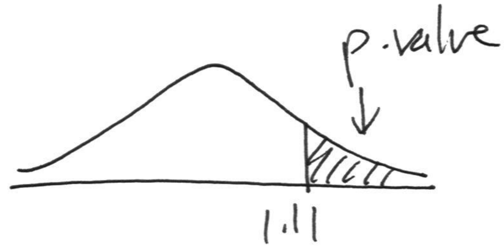
(d) (Please ignore the new information in part C above) Please ~~test~~ the hypothesis that the percentage of college students who feel depressed is increasing. A complete answer to this problem requires a null hypothesis, an alternative hypothesis, the correct test, the resulting p-value from the test, and an interpretation of the p-value in simple language (i.e. do you reject or not reject the null and is the result statistically significant and a brief explanation of the meaning in plain language). Please use an alpha=.05 as your decision rule. (25 points)

$\alpha = .05$

$H_0: p = .45$

$H_1: p > .45$

$$z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}} = \frac{.50 - .45}{\sqrt{\frac{(.45)(.55)}{121}}} = 1.11$$



p-value is .1335 and .1335 > .05 so

DO NOT REJECT THE NULL THIS IS NOT STATISTICALLY SIGNIFICANT. WHICH MEANS THERE IS NOT ENOUGH EVIDENCE HERE TO SUPPORT THE IDEA THAT ~~OR~~ DEPRESSION IS INCREASING

Ch. 19

(e) The (unethical) researcher in charge of a recent study of 169 college students would like every proposed null hypothesis rejected at the alpha=.05 level for any one-sided test performed. What minimum sample size should he select to be assured that he will always "reject the null" whenever his sample proportions are within 3 percent of his null hypotheses? You may assume that either p=.50 or p-hat ($\hat{p}$) =.50 to help you solve this problem. (10 points)

for a one-sided $\alpha = .05$ this implies

or

in either case

$z = 1.64$ or 1.65 or $z = -1.65$ or -1.64

sample size

$$n = \frac{z^2 (p)(q)}{(MoE)^2} = \frac{(1.64)^2 (.5)(.5)}{(.03)^2} \approx 747 \text{ or } 748$$

if used $z = 1.65$ then $n \approx 756$ or 757