4
17
10
7
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STAT:2010/4200, Statistical Methods and Computing
Spring 2019, Instructor: Cowles
Midterm 2

Name: Solutions Section no. _____

Show your work on any problems that involve calculations. If your answer to a multiple choice or true-false question would vary under different conditions, write an explanation. I will grade on a curve and will give partial credit wherever possible.

1. The Environmental Protection Agency (EPA) fuel economy ratings say that the Toyota Prius hybrid car gets 48 miles per gallon (mpg) on the highway. Deborah wonders whether the actual long-term average highway mileage μ of her new Prius is less than 48 mpg. She keeps careful records of gas mileage for 3000 miles of highway driving. Her result is $\bar{x} = 47.2$ mpg. What are her null and alternative hypotheses? (Circle one)

2 (a)

$$H_0 : \mu = 48$$
$$H_a : \mu < 48$$

(b)

$$H_0 : \mu = 48$$
$$H_a : \mu > 48$$

(c)

$$H_0 : \bar{x} = 48$$
$$H_a : \bar{x} < 48$$

(d)

$$H_0 : \bar{x} = 48$$
$$H_a : \bar{x} > 48$$

2. To assess the opinion of students about campus safety at Iowa State University, a reporter for the student newspaper interviews 15 students she meets walking on the campus late at night who are willing to give their opinion. The sample is (circle one):

(a) all students who walk on campus late at night
(b) all students at universities with safety issues
(c) the 15 students interviewed
(d) all students approached by the reporter

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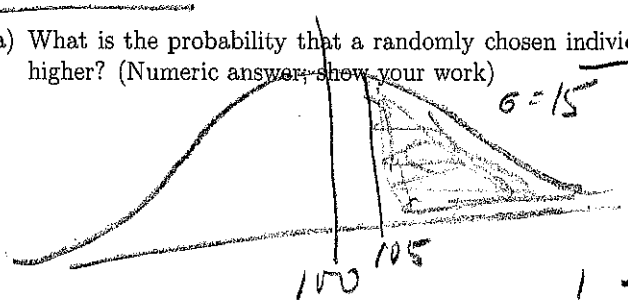
3. The Wechsler Adult Intelligence Scale (WAIS) is a common IQ test for adults. The distribution of WAIS scores for people over 16 years of age is approximately Normal with mean 100 and standard deviation 15.

(a) What is the probability that a randomly chosen individual has a WAIS score of 105 or higher? (Numeric answer; show your work)



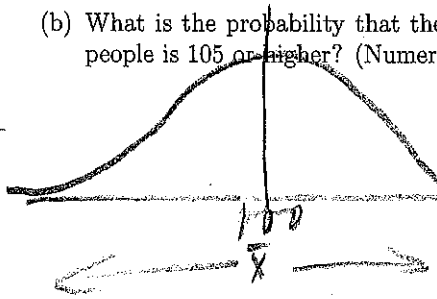
$\sigma = 15$

$z = \frac{105-100}{15} = 0.33$

$Pr(Z > 0.33) =$

$1 - .6293 = .37$

(b) What is the probability that the average WAIS score of a simple random sample of 60 people is 105 or higher? (Numeric answer; show your work)



$\sigma_{\bar{x}} = \frac{15}{\sqrt{60}}$ $z = \frac{105-100}{15/\sqrt{60}} = 2.58$

$Pr(Z > 2.58) =$

$1 - .995 = 0.005$

4. Low birthweight carries many risks. One study followed 113 male infants with very low birth weight to adulthood. At age 20, the mean IQ score for these men was $\bar{x} = 87.6$. Assume that IQ scores vary Normally with standard deviation $\sigma = 15$.

(a) Compute a 95% confidence interval for the mean IQ score at age 20 for all very-low-birth-weight males. (Numeric answer; show your work)

$\bar{x} \pm 1.96 \frac{\sigma}{\sqrt{n}}$

$87.6 \pm 1.96 \frac{15}{\sqrt{113}}$

$(84.83, 90.37)$

(b) You want to use the same data to perform a two-sided test of the null hypothesis that the mean IQ score at age 20 for all very-low-birth-weight males is 100 (the same as in the general population of adults over age 16). What does your confidence interval tell you about whether you can reject H_0 at the $\alpha = 0.05$ significance level? Explain briefly.

$H_0: \mu = 100$

$H_A: \mu \neq 100$

Since 100 is not in the 95% confidence interval, we can reject H_0 at the .05 significance level.

5. Dog breeders wish to do a two-sided test of the null hypothesis that the mean height μ in the population of all male golden retrievers is 23 inches. They set their significance level at $\alpha = 0.10$. They wish to have 80% power against the alternative that $\mu = 22$ inches. Use this information to answer the following questions.

(a) The breeders' choices of significance level and power mean: (circle **all** the correct statements)

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i. They want to have no more than a 10% risk of rejecting the null hypothesis if μ is 23 inches.

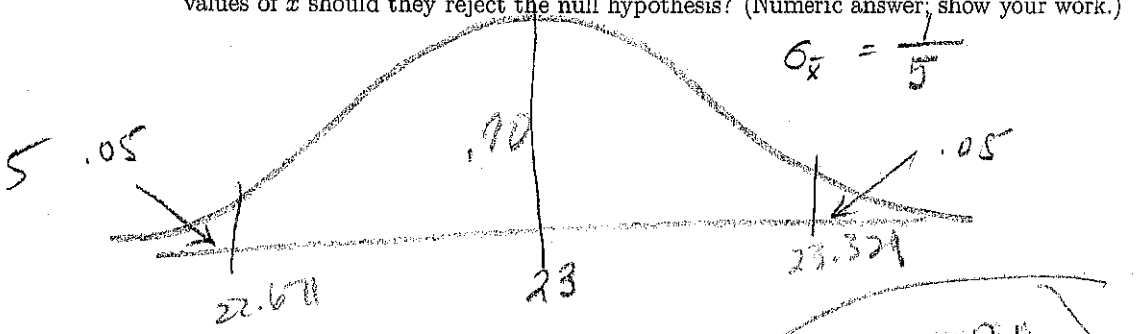
ii. They want to have an 80% chance of rejecting the null hypothesis if μ is 22 inches.

iii. They want to have no more than a 10% risk of failing to reject the null hypothesis if μ is 23 inches.

iv. They want to have an 80% chance of failing to reject the null hypothesis if μ is 22 inches.

v. They should reject the null hypothesis if they get a p-value smaller than 0.10.

(b) Suppose that the population standard deviation of heights in male golden retrievers is $\sigma = 1$ inch and that the breeders have 25 male golden retrievers in their study. For what values of $\bar{x}$ should they reject the null hypothesis? (Numeric answer; show your work.)



$23 - 1.645(.2)$ < 22.671

$23 + 1.645(.2)$ > 23.329

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6. The tenure-track faculty in Statistics at The University of Iowa are:

Full professors	Associate professors	Assistant professors
Kung-Sik Chan	Joyee Ghosh	Sanvesh Srivastava
Kate Cowles	Dsnat Stramer	Boxiang Wang
Jian Huang	Aixin Tan	
Joe Lang		
Ralh Russo		
Luke Tierney		
Dale Zimmerman		

(a) The department chair wants to randomly select five faculty members to serve on a committee. He wants to guarantee that faculty from all three ranks are selected. The best sampling method for him to use is: (circle one)

i. simple random sampling
ii. stratified random sampling
iii. convenience sampling
iv. judgment sampling
v. voluntary response sampling

(b) Using the method you selected in the previous question, draw a random sample of 4 faculty members of whom 2 are Full Professors, 1 is an Associate Professor, and 1 is an Assistant Professor. Use Table B starting at line 24. Write the names of the committee members you drew.

Starting codes at 1
Zimmerman Chan Tan Srivastava
or
Starting codes at 0
Cowles Chan Ghosh Srivastava

Chan Huang Jan Wang
Kung Chan