

Homework #5: Keeping things cool with statistics?

1. Your company has a contract to perform preventive maintenance on thousands of air conditioning units in a large city. Based on service records from the past year, the time (in hours) that a technician requires to complete the work follows a strongly right-skewed distribution with $\mu = 1$ hour and $\sigma = 1.5$ hours. As a promotion, your company will provide service to a random sample of 70 air-conditioning units free of charge.

a. What is the shape of the sampling distribution of \bar{x} for samples of size $n = 70$ from this population? Justify.

Since n is greater than 30, it's approx. Normal CLT

b. Calculate the mean and SD of the sampling distribution of \bar{x} for SRSs of size 70.

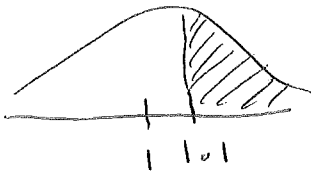
$$\mu_{\bar{x}} = 1$$

$$\sigma_{\bar{x}} = \frac{1.5}{\sqrt{70}} = .179$$

10% condition, $10n \leq N$ $10(70) \leq N$
 Def more than 700 air conditioners.

c. Calculate the probability that the average maintenance time \bar{x} for 70 units exceeds 1.1 hours.

$N(1, .179)$



$$P(\bar{x} \geq 1.1)$$

$$P\left(z \geq \frac{1.1 - 1}{.179}\right) = P(z \geq .55) = .2882$$

d. You plan to budget an average of 1.1 hours per unit for a technician to complete the work. Will this be enough time? Based on your answer to the previous problem, did the company budget enough time? Explain.

The company should budget more since over 25% of the maintenance takes longer than 1.1 hours

2. A college's data about incoming freshmen indicates that the mean of their high school GPAs was 3.4 with a standard deviation of 0.35; the distribution was roughly mound-shaped and only slightly skewed. The students are randomly assigned to freshman writing seminars in groups of 25.

a. What might the mean GPA of one group of these seminar groups be?

$$\mu_x = 3.4$$

b. What is the approximate standard deviation of GPA of one group of these seminar groups?

$$\sigma_{\bar{x}} = \frac{0.35}{\sqrt{25}} = .07 \quad \begin{array}{l} 10n \leq N \\ 10(25) \leq N \end{array} \quad \begin{array}{l} \text{Def more than 250} \\ \text{Incoming Freshman} \end{array}$$

c. Describe the appropriate shape of the sampling distribution of GPA of one group.

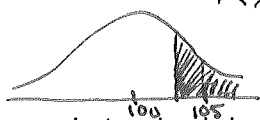
It is still mound-shaped & slightly skewed

d. Is a sample size of 25 sufficiently large enough? Explain.

No since it does not pass the CLT. $n \geq 30$

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

a.) What is the probability that a randomly chosen individual has a WAIS score of 105 or higher? $N(100, 15)$



$$P(x > 105) = P(z > \frac{105-100}{15}) = P(z > .33) = .369$$

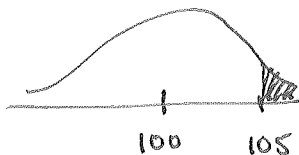
b.) What are the mean and standard deviation of the average WAIS score \bar{x} for an SRS of 60 people?

$$\mu_{\bar{x}} = 100 \quad N(100, 1.94)$$

$$\sigma_{\bar{x}} = \frac{15}{\sqrt{60}} = 1.94$$

c.) What is the probability that the average WAIS score of an SRS of 60 people is 105 or higher?

$$N(100, 1.94) = P(\bar{x} \geq 105) = P(z \geq \frac{105-100}{1.94}) = P(z \geq 2.57)$$



$$= .005$$

d.) Would your answers to a.), b.) or c.) be affected if the distribution of WAIS scores in the adult population was distinctly nonnormal? Explain

(a.) would not be able to calculate

(b & c) stay the same because of CLT ($60 \geq 30$)