CHAPTER 6 SPSS Problem SOLUTION

\*Note: student’s tables will differ slightly.

1. In this problem students should follow the example in the SPSS demonstration. The idea is that, as sample size increases, standard error decreases. In other words, the point of the problem is to demonstrate the Central Limit Theorem.

|  |  |  |  |
| --- | --- | --- | --- |
| ***25% Sample*** | ***N*** | ***Mean*** | ***Standard Error*** |
| MAEDUC | 334 | 11.29 | .203 |
| PAEDUC | 294 | 11.04 | .251 |

|  |  |  |  |
| --- | --- | --- | --- |
| ***50% Sample*** | ***N*** | ***Mean*** | ***Standard Error*** |
| MAEDUC | 653 | 11.64 | .135 |
| PAEDUC | 571 | 11.61 | .169 |

|  |  |  |  |
| --- | --- | --- | --- |
| ***75% Sample*** | ***N*** | ***Mean*** | ***Standard Error*** |
| MAEDUC | 976 | 11.48 | .114 |
| PAEDUC | 842 | 11.41 | .145 |

**CHAPTER 6 EXERCISE SOLUTIONS**

1. The relationship between the standard error and the standard deviation is where is the standard error of the mean and is the standard deviation. Since is divided by , must always be smaller than , except in the trivial case where *N* = 1. Theoretically, the dispersion of the mean must be less than the dispersion of the raw scores. This implies that the standard error of the mean is less than the standard deviation.

2.

a. The standard error of the mean is proportional to. The standard error of the mean is

σ for a sample size of 100.

σ for a sample size of 1,600.

Clearly, σ is smaller by a factor of 4 when sample size increases to 1,600.

b.

σ

σ

So when sample size decreases, standard error of the mean increases by



c. Assume an initial sample size of 100. Any initial value will suffice. Then

σ

σ

So, standard error decreases by a factor of 2, which is the square root of 4.

3.

a. The mean number of active military personnel per region in 2009 was



with a standard deviation of 119,819.

b. 10 sample means (students’ results will differ) calculated from samples of size 3:

223,410.7

52,547.0

84,785.0

165,595.3

53,129.3

142,018.0

88,199.0

193,251.3

41,593.0

89,428.0

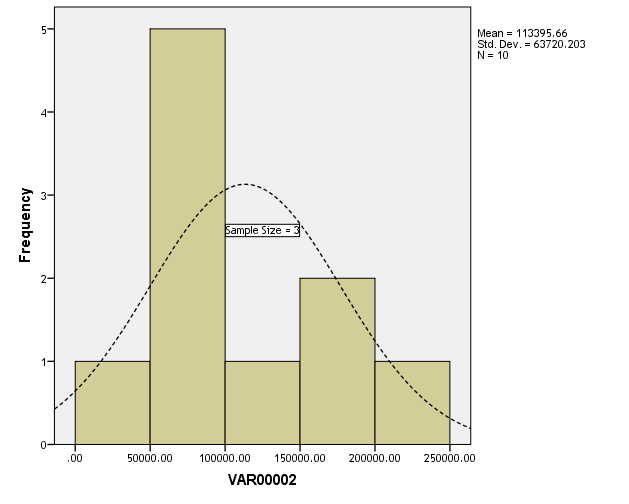
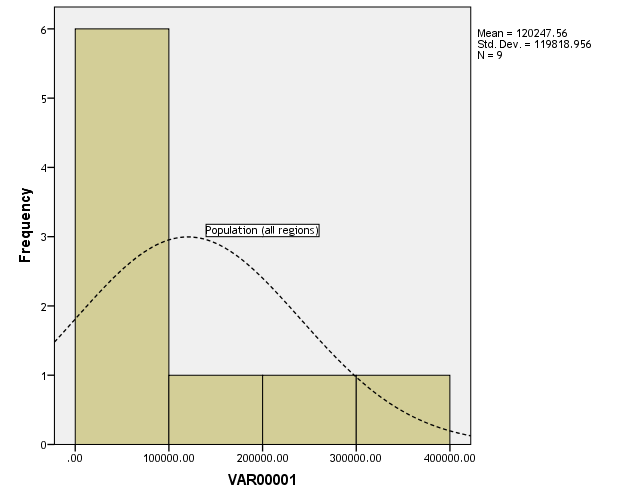
c. The mean of these 10 means is 113,395.66. Right away we notice that the population mean and the mean of the sampling distribution are somewhat close, a feature that we should come to expect given the fact that μ = μ.

d. The standard deviation for all regions is 119,819. The standard error is calculated using the following equation:

σ

We know that the value of the standard error will always be less than the value of the standard deviation in the population.

e. The population distribution is positively skewed and not close to normal. Since a very small sample size is used in this problem, the histogram for the samples of size 3 does not look normal. The distributions appear unimodal. The fact that the sample distribution of the means tends toward normality because of the Central Limit Theorem would become even more apparent if we took samples of size 5 or 6.



f. We treated the distribution for all regions as the population distribution.

4.

a. The standard error of the mean of $77,531 is 

A sample mean of $71,000 corresponds to a *Z* score of



The area between the score and the mean (which is $77,531) is about .4394, which is also the probability of a mean between $71,000 and $77,531.

b. For $85,000



The area beyond $85,000 is 0.0384. So, the probability that the sample mean exceeds $85,000 is 3.84%.

5.

a. Mean = 5.3; standard deviation = 3.27.

b. Here are 10 means from random samples of size 3: 6.33, 5.67, 3.33, 5.00, 7.33, 2.33, 6.00, 6.33, 7.00, 3.00.

c. The mean of these 10 sample means is 5.23. The standard deviation is 1.76. The mean of the sample means is very close to the mean for the population. The standard deviation of the sample means is much less than the standard deviation for the population. The standard deviation of the means from the samples is an estimate of the standard error of the mean we would find from one random sample of size 3.

6.

a. The standard error is calculated as follows:



This value represents the average standard deviation of any sample mean from the mean of means. Accordingly, it may also be referred to as the standard deviation of the sampling distribution.

b. With the exception of cases where *N* = 1, the standard error will always be less in value than the standard deviation of the population. This is expressed by the formula



The shape of the sampling distribution is normal; thus, even when working with a skewed distribution, we know that the sampling distribution is normal. Suggestions for reducing the sampling error include increasing the sample size.

7. a. = = .1734

b. z = = = .17

The area above this Z score is .4325. Therefore, we’d have a .4325 chance of drawing a sample with a mean of 2.00 kids or greater from this “population”.

8. First, we find the standard error.

= = .441

z = = = -3.33

The area below this Z score is .0004. Therefore, we’d have a .0004 chance of drawing a sample with a mean of 12.00 years of education or smaller from this “population”.