BIOE 440: Homework 4

1. Consider the population of observations: 3, 4, 5.
   - **1a.** Compute μ and σ^2 for this population, where σ^2 is defined for the population according to formula (2.5.3) on page 45 of the textbook.
   - **1b.** List all possible random samples (with replacement) of size $n = 2$.
   - **1c.** For each sample, find $\bar{x}$ and s^2.
   - **1d.** Find $\mu_{\bar{x}}$ and $\sigma^2_{\bar{x}}$ and note that their relationships to μ and σ^2 satisfy Statements 2 and 3 on p. 140.
2. Exercise 5.3.1 (p. 145)

central limit theorem and transform the resulting approximately normal sampling distribution of $\bar{x}$ (which has a mean of 120 and a standard deviation of $15/\sqrt{50} = 2.1213$) to the standard normal. The probability we seek is

$$\begin{aligned} P(115 \le \bar{x} \le 125) &= P\left(\frac{115 - 120}{2.12} \le z \le \frac{125 - 120}{2.12}\right) \\ &= P(-2.36 \le z \le 2.36) \\ &= .9909 - .0091 \\ &= .9818 \end{aligned}$$

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EXERCISES

5.3.1 The National Health and Nutrition Examination Survey of 1988–1994 (NHANES III, A-1) estimated the mean serum cholesterol level for U.S. females aged 20–74 years to be 204 mg/dl. The estimate of the standard deviation was approximately 44. Using these estimates as the mean μ and standard deviation σ for the U.S. population, consider the sampling distribution of the sample mean based on samples of size 50 drawn from women in this age group. What is the mean of the sampling distribution? The standard error?

5.3.2 The study cited in Exercise 5.3.1 reported an estimated mean serum cholesterol level of 183 for women aged 20–29 years. The estimated standard deviation was approximately 37. Use these estimates as the mean μ and standard deviation σ for the U.S. population. If a simple random sample of size 60 is drawn from this population, find the probability that the sample mean serum cholesterol level will be:

(a) Between 170 and 195 (b) Below 175

(c) Greater than 190

5.3.3 If the uric acid values in normal adult males are approximately normally distributed with a mean and standard deviation of 5.7 and 1 mg percent, respectively, find the probability that a sample of size 9 will yield a mean:

(a) Greater than 6 (b) Between 5 and 6

(c) Less than 5.2

5.3.4 Wright et al. (A-2) used the 1999–2000 National Health and Nutrition Examination Survey (NHANES) to estimate dietary intake of 10 key nutrients. One of those nutrients was calcium (mg). They found in all adults 60 years or older a mean daily calcium intake of 721 mg with a standard deviation of 454. Using these values for the mean and standard deviation for the U.S. population, find the probability that a random sample of size 50 will have a mean:

(a) Greater than 800 mg (b) Less than 700 mg

(c) Between 700 and 850 mg

5.3.5 In the study cited in Exercise 5.3.4, researchers found the mean sodium intake in men and women 60 years or older to be 2940 mg with a standard deviation of 1476 mg. Use these values for the mean and standard deviation of the U.S. population and find the probability that a random sample of 75 people from the population will have a mean:

(a) Less than 2450 mg (b) Over 3100 mg

(c) Between 2500 and 3300 mg (d) Between 2500 and 2900 mg