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Statistics for laboratory scientists

Homework problems for lecture 10

1. Suppose we measure the \log_{10} cytokine response of 15 mice following some treatment, and observe the sample mean $\bar{x}=3.2$ and sample SD $s=1.5$.
 - a. If x_1, x_2, \dots, x_{15} are iid Normal(mean=2, sd=1.5), What is the chance of observing a sample mean greater than or equal to 3.2?
 - b. If x_1, \dots, x_{15} are iid Normal(mean=3, sd=1.5), What is the chance of observing a sample mean greater than or equal to 3.2?
 - c. Repeat (a) for the case the population SD is 3.0.
 - d. Repeat (b) for the case the population SD is 3.0.
 - e. Repeat (a) for the case the population SD is 1.5 but $n=3$.
 - f. Repeat (b) for the case the population SD is 1.5 but $n=3$.
 - g. Repeat (a) for the case the population SD is 1.5 but $n=100$.
 - h. Repeat (b) for the case the population SD is 1.5 but $n=100$.
2. Suppose we have 100 independent draws from some population distribution whose shape is unknown but where the population mean is 10 and SD is 2.5. Suppose that $n=100$ is sufficiently large that for the sample mean to have an approximately normal distribution.
 - a. What is the chance that the sample mean is within 0.1 units of the population mean?
 - b. What is the chance that the sample mean exceeds the population mean by at least 0.25 units?

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