1. Before a blood donation, the American Red Cross checks your hemoglobin level. If it is too low, the agency will ask you to wait to donate. The measurement process is not perfect and past results suggest the observed measurements are approximately Normal with a mean equal to the patient’s true hemoglobin level and a standard deviation of 0.15 g/dL. Given that the cutoff for a female is 12.5 g/dL, what is the probability that,
   a. A female with a true hemoglobin level of 12.8 g/dL will be asked to wait to donate?
   b. A female with a true hemoglobin level of 12.3 g/dL will be able to donate?
   c. A female with a true hemoglobin level of 12.8, using the average of two independent measurements, will be asked to wait to donate?
   d. Instead of averaging the two measurements like in c), suppose the female is able to donate only if both readings are above the limit. What is the probability the female will be asked to wait to donate?
   e. The approaches in parts c) and d) both involve two measurements but they are used in different ways. Which of these approaches has more power to correctly identify this person as having a level above the cutoff? Explain your answer.

2. Use the data in Montgomery 2-24 to test whether the fill volumes of the two machines are different. In other words, write out the null and alternative hypotheses, perform the t test and state your conclusions.

3. A fellow student is concerned about the assumption of normality in Montgomery 2-24 and wants to perform a permutation test instead. Using SAS (Topic 3, pages 13-14) or other software obtain an estimate of the permutation test P-value using 1000 permutations. If you use SAS, make sure to specify what random seed you use in proc multtest.

4. Suppose I generate 10 random variables in the following manner. I first generate a variable $X$ from a Normal distribution with mean 50 and standard deviation 3. I then randomly generate 10 variables $Y_1, Y_2, ..., Y_{10}$ from a Normal with mean 0 and standard deviation 1 and add the variable $X$ to each one. This creates 10 random variables

   \[ Z_i = X + Y_i \quad i = 1, 2, ..., 10. \]

   a. What is the $E(Z_i)$ and $\text{Var}(Z_i)$?
   b. What is the $E(\overline{Z})$ and $\text{Var}(\overline{Z})$?

5. Montgomery 2-34

6. Use the results summarized in Montgomery 2-39 to perform a t test testing $H_1 : \mu_N > 2\mu_S$, where the subscripts $N$ and $S$ refer to normal and schizophrenic, respectively. Show your work.