Homework 8 - STAT 231

Due in class, Monday, November 4

Some of the following problems are from the Devore textbook.

1. Chapter 8: Problem 1
2. Chapter 8: Problem 20 (Don't consider the third part)
3. Chapter 8: Problem 24
4. Chapter 8: Problem 35(a)
5. Chapter 8: Problem 48(a)-(b)
6. Chapter 9: Problem 8
7. Chapter 9: Problem 18 Use test statistic from our formula sheet
8. Chapter 9: Problem 22 Use test statistic from our formula sheet
   For this problem, you can enter the data into JMP (one column for the numerical values and another column as labels: high (H) or non-high (H)) to make graphs and get summary statistics. For (a), you can make side-by-side histograms (instead of boxplots) by selecting "Graph", "Graph Builder" and then the blue "Histogram" icon. In the histogram window, Put the labels column in the "x" spot and the numerical column in the "y" spot.
9. The drying time of a certain type of paint under specified test conditions is known to be normally distributed with mean value 75 min and standard deviation 9 min. Chemists have proposed a new additive designed to decrease average drying time. It is believed that drying times with this additive will remain normally distributed with $\sigma = 9$. Because of the expense associated with the additive, evidence should strongly suggest an improvement in average drying time before such a conclusion is adopted. Let μ denote the true average drying time when the additive is used. The appropriate hypotheses are $H_0 : \mu = 75$ versus $H_a : \mu < 75$. Only if H_0 can be rejected will the additive be declared successful and then be used. Assume a sample of size n = 25 is obtained.
   a. If $\bar{X} = 72.3$, what is the conclusion using $\alpha = 0.01$?
   b. What is α for the test procedure that rejects H_0 when $\bar{X} < 69.816$?
   c. For the test procedure of part (b), what is $\beta(70)$?
10. Let μ denote the true average tread life of a certain type of tire. Consider testing $H_0 : \mu = 30,000$ versus $H_a : \mu > 30,000$ based on a sample of size $n = 16$ from a normal population distribution with $\sigma = 1500$.
    a. If $\bar{X} = 30,960$ and a level $\alpha = 0.01$ test is used, what is the decision?
    b. If a level .01 test is used, what is $\beta(30,500)$?
    c. If $\bar{X} = 30,960$, what is the smallest α at which H_0 can be rejected (based on $n = 16$)?

Note: The following two problems involve the `Cars2015` dataset that is available in Canvas (Homework folder). We assume that cars in this dataset are a random sample of all 2015 cars. Use JMP to obtain summary statistics (samples means and standard deviations) in each problem detailed below; then with these statistics, complete the associated two-sample tests and confidence intervals by hand.

11. We are interested in comparing highway mileage (HwyMPG) for small and midsized cars.

    You can get the HwyMPG for each type of car by choosing `Analyze Distribution` and dragging the "HwyMPG" variable to the *Columns* dialog box and the "Size" variable to the *By* dialog box. Note that the first statistics you will see are for large cars so you need to scroll down to get to the midsized and small ones.

    (a) A person might suspect that small cars get better highway mileage than midsized cars. Conduct a hypothesis test to determine whether there is conclusive evidence to support this claim. Use a level of significance of $\alpha = 0.05$.

    (b) Calculate a 90% confidence interval for mean difference in highway mileage between small and midsized cars.

12. We are interested in comparing fuel capacity (FuelCap) for cars of type "Hatchback" to cars of type "Wagon".

    (a) Conduct a hypothesis test to test whether the mean fuel capacity for all 2015 Hatchbacks is different that the mean fuel capacity for all 2015 Wagons. Assume that prior to seeing the data, we do not know which type we would suspect would have greater fuel capacity (that is, use a 2-sided alternative hypothesis). Use $\alpha = 0.05$.

    (b) Calculate a 95% confidence interval for mean difference in fuel capacity between Hatchbacks and Wagons.