STMATH 341, Chapter 10: Two-Sample Hypothesis Tests

1. During a local promotion to increase sales of a certain store brand of milk, Bob Johnson, staff statistician for the Vons food chain, performed a hidden shopper observation at selected stores of Vons and Savemart to determine if patrons shopping at Vons purchased significantly more milk. To try to eliminate any bias in his data collection, Bob did his best to duplicate the same conditions while observing these people buy milk. The following are the that Bob collected (shown in half gallons of milk sold in a given observation period):

Von's	$3, 4, 5, 2, 4, 6, 3, 5, 8, 9, 5, 2, 1, 7, 3, 6, 5$
Savemart	$3, 3, 2, 2, 3, 5, 2, 1, 7$

   Test the hypothesis that Vons sells more milk than Savemart at a 5% level of significance. (Assume normal populations where standard deviations are equal but unknown.)

   (a) State the null and the alternative hypotheses.

   H_0 :

   H_1 :

   (b) What is the test statistic (up to 3 decimal places)?

   (c) What is the p-value (up to 3 decimal places)?

   (d) What is your decision (circle one)?

   Reject H_0 Fail to Reject H_0

   (e) What is your conclusion (in a complete English sentence)?

2. Bob Johnson also believes that the proportion of Vons shoppers that purchase groceries in excess of \$50 is significantly larger than those at Savemart stores. To verify his belief, he randomly selects 120 customers from the Vons store and found that 71 of those customers purchase items in excess of \$50. A similar sample collected at Savemart found that amongst 86 shoppers, 40 purchased items in excess of \$50.

   Test the hypothesis that Bob Johnson's claim is believable. What should Bob Johnson conclude based on $\alpha = 0.05$? Would your answer change if you used $\alpha = 0.01$?

   (a) State the null and the alternative hypotheses.

   H_0 :

   H_1 :

   (b) What is the test statistic (up to 3 decimal places)?

   (c) What is the p-value (up to 3 decimal places)?

   (d) What is your decision for $\alpha = 0.05$?

   Reject H_0 Fail to Reject H_0

   (e) What is your decision for $\alpha = 0.01$?

   Reject H_0 Fail to Reject H_0

   (f) What is your conclusion for $\alpha = 0.01$ (in a complete English sentence)?

3. Swiftly Treadwell is an Olympic team coach for athletes that run the 1500 meter race. Assume that 5 runners completed Swiftly's 6 month training program and their times in minutes are shown below. Take the appropriate steps necessary to test the hypothesis that there is a significant ($\alpha = 0.05$) decrease in the mean time per 1500 meters. (Assume the population of paired differences is normally distributed.)

$$d = \text{ time before } - \text{ time after}$$

Runner	Time Before Training	Time After Training
1	5.9	5.4
2	7.5	7.1
3	6.1	6.2
4	6.8	6.3
5	8.1	7.8

(a) State the null and the alternative hypotheses.

H_0 :

H_1 :

(b) What is the test statistic (up to 3 decimal places)?

(c) What is the p-value (up to 3 decimal places)?

(d) What is your decision (circle one)?

Reject H_0 Fail to Reject H_0

(e) What is your conclusion (in a complete English sentence)?

(f) Construct a 95% confidence interval for d and write a one sentence interpretation of this interval.