

If you are asked to conduct an appropriate hypothesis test, please show all of the following:

- 1) A statement of the null and alternative hypotheses using appropriate symbols
- 2) The calculation of an appropriate test statistic (show your work: show the equation you use, how you plug in, and your final answer)
For test statistics involving the t-distribution: round to 3 decimal places.
For test statistics involving the Normal distribution: round to 2 decimal places.
- 3) Calculation of the p-value or critical value, as appropriate (show your work)
- 4) Conclusion: do you reject the null hypothesis? Why or why not? Include the significance level (if you're using the p-value method) or the rejection region (if you're using the critical value method).
- 5) Interpretation: one sentence explaining what the conclusion means in the context of the original research question.

Assignment Questions

1. [8 marks] There are two major bookstores in a relatively large city. They constantly measure their performance relative to one another. The monthly sales receipts total \$15,200 on average for Bookstore 1. Bookstore 2 is interested in knowing whether their average monthly sales receipts are different from Bookstore 1. The last 6 months of data from Bookstore 2 are given below. The population standard deviation of monthly sales receipts for Bookstore 2 is \$3,500.

Month	1	2	3	4	5	6
Bookstore 2	\$11,000	\$12,000	\$22,000	\$18,000	\$13,000	\$500

Conduct an appropriate hypothesis test. Use the p-value method. [8 marks]

Let mean for Bookstore 1 be μ_0 and mean for Bookstore 2 be $\bar{x}$.

Hypothesis statement;

H₀: $\mu_0 - \bar{x} = 0$

H₁: $\mu_0 - \bar{x} \neq 0$

Test statistics for this is t-test, t-distribution.

Formula;

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

Bookstore 2 mean($\bar{x}$) = \$ (11,000+ 12000+ 22000+ 18000+13000+500)/6 = 76,500/6 = \$ 12750
Substituting,

$$t = (12750 - 15200) / (3500/\sqrt{6}) = -1.715$$

p-value corresponding to -1.715 and df= 5 = 0.147006.

Significance value of our test is 0.05.

since p-value is greater than significance level, we therefore fail to reject H₀.

In conclusion, the average sales between the two bookstores, that is, Bookstore 1 and Bookstores 2 are not significantly different.

2. [8 marks] A travel agency is interested in comparing the travel experiences of customers travelling on two airlines: Airline A and Airline B. They would like to know if there is a difference in the population mean travel time on a direct flight from Saskatoon to Toronto, depending on the airline a traveler chooses to fly. They recruit five employees who are asked to fly direct from Saskatoon to Toronto. Each employee is asked to record the amount of time spent in the air. The times recorded by the employees are provided below (in hours). The population mean time for Airline B to fly from Saskatoon to Toronto is 3.4 hours.

Employee	1	2	3	4	5
Airline A	3.25	3.5	3	3.75	3.75

Conduct an appropriate hypothesis test using the critical value method.

Hypothesis;

$H_0: \mu - \bar{x} = 0$

$H_1: \mu - \bar{x} \neq 0$

Test statistic is t-test

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

Mean ($\bar{x}$) = $(3.25 + 3.5 + 3 + 3.75 + 3.75)/5 = 3.45$

Standard deviation, $s = 0.32596$

$n = 5$

$$t = (3.45 - 3.4) / (0.32596 / \sqrt{5}) = 0.343$$

t-critical = 2.776

Since, our test statistic $t = 0.343$ is less than critical value, 2.776, We fail to reject H_0 .

In conclusion, there is an insignificant difference in the population mean travel time on a direct flight from Saskatoon to Toronto between flight A and B.

3. [9 marks] A video game company is interested in knowing the population mean number of hours spent playing a new game from start to finish. If the game takes longer than 40 hours to play, on average, then it will need to be re-worked – the company wants to know if the game will need to be re-worked. The company collects a sample of 15 video game players with various levels of expertise, and finds that it takes them 42 hours, on average, to complete the game, with a standard deviation of 1.5 hours.

a. [8 marks] Conduct an appropriate hypothesis test using the p-value method.

Let our $\bar{x} = 42$ hour

$\mu_0 = 40$

Hypothesis;

$H_0: \bar{x} = 40$

$H_1: \bar{x} \geq 40$

Test statistic is t-test

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

Substituting formula gives,

$$t = (42 - 40) / (1.5 / \sqrt{15}) = 5.164$$

p-value corresponding to 5.164 and df of 14 = 0.000072

Our p-value is less than the significance value, hence we reject null hypothesis, H_0 .

In conclusion, the average time taken to complete the game from the sample is taking longer than 40 hours and therefore the game needs to be re-worked.

b. [1 mark] Explain what a Type I Error would mean in this context (maximum 2 sentences).

Type I error in this context would mean rejecting a null hypothesis which is true, that is, rejecting null hypothesis which we should fail to reject.