10.1 Two Population Means with Unknown Standard Deviations

Section 10.1 Two Population Means with Unknown Standard Deviations

Learning Objective:

In this section, you will:

• Apply hypothesis testing and calculate confidence intervals to real-world problems about two population means

1. The two independent samples are simple random samples from two distinct populations.
2. For the two distinct populations:
   - if the sample sizes are small, the distributions are important (should be normal)
   - if the sample sizes are large, the distributions are not important (need not be normal)

Two population means from independent samples where the population standard deviations are not known

- Random Variable: $X1 - X2$ = the difference of the sampling means
- Distribution: Student's *t*-distribution with degrees of freedom (variances not pooled)
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Example 1a: The average amount of time boys and girls aged seven to 11 spend playing sports each day is believed to be the same. A study is done and data are collected, resulting in the data in table below. Each population has a normal distribution.

	Sample Size	Average Number of Hours Playing Sports Per Day	Sample Standard Deviation
Boy	9	2	0.866
Girl	16	3.2	1.00

Is there a difference in the mean amount of time boys and girls aged seven to 11 play sports each day? Test at the 5% level of significance.

1. Null and Alternative Hypothesis
2. Calculator Work
3. Test Statistic and P-Value

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4. Conclusion about the null hypothesis
5. Final conclusion that addresses the original claim

Example 1b: Using the date from 1a, construct the corresponding confidence interval estimate for the difference between the mean amount of time boys and girls aged seven to 11 play sports each day. What does the result suggest about the two means?

Example 2: A professor at a large community college wanted to determine whether there is a difference in the means of final exam scores between students who took his statistics course online and the students who took his face-to-face statistics class. He believed that the mean of the final exam scores for the online class would be lower than that of the face-to-face class. Was the professor correct? The randomly selected 30 final exam scores from each group are listed below.

Online Class exam scores: 67.6; 41.2; 85.3; 55.9; 82.4; 91.2; 73.5; 94.1; 64.7; 64.7; 70.6; 38.2;

61.8; 88.2; 70.6; 58.8; 91.2; 73.5; 82.4; 35.5; 94.1; 88.2; 64.7; 55.9; 88.2; 97.1; 85.3; 61.8; 79.4; 79.4

Face-to-Face Class exam scores: 77.9; 95.3; 81.2; 74.1; 98.8; 88.2; 85.9; 92.9; 87.1; 88.2; 69.4;

57.6; 69.4; 67.1; 97.6; 85.9; 88.2; 91.8; 78.8; 71.8; 98.8; 61.2; 92.9; 90.6; 97.6; 100; 95.3; 83.5;

92.9; 89.4

1. Null and Alternative Hypothesis

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2. Calculator Work
3. Test Statistic and P-Value
4. Conclusion about the null hypothesis
5. Final conclusion that addresses the original claim
6. Test the above claim by constructing an appropriate confidence interval.

For more information and examples see online textbook OpenStax Introductory Statistics pages 567-576.