

MATHEMATICS 360-255-LW

Quantitative Methods II

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XVI – Inferences for Independent Samples

- Two groups of subjects participated in an experiment designed to test the effect of frustration on aggression. The experimental group of 40 subjects received a frustrating puzzle to solve, whereas the control group of 40 subjects received an easy, nonfrustrating version of the same puzzle. Level of aggression was then measured for both groups. A mean aggression score of 4.0 was found for the experimental group (frustration), and of 3.0 for the control group (no frustration), where higher mean scores indicate greater aggression. Assume that the population standard deviation for the experimental group is 2.0, and 1.5 for the control group.
 - Construct a 95% confidence interval for the difference in the mean aggression between the experimental group and the control group.
 - Test at the 5% significance level if frustration increases aggression. Try with both approaches, the classical and the p -value.
- An experiment was conducted to compare the mean absorption of two drugs (A and B) in specimens of muscle tissue. Forty-eight tissue specimens were randomly divided into two equal groups. Each group was tested with one of the two drugs. The drug A had a mean absorption rate of 7.9, and drug B had a mean absorption rate of 8.5. Assume that absorption rates are normally distributed for both drugs, with a population standard deviation of 1.1 for drug A and of 1.2 for drug B.
 - Construct a 90% confidence interval for the difference in the mean absorption rates.
 - Using a 10% level of significance, can you conclude that the absorption rate is different for the two drugs? Try with both approaches, the classical and the p -value.
- “Are intellectuals more likely to wear a beard?” wondered a social psychologist. To answer her question, she asked samples of bearded and clean-shaven men about their level of educational attainment. The following data on years of schooling was obtained.

Beard	18	23	12	14	18	16	15	19	12	21	19	8
	21	16	19	20	18	15	14	16	11	12	13	13
	14	19	18	23	19	17	17	12	11			
No Beard	16	11	12	15	14	12	11	19	11	22	13	9
	21	18	19	12	11	14	16	14	13	12	14	14
	12	11	11	15	17	18	21	22	23	14	13	

Assume that the population standard deviation for men with beards is 3.69 years and for men with no beards 3.77 years.

- Construct a 99% confidence interval for the difference between the mean schooling of bearded and clean-shaven men.
- Using a 1% level of significance, can you conclude bearded men have more schooling than clean-shaven men? Try with both approaches, the classical and the p -value.

4. The Thematic Apperception Test presents subjects with ambiguous pictures and asks them to tell a story about the picture. These stories can be scored in any number of ways. A psychologist asked mothers of 20 Normal and 20 Schizophrenic children to complete the TAT, and scored for the number of stories (out of 10) that exhibited a positive parent-child relationship. Assume TAT scores are normally distributed. Here are the results.

Normal	8	4	6	3	1	4	4	6	4	2
Schizophrenic	2	1	1	3	2	7	2	1	3	1
Normal	2	1	1	4	3	3	2	6	3	4
Schizophrenic	0	2	4	2	3	3	0	1	2	2

- a) Construct a 95% confidence interval for the difference in the mean number of stories that exhibited a positive parent-child relationship between Normal and Schizophrenic children.
- b) Using a 5% level of significance, can we conclude that normal children exhibit a more positive parent-child relationship? Try with both approaches.
5. To study the influence of motivation on problem solving abilities, a psychologist asked 10 children to solve as many problems as they could in 10 minutes. One group (5 subjects) was told that this was a test of their innate problem-solving ability; a second group (5 subjects) was told that this was just a time-filling task. Assume the number of problems solved is normally distributed. Here are the results.

Innate ability	4	5	8	3	7
Time-filling task:	11	6	9	7	9

- a) Construct a 99% confidence interval for the difference in the mean number of problems solved between the two experimental conditions.
- b) Using a 1% level of significance, can we conclude that the mean number of problems solved vary with experimental condition? Try with both approaches.
6. A criminologist was interested in determining whether there was disparity in sentencing based on the race of the defendant. She selected at random 18 burglary convictions and compared the prison terms given to the 10 whites and 8 blacks sampled. Assume the length of sentences is normally distributed. The sentence lengths (in years) are shown for the white and black offenders.

Whites	3	5	4	7	4	5	6	4	3	2
Blacks	4	8	7	3	5	4	5	4		

- a) Construct a 90% confidence interval for the difference in the mean sentence length between blacks and whites convicted of burglary.
- b) Using a 10% level of significance, can we conclude that whites and blacks convicted of burglary in this jurisdiction do not differ with respect to prison sentence length? Try with both approaches, the classical and the p -value.

ANSWERS

1. a) 0.225 to 1.775
 b) $H_0 : \mu_E - \mu_C = 0$ critical values: $z_{0.05} = 1.645$ Reject H_0
 $H_A : \mu_E - \mu_C > 0$ test statistic: $z = 2.53$
 p -value = 0.0057
2. a) 0.053 to 1.147
 b) $H_0 : \mu_B - \mu_A = 0$ critical values: $\pm z_{0.05} = \pm 1.645$ Reject H_0
 $H_A : \mu_B - \mu_A \neq 0$ test statistic: $z = 1.81$
 p -value = 0.0702
3. a) -1.04 to 3.63
 b) $H_0 : \mu_b - \mu_{nb} = 0$ critical value: $z_{0.01} = 2.33$ Fail to reject H_0
 $H_A : \mu_b - \mu_{nb} > 0$ test statistic: $z = 1.43$
 p -value = 0.076
4. a) 0.347 to 2.553
 b) $H_0 : \mu_n - \mu_s = 0$ critical value: $t_{(38,0.05)} = 1.684$ Reject H_0
 $H_A : \mu_n - \mu_s > 0$ test statistic: $t = 2.66$
 $0.005 < p$ -value < 0.007
5. a) -1.271 to 7.271
 b) $H_0 : \mu_t - \mu_i = 0$ critical values: $\pm t_{(8,0.005)} = \pm 3.355$ Fail to reject H_0
 $H_A : \mu_t - \mu_i \neq 0$ test statistic: $t = 2.357$
 $0.044 < p$ -value < 0.050
6. a) -0.611 to 2.011
 b) $H_0 : \mu_b - \mu_w = 0$ critical value: $t_{(16,0.05)} = 1.746$ Fail to reject H_0
 $H_A : \mu_b - \mu_w \neq 0$ test statistic: $t = 0.93$
 $0.333 < p$ -value < 0.382