

BUS 173 Applied Statistics

Sample Midterm I Exam

This sample exam does not cover all the materials you are responsible to know for your midterm 1 exam. This sample is designed to give you an idea of the question pattern and the level of difficulty you are likely to face in the exam. You are advised to peruse the class notes, slides and worksheets to be fully prepared for this exam.

Follow the steps done in class to run the following hypothesis tests:

Hypothesis Test about Population Mean (μ) for Cases 1 & 2:

Problem 1: The college bookstore tells prospective students that the average cost of its textbooks is \$52 with a standard deviation of \$4.50. A group of smart statistics students thinks that the average cost is higher. In order to test the bookstore's claim against their alternative, the students will select a random sample size of 100. Assume that the mean from their random sample is \$52.80. Test the theory at 5% level of significance.

Problem 2: It is believed that the average level of prothrombin in a normal population is 20 mg/100 ml of blood plasma, with a standard deviation of 4 mg/100 ml. To verify this, a sample is taken from 40 individuals in whom the average is 18.5 mg/100 ml. Is there enough statistical evidence present to infer that the population average level of prothrombin in 100 ml of blood plasma is different from 20 mg?

Hypothesis Test about Population Mean (μ) for Cases 4 & 5:

Problem 3: A random sample of 14 cows was selected from a large dairy herd at Brookfield Farm. The milk yield in one week was recorded, in kilograms, for each cow. The sample average was 138.28 kilograms and the standard deviation of the sample is 24.58 kilograms. Investigate the claim that the mean weekly milk yield for the herd is greater than 120 kg.

Problem 4: The high school athletic director is asked if football players are doing well academically as the other student athletes. We know from a previous study that the average GPA for the student athletes is 3.10. After an initiative to help improve the GPA of student athletes, the athletic director randomly samples 20 football players and finds that the average GPA of the sample is 3.18 with a sample standard deviation of 0.54. Is there a significant improvement? Use a 0.05 significance level.

Hypothesis Test about Population Proportion (p)

Problem 5: An e-commerce research company claims that 60% or more graduate students have bought merchandise online. A consumer group is suspicious of the claim and thinks that the proportion is lower than 60%. A random sample of 80 graduate students show that only 22 students have ever done so. Is there enough evidence to show the true proportion is lower than 60%? Conduct an appropriate hypothesis test.

Problem 6: The CEO of a large electric utility claims that 80 percent of his 1,000,000 customers are very satisfied with the service they receive. To test this claim, the local newspaper surveyed 100 customers, using simple random sampling. Among the sampled customers, 73 percent say they are very satisfied. Based on these findings, can we reject the CEO's hypothesis that 80% of the customers are very satisfied? Use a 0.05 level of significance. Conduct a two-tailed test.

Hypothesis Test for Difference in Two Population Means (using Independent Samples)

Problem 7: A random sample of 48 men with new CPA certifications showed a mean starting salary of \$80,168 and a standard deviation of \$8000. At the same time, a random sample of 39 women with new CPA certifications showed a mean starting salary of \$70,754 and a standard deviation of \$6000.

- (a) Assuming that population standard deviations are equal, test if men are paid more than women at 1% significance level.
 (b) Construct a 95% confidence interval for the difference in the mean salaries of men and women.

Problem 8: We want to compare the average weights of Hilsha fish in two river basins: (1) Padma and (2) Meghna River. Based on the health of the two rivers, we believe that the Hilsha in the Padma will be larger, on average, and would like to test for this effect. We randomly sample 100 Hilsha fish in each basin. The mean weight of the Padma Hilsha is 800 grams with a standard deviation of 400 grams. The mean weight of the Meghna Hilsha is 700 grams with a standard deviation of 300 grams. Assume that the population standard deviations are different. At 5% level of significance, does the data provide sufficient evidence that the Hilsha in the Padma will be larger on average?

Hypothesis Test for Difference in Two Population means (using Matched Pairs Samples)

Problem 9: A state legislator wants to determine whether her voter’s performance rating (0 – 100) has changed from last year to this year. The following table shows the legislator’s performance rating for the same 16 randomly selected voters for last year and this year.

Voter	Rating (last year)	Rating (this year)
1	60	56
2	54	48
3	78	70
4	84	60
5	91	85
6	25	40
7	50	40
8	65	55
9	68	80
10	81	75
11	75	78
12	45	50
13	62	50
14	79	85
15	58	53
16	63	60

At 1% significance level, is there enough evidence to conclude that the legislator’s performance rating has changed? Assume the performance ratings are normally distributed.

Problem 10: Police trainees were seated in a darkened room facing a projector screen and given a memory test. A **matched pair** random sample of 15 trainees who tool this test were then given a week-long memory training course. The results are listed at follows:

Police trainee	Memory score after training	Memory score before training
1	6	6
2	8	5
3	6	6

4	7	5
5	9	7
6	8	5
7	9	4
8	6	6
9	7	7
10	5	8
11	9	4
12	8	5
13	6	4
14	8	6
15	6	7

Test at 5% level of significance, whether the memory course improved the ability of the trainees to correctly identify license plates.

Hypothesis Test for Difference in Two Population Proportions

Problem 11: Time magazine reported the result of a telephone poll of 800 adult Americans. The question posed of the Americans who were surveyed was: "Should the federal tax on cigarettes be raised to pay for health care reform?" The results of the survey were:

Non-Smokers	Smokers
$n_1 = 605$	$n_2 = 195$
$y_1 = 351$ said "yes"	$y_2 = 41$ said "yes"
$\hat{p}_1 = \frac{351}{605} = 0.58$	$\hat{p}_2 = \frac{41}{195} = 0.21$

Is there sufficient evidence at the $\alpha = 0.05$ level, say, to conclude that the two populations — smokers and non-smokers — differ significantly with respect to their opinions?

Problem 12: Males and females were asked about what they would do if they received a \$100 bill by mail, addressed to their neighbor, but wrongly delivered to them. Would they return it to their neighbor? Of the 69 males sampled, 52 said yes and of the 131 females sampled, 120 yes.

Does the data indicate that the proportions that said yes are different for male and female at a 5% level of significance?