



**Problem 2.** (5 pts)

If a normally distributed sample of size 16 produces a 95% confidence interval for a mean  $\mu$  that ranges from 44.7 to 49.9, what are the values of  $\bar{x}$  and  $s$ ? (assume that the **variance is unknown**)

**Problem 3.** (10 pts)

A worker, looking for a new position, wonders if the salary difference between type X and Y institutions is really significant. He finds that a random sample of 200 type X institutions has a mean salary of 54 thousands, with a standard deviation  $\sigma_X = 8.5$  thousands. A random sample of 200 type Y institutions has a mean salary of 46 thousands, with a standard deviation  $\sigma_Y = 8.1$  thousands. Do these data indicate a **significantly higher** salary at type X institutions?

**Problem 4.** (5 pts)

A professor wants to compare the students' scores with the national average. The professor chooses 20 students, who score an average  $\bar{x} = 50.2$  on a standardized test. Their scores have a sample standard deviation of  $s = 2.5$ . The national average on the test is a 60. The professor wants to know are the obtained scores **significantly lower** than the national average or not.

**Problem 5.** (5 pts)

The grades in a test are known to follow a normal distribution, but the mean and variance are unknown. A random sample of 6 students produced the following scores: 8, 33, 22, 12, 5, 10. Use the  $t$ -distribution to find a 90% two-sided confidence interval for the mean score.

**Problem 6.**

A random sample of 10 male newborns has a mean weight of 123 ounces and a sample standard deviation  $s_X = 8$  ounces, while a sample of 8 female has a mean weight of 116 ounces and a sample standard deviation of  $s_Y = 5$  ounces. Assume that the **population variances are the same**.

(i) (10 pts) Test at 0.05 level of significance if there is a **significant difference** between the weights of the two groups.

(ii) (10 pts) Find the 95% confidence interval for the difference between the means.

**Problem 7.** (10 pts)

Given the width-to-length ratios with  $\bar{x} = 0.637$  and  $s = 0.141$  for a random sample of the flags of 34 countries check the hypothesis that the width-to-length ratio for national flags is 0.618 with 0.05 level of significance. Assume that the alternative hypothesis is two-sided. Additionally, find a 90% confidence interval for a mean.

**Problem 8.** (5 pts)

The manufacturer's tests have shown that in a year's time in the particular kind of soil the manufacturer must deal with, the average depth of the maximum pit in a foot of pipe is  $\mu_0 = 0.0042$  inch. To see whether that average can be reduced, ten pipes are coated with a new plastic and buried in the same soil. After one year, the average maximum pit depth is recorded being 0.0039 inch. Given that the sample standard deviation for these 10 measurements is  $s = 0.00383$  inch, can it be concluded at the 0.05 level of significance that the plastic coating is beneficial (i.e. is the **average reduced** or the same)?

**Problem 9.**

A medical researcher believes that women typically have lower serum cholesterol than men. To test this hypothesis, he took a sample of 476 men and found their mean serum cholesterol to be 189 mg/dl with a sample standard deviation  $s_X = 34.2$ . A group of 592 women had an average 177.2 mg/dl and a sample standard deviation  $s_Y = 33.3$ . Set 0.05 level of significance and use **pooled variance**.

- (a) (5 pts) Is the **lower average** for the women statistically significant?
- (b) (5 pts) Find 95% confidence interval for the difference of means.

**Problem 10.** (10 pts)

In a comparison of these two diets for one-year weight loss, a study found that 77 subjects on the diet A had an average weight loss of 4.7 kg and a sample standard deviation  $s_X = 7.05$  kg. Similar figures for the 79 people on the diet B were 1.6 kg and  $s_Y = 5.36$  kg. Is the **greater reduction** with the diet A statistically significant? Test for 0.05 level of significance (use **non-pooled variance**).