

**Assignment**  
**Statistical Methods**  
**From 01/03 to 14/03/1442**

**Problem 1 (7 points) :** An experiment reported in Population Science compared fuel economies for two types of diesel mini-trucks. 12 Volkswagen and 10 Toyota were tested. The 12 Volkswagen averaged  $\bar{X}_1 = 16$  kilometers per liter with a standard deviation  $s_1 = 1.0$  kilometer per liter and the 10 Toyota trucks averaged  $\bar{X}_2 = 11$  kilometers per liter with a standard deviation of  $s_2 = 0.8$  kilometer per liter. Assume the distances per liter are approximately normally distributed with equal variances.

1. Find 90% and 95% confidence intervals for  $\bar{X}_1$  and  $\bar{X}_2$  respectively. (3 points)
2. Find the point estimate of the difference  $\mu_1 - \mu_2$  between the two population means. (1 point)
3. Calculate the pooled estimate of the population variance  $S_p^2$ . (1 point)
4. Construct 99% confidence interval for  $\mu_1 - \mu_2$ . (2 point)

**Problem 2 (5 points) :** Light trucks are produced on assembly line  $A$  and assembly line  $B$ . A random sample of 60 light trucks produced on the first assembly line  $A$  showed that 18 had a defect. Another independent random sample of 90 light trucks produced on the second assembly line  $B$  showed that 16 had a defect. Let  $p_1$  and  $p_2$  be the true proportions of trucks with defect on the two assembly lines.

1. Find 95% and 99% confidence intervals for  $p_1$  and  $p_2$  respectively. (2 points)
2. Find the point estimate of the difference  $p_1 - p_2$  between the two population proportions. (1 point)

3. Construct 90% confidence interval for  $\mu_1 - \mu_2$ . (2 points)

**Problem 3 (4 points) :**

In a series of experiments to determine the absorption rate of certain pesticides into skin, measured amounts of two pesticides were applied to several skin specimens. For pesticide *A*, the variance of the amounts absorbed in  $n_1 = 6$  specimens was  $s_1^2 = 2.3$ , while for pesticide *B*, the variance of the amounts absorbed in  $n_2 = 10$  specimens was  $s_2^2 = 0.6$ . Assume that for each pesticide, the amounts absorbed are a simple random sample from a normal population.

1. Find 90% and 99% confidence intervals for  $\sigma_1$  and  $\sigma_2$  respectively. (1 point)
2. Calculate the point estimate of the ratio  $\frac{\sigma_1^2}{\sigma_2^2}$  of the two population variances. (1 point)
3. Construct 95% confidence interval for  $\frac{\sigma_1^2}{\sigma_2^2}$ . (2 points)

**Problem 4 (4 points) :** A pharmaceutical company makes tranquilizers. It is assumed that the distribution for the length of time they last is approximately normal. Researchers in a hospital used the drug on a random sample of nine patients. The effective period of the tranquilizer for each patient (in hours) was as follows : 2.7 ; 2.8 ; 3.0 ; 2.3 ; 2.3 ; 2.2 ; 2.8 ; 2.1 and 2.4. We denote by  $X$  the random variable representing the effective length of time for a tranquilizer.

1. Calculate the point estimate of  $\bar{X}$ . (1 point)
2. Calculate the point estimate of the sample standard error. (1 point)
3. Which distribution should you use for this problem? Explain your choice. (1 point)
4. Construct a 95% confidence interval for the population mean length of time  $\mu$ . (1 point)