

**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 μ_1 and μ_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 $p_1 - p_2$. (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 σ_1 and σ_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 μ . (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 μ . (1 point)