

注意：全部題目均請作答於試卷內之「非選擇題作答區」，請標明題號依序作答。

1. [30%] The daily concentration of pollutants in a river has a mean of 70 mg/l and a standard deviation of 10 mg/l.
 - (i) (10%) Suppose that the daily concentration follows a normal distribution. The critical level of pollutant concentration would be reached if the daily concentration exceeds 100 mg/l. What is the probability that the daily concentration of pollutants in the river would not exceed the critical level?
 - (ii) (10%) Suppose that the pollutant concentration between different days of a week is statistically independent. What is the probability that the critical level of pollutant concentration would not be reached during a given week?
 - (iii) (10%) Suppose that the daily concentration follows a log-normal distribution. What is the probability that the daily concentration of pollutants in the river would not exceed the critical level (100 mg/l)?
2. [20%] A manufacturer produces steel rods in three sizes (small, medium and large). For the steel rods sold by this manufacturer, 50% are of small size, 40% are of medium size and 10% are of large size. Based on the strength test results, 15% of the small steel rods do not meet the specification. The percentages that do not meet the specification are 10% and 5% for medium and large steel rods, respectively.
 - (i) (10%) Determine the probability that a rod randomly chosen from this manufacturer will not meet the specification.
 - (ii) (10%) If a rod randomly chosen from this manufacturer does not meet the specification, what is the probability that this rod is of medium size?
3. [10%] Laboratory tests are performed to evaluate the compressive strengths for 2 types of concrete (A and B). 10 specimens are used for each type of concrete. The sample standard deviations are 200 kPa and 250 kPa for concrete A and concrete B, respectively. Construct a 90% confidence interval for the ratio of the 2 population variances (σ_A^2/σ_B^2).

4. [10%] Laboratory tests are performed to evaluate how confining pressure (x) affects the shear resistance (y) of a material. Estimate the linear regression line ($\hat{y} = b_0 + b_1x$) by using the least square method.

Confining Pressure	27.7	23.9	24.7	28.1	26.9	27.4	22.6	25.6
Shear Resistance	23.6	25.9	26.3	22.5	21.7	21.4	25.8	24.9

5. [20%] There are two classes (A and B) for a Statistics course. Class A utilizes distance learning while class B utilizes traditional classroom learning. If random samples of size 10 are taken from large groups of students from classes A and B, and the scores which they obtained in the final examination are:

Class A	81	85	75	79	83	76	78	81	84	78
Class B	82	87	94	88	79	80	87	83	75	85

- (i) (10%) Calculate the sample means and sample variances of the scores for classes A and B respectively.
 - (ii) (10%) Assume that the populations of the test scores can be approximated with normal distributions having the same variance, test the claim that there is no difference between the scores for classes A and B. Use the P-value approach and 0.05 as the level of significance.
6. [10%] The cumulative distribution function for random variable X is given by:

$$F(x) = \begin{cases} 1 - \left(\frac{10}{x}\right)^4 & x \geq 10 \\ 0 & x < 10 \end{cases}$$

- (i) (5%) Determine the median of X .
 - (ii) (5%) Find the expected value of X .

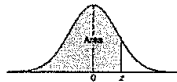


Table Areas under the Normal Curve

Table (continued) Areas under the Normal Curve

Table of areas under the normal curve for z-scores from -3.4 to -0.0. The table is split into two columns of 10 z-values each, with corresponding area values.



Table Critical Values of the t-Distribution

Table (continued) Critical Values of the t-Distribution

Table of critical values for the t-distribution. The table is split into two columns. The first column shows values for alpha levels 0.40, 0.30, 0.20, 0.15, 0.10, 0.05, and 0.025. The second column shows values for alpha levels 0.02, 0.015, 0.01, 0.0075, 0.005, 0.0025, and 0.0005. Degrees of freedom (v) range from 1 to infinity.

