1. Consider a 2 x 2 contingency table as follow:

Populations	1	2	Totals
Success	X1	X2	X
Failures	n1-X1	n2-X2	n-X
Totals	n1	n2	n

where n = n1+n2 and X = X1+X2.

(a) Based on independent sample, what is the Z-test statistic for differences in two proportions, i.e., H_0: $p_1 = p_2$? (5%)

(b) Show that the Chi-square test statistics for homogeneity of proportions is equal to Z^2. (15%)

2. Given the data of two independent samples,

$\overline{X}_1 = 3.27$, $S_1^2 = 1.698$, $n_1 = 21$ and $\overline{X}_2 = 2.53$, $S_2^2 = 1.353$, $n_2 = 25$

(a) In what kind situations, the F statistic of ANOVA can be used to test the null hypotheses that $\mu_1 = \mu_2$. (5%)

(b) Using the data sets, compute the ANOVA table. (10%)

3. An experiment to compare completion times for three technical tasks was performed in the following manner. Because complete time may vary considerably from person to person, each of the eight technicians was asked to perform all three tasks. The tasks were presented to each technician in a random order with suitable time lags between the tasks.

Technician	Task A	Task B	Task C
1	6	5	3
2	9	8	4
3	6	9	3
4	5	8	6
5	7	8	9
6	5	7	6
7	6	7	5
8	6	5	7

(a) What kind design of the experiment ? What is the suitable test statistic ? (8%)

(b) Do the data in following present sufficient evidence to indicate that the distributions of completion times for the three tasks differ in location? ($\chi^2_{.05,2} = 5.99$) (7%)

4. Consider we have available a random sample $X_1, X_2, \ldots, X_n$ from a normal distribution, and wish to predict the value of X_{n+1}. Derive the prediction intervals (PI) for a single future observation. (10%)

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5. By examining the scatter plot of following data, address a suitable regression model and derive the slope of piecewise linear function. (15%)

X	1	2	3	4	5	6	7	8	9
Y	2.3	3.8	6.5	7.4	10.2	10.5	12.1	13.2	13.6

6. (a) The data consists of n independently selected pairs (X_i, Y_i), i=1, 2, …, n. Let $D_i = X_i - Y_i$, the D_i's are assumed to be normally distributed with variance σ_D^2. Find the variance for $\overline{D}$ in terms of the correlation between X and Y. (10%)

   (b) If the two-sample *t* test is used (incorrectly) to analyze paired data, what will happen? (5%)

7. The superintendent of a large school district believes that the number of students absent on any given day has a poisson distribution with parameter λ. Use the accompanying data on absences for 50 days to derive a large-sample 95% confidence interval for λ. (10%)

Number of absences	0	1	2	3	4	5	6	7	8	9	10
Frequency		1	4	8	10	8	7	5	3	2	1	1