※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (20%) NCKU, Inc., manufacturers bicycles at plants located in Taipei, Tainan, and Kaohsiung. To measure how many employees at these plants know about logistics management, a random sample of six employees was selected from each plant and given a logistics-awareness examination. The examination scores obtained for these 18 employees are listed in the following table. Managers want to use these data to test the hypothesis that the mean examination score is the same for all three plants. Help them to construct the ANOVA table.

Observation	Plant 1 Taipei	Plant 2 Tainan	Plant 3 Kaohsiung
1	85	71	59
2	75	75	64
3	82	73	62
4	76	74	69
5	71	69	75
6	85	82	67
Sample mean	79	74	66
Sample variance	34	20	32
Sample standard deviation	5.83	4.47	5.66

2. (20%) Consider the smartphone market share being conducted by NCKU marketing research. Over the past year market share have stabilized at 30% for Samsong, 50% for Orange, and 20% for HCT. Recently HCT has developed a "new and improved" product that has replaced its current entry in the market. NCKU marketing research has been retained by HCT to determine whether the new product will alter market shares. The NCKU market research has used a customer panel of 200 customers for the study. Each individual has been asked to specify a purchase preference among the three alternatives: Samsong's product, Orange's product, and HCT's product. The 200 responses are summarized below.

Observed Frequency		
Samsong's product	Orange's product	HCT's product
48	98	54

Calculate the test statistic for goodness of fit test to determine whether the sample of 200 customers under the assumption that $P_{Samsong} = 0.3$, $P_{Orange} = 0.5$, and $P_{HCT} = 0.2$.

3. (20%) Each customer who enters Johnny's car dealer store will purchase a new car with probability p. If the number of customers entering the dealer store is Poisson distributed with mean λ,

　A. What is the probability that Johnny does not sell any car?

　B. What is the probability that Johnny sells k cars?

4. (20%) In simple linear regression analysis, vector $\mathbf{Y}$ consisting of the n observations on the response variable; the matrix $\mathbf{X}$ consists of a column of 1s and a column containing the n observations on the predictor variable X. Consider the problem of finding the least squares estimates of the parameters for the regression function $E(Y) = \beta_0 + \beta_1 X$, where the variables Y, and X represent, respectively, the number of weeks before flavor deterioration of a food product begins to occur, and $°F$ of storage temperature. Using matrix methods, find the estimation of parameters, $\hat{\boldsymbol{\beta}}$ and write the elements of the matrix in the form of a simple fraction.

$i:$	1	2	3	4
$X_i:$	6	5	0	2
$Y_i:$	7	8	8	3

$$\mathbf{Y} = \begin{bmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{bmatrix}, \quad \mathbf{Y}' = \begin{bmatrix} Y_1 & Y_2 & \cdots & Y_n \end{bmatrix}, \quad \mathbf{X} = \begin{bmatrix} 1 & X_1 \\ 1 & X_2 \\ \vdots & \vdots \\ 1 & X_n \end{bmatrix}, \quad \mathbf{X}' = \begin{bmatrix} 1 & 1 & \cdots & 1 \\ X_1 & X_2 & \cdots & X_n \end{bmatrix}, \quad \boldsymbol{\beta} = \begin{bmatrix} \beta_0 \\ \beta_1 \end{bmatrix}, \quad \hat{\boldsymbol{\beta}} = \begin{bmatrix} \hat{\beta}_0 \\ \hat{\beta}_1 \end{bmatrix}$$

5. (20%) The reliability of two types of machines used in the same manufacturing process is to be tested. The first machine failed to operate correctly in 90 out of 300 trials while the second type failed to operate correctly in 50 out of 250 trials.

   A. Give a point estimate for the difference between the population proportions of these machines.

   B. Calculate the pooled estimate of the population proportion.