UG/5th Sem/STAT(H)/T/19

2019

B.Sc. (Hons)

5th Semester Examination

STATISTICS

Paper - DSE 1-T

Full Marks : 40   Time : 2 Hours

The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.

Statistical Quality Control

Group - A

1. Answer any *five* out of eight questions :   5×2=10

   (a) What do you mean by statistical quality control?

   2

   (b) Define a control chart.   2

   (c) Distinguish between a defect and a defective. 2

   (d) Define Acceptance Quality Level (AQL).   2

[Turn Over]

(e) Distinguish between Producer's risk and Consumer's risk. 2

(f) When is a c-chart used ? 2

(g) Briefly describe six sigma. 2

(h) What do you mean by a sampling inspection plan ? 2

Group - B

2. Answer any *four* out of six questions : 4×5=20

(a) Define Operating Characteristic (O.C.) curve of a sampling inspection plan. How can one compare two sampling plans on the basis of their OC curves ? 2+3

(b) Distinguish between process control and product control. As a producer, discuss which of the two would you prefer ? 2+3

(c) If you are provided with means, standard deviations and ranges of the items manufactured at regular intervals of time, how do you utilise them to comment on the production process? 5

(d) Discuss on chance causes and assignable causes of variation in quality of a manufacturing process. 5

(e) Describe how you will construct a control chart for number of defectives contained in product lots. 5

(f) What do you mean by a rational subgroup? What are the main considerations for the formation of such groups? 2+3

Group - C

3. Answer any *one* out of two questions : 1×10=10

(a) Describe single sampling inspection plans by attribute. Derive the expressions for average sample number (ASN) and average outgoing quality (AOQ) for such sampling plans. 2+4+4

(b) In a certain manufacturing process, the proportion of defective electric bulbs in m samples each consisting of n bulbs are observed at regular intervals of time. Use the data to set up an appropriate control chart for the process.
6

How will you modify the control chart when the samples are not of equal size ? 4

[Turn Over]

Econometrics

Full Marks : 40   Time : 2 Hours

1. Answer any *five* questions :   2×5=10

  (a) Show that if r is the correlation coefficient between n pairs of values (X_i, Y_i), then the correlation coefficient between the n pairs $(aX_i + b, c Y_i + d)$ where a, b, c and d are constants, is also r.   2

  (b) If the sample values of x in the linear model

$$Y_i = \alpha + \beta X_i + \epsilon_i$$

have zero mean, show that the covariance of the least square estimates of α and β is zero.   2

  (c) What are the assumptions in multiple linear regression model ?   2

  (d) Show that the simple linear regression line will pass through the point of means $(\bar{X}, \bar{Y})$.   2

  (e) Show that the residuals have zero covariance with the sample X values.   2

  (f) What is multi collinearity ?   2

  (g) What is auto correlation ?   2

(h) Show that the ML estimator of σ^2 in regression model is consistent.   2

2. Answer any *four* questions : $5 \times 4 = 20$

(a) A model is specified as $Y_t = \delta Y_{t-1} + u_t$, $|\delta| < 1$

$$u_t = \epsilon_t + \alpha \, \epsilon_{t-1}$$

with $\underset{\sim}{\epsilon} \sim N\left(\underset{\sim}{0}, \sigma_{\widetilde{\epsilon}} \cdot \underset{\sim}{I}\right)$.

Obtain an estimate of δ.   5

(b) Suppose a model is specified as $\underset{\sim}{Y} = \underset{\sim}{X} \underset{\sim}{\beta} + \underset{\sim}{U}$

with $u_t = \phi \, u_{t-1} + \epsilon_t$

Describe a test for zero autocorrelation.   5

(c) Suppose a model for the linear effect of fertilizer on yield is specified as $Y_{ij} = \alpha + \beta X_i + u_{ij}$, $i = 1, 2, \ldots, m \; (m > 1)$, $j = 1, 2, \ldots, n_i \; (n_i > 2)$

with $E(\underset{\sim}{u_i}) = 0$ and $E(\underset{\sim}{u_i} \, u_i') = \sigma_i^2 I_{n_i}$, $i = (u)_m$. Obtain a test for the equality of variances.   5

(d) What are the consequences of autocorrelated disturbances ?   5

[Turn Over]

(e) Describe a diagnostic tool for detecting multicollinearity. 5

(f) In the regression equation

$$y_t = \beta x_{1t} + \gamma x_{2t} + u_t, \ t = 1, 2, \ldots, n$$

all variables are expressed as deviations from their sample means.

Obtain estimates of β and γ. 5

3. Answer any *one* question : $10 \times 1 = 10$

(a) Consider a multiple regression model for which all classical assumptions hold, but in which there is no constant term. Test the null hypothesis that there is no relationship between $\underline{y}$ and $\underline{x}$, that is,

$$H_0 : \beta_2 = \beta_3 = \ldots = \beta_k = 0$$

against the alternative that at least one of the β's is non-zero. 10

(b) Consider a heteroscedastic model (for which all other classical assumptions hold)

$$Y_{ij} = \alpha + \beta X_i + u_{ij}, \qquad i = 1, 2, ..., m \ (m > 1)$$

$$j = 1, 2, ..., n_i \ (n_i > 2).$$

Suppose $\text{var}(u_{ij}) = \sigma_i^2$. Obtain an estimator of σ_i^2 and verify its unbiasedness.   5+5=10