2021
STATISTICS
[HONOURS]
Paper : IX

Full Marks : 80	Time : 4 Hours

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

Answer all the questions.

1.	Answer any **seven** questions:	1×7=7

a)	Suggest the name of a non-parametric test for one sample location problem.

b)	Is non-parametric test used for categorical data?

c)	SPRT was introduced by _____.
(Fill in the blank)

d)	Write one disadvantage of non-parametric test.

e)	What is the degrees of freedom of a chi-square statistic for testing independence in a k×k contingency table?

f)	What do you mean by "rational subgroups"?

g)	Give two examples of assignable causes of variation in SQC.

[Turn over]

h)	What do you mean by "Producer's risk"?

i)	Write down the full form of LTPD.

2.	Answer any **six** questions:	2×6=12

a)	Explain how the sequential test procedure differs from the Neyman-Pearson test procedure.

b)	What is a contigency table? State the hypothesis you test using the chi-square statistic in a contigency table.

c)	Write down the use of Wald-Wolfowitz run test.

d)	Define OC function in sequential analysis.

e)	Distinguish between "process control" and "product control".

f)	For sampling inspection plan by attributes define LTPD and AOQL.

g)	Write down the control limits for control chart of fraction defective, when standard value is not given.

h)	Explain the main difference between parametric and non-parametric approaches.

3.	Answer any **three** questions:	7×3=21

a)	Derive the large sample standard errors of the sample b_1 and b_2 coefficients and discuss their uses in large sample tests.

b) Describe the Mann-Whitney-Wilcoxon test for testing the identity of two absolutely continuous distributions. Obtain the mean and variance of the test-statistic.

c) What is meant by "Stabilization of Variance"? Apply the procedure to the sample correlation coefficient based on a sample from a bivariate normal population.

d) Explain how $\bar{X}$-chart is drawn in practice when standards are not given. How would you interpret the points falling outside the control limits on this chart?

e) Describe single sampling plan. Obtain expressions for OC and AOQ curve for this plan.

4. Answer any **four** questions: 10×4=40

a) Derive the large sample distribution of Pearsonian chisquare statistic and discuss its uses.

b) Derive the large sample standard error of the sample central moment of order r.

c) Explain the terms in connection with statistical quality control:

   i)   Specification units

   ii) Average Total Inspection

   iii) AOQL

   iv) Assignable cause

   v)   Tolerance limit

d) Let X be a Bernoulli variate with probability mass function:
$$f(x;\theta)=\theta^x(1-\theta)^{1-x}\ ;\ x=0,1,\quad 0\le\theta\le1$$
Employ SPRT for testing $H_0:\theta=\theta_0$ against $H_1:\theta=\theta_1$. Also obtain ASN and OC functions.

e) If T is a consistent estimator of θ, show that, under appropriate assumptions, the varaiance of the function g(T), in large samples, is given by $\left[g'(\theta)\right]^2 var(T)$. Show how one can utilize the result to find a variance stabilizing transformation for an estimator whose variance is a function of the estimated parameter.

f) Let $x_1,x_2,...,x_n$ be a random sample from a population. Describe a test for the hypothesis that the population median is zero against the alternative that it is negative. Obtain a $100(1-\alpha)\%$ confidence interval for the population median based on the sign-test.