IV Semester B.Sc. Examination, May/June 2018
(CBCS) (2015 – 16 and Onwards) (Fresh + Repeaters)
STATISTICS – IV
Testing of Hypotheses

Time : 3 Hours   Max. Marks : 70

Instructions : i) Answer **any five** sub-divisions from Section – **A**, **any five** sub-divisions from Section – **B** and **any five** questions from Section – **C**.

ii) Scientific calculators are **allowed**.

SECTION – A (10 Marks)

I. Answer **any five** sub-divisions from the following :   (5×2=10)

1) a) Define simple and composite hypotheses with examples.

   b) Distinguish between parameter space and sample space.

   c) Define the terms :

      i) Critical region

      ii) Critical function of a test.

   d) State 'Normal test of significance'.

   e) State the conditions for the validity of Chi-square test for goodness of fit.

   f) Mention the assumptions involved in paired t-test.

   g) State M.L.R. property.

   h) Find the number of runs and the length of longest run from the following sequence :

   SSFFSSSFFFFSSFSFSFSSSSSFSFSF

SECTION – B (15 Marks)

II. Answer **any five** sub-divisions from the following :   (5×3=15)

2) a) Define the terms :

      i) Null and alternative hypotheses

      ii) Type I and Type II errors.

b) Let P be the probability that a coin will fall head in a simple toss. In order to test $H : P = \dfrac{1}{2}$ against $K : P = \dfrac{2}{3}$, the coin is tossed 5 times and hypothesis H is rejected if more than 3 heads are obtained. Compute size and power of the test.

c) A sample of size one is taken from a population with density function

$f(x, \theta) = (1+\theta)x^\theta ; \quad 0 < x < 1$
$$\theta > 0$$

To test hypothesis $H : \theta = 2$ against $K : \theta = 3$, a test function is given by
$$\phi(x) = \begin{cases} 1, & \text{if } x \le 0.3 \\ 0, & \text{otherwise} \end{cases} \text{ obtain power of the test.}$$

d) Explain the test procedure for testing the hypothesis $H : \rho = \rho_0$ where ρ is the population correlation co-efficient.

e) Explain t-test for testing the significance of population mean.

f) Describe Chi-square test for testing $H : \sigma^2 = \sigma_0^2$ against $K : \sigma^2 \ne \sigma_0^2$, where σ^2 is the population variance.

g) Define uniformly most powerful (UMP) test. State the theorem used for obtaining UMP test based on MLR property.

h) Define Mann-Whitney U-Statistic and Wilcoxon's rank-sum T-statistic. State the relationship between them.

SECTION – C (45 Marks)

III. Answer **any five** questions from the following : (5×9=45)

3) a) Describe t-test for testing the equality of means of two normal populations.

b) Explain the test procedure for testing $H : P = P_0$ against $K : P > P_0$, where P is the binomial population proportion. (5+4)

4) a) Explain large sample test for testing an hypothetical value of population mean.

b) Derive an expression of Chi-square statistic from a (2×2) contingency table with the cell frequencies a, b, c and d. (4+5)

5) a) Obtain most powerful (MP) test of level α for testing H : $\mu = \mu_0$ against K : $\mu = \mu_1$ ($\mu_1 < \mu_0$) based on a random sample of size 'n' from normal N (μ, 1) distribution.

b) If a single observation is drawn from a population with density function

$$f(x) = \frac{1}{\pi}\left\{\frac{1}{1+(x-\theta)^2}\right\}; -\infty < x < \infty.$$ Show that MLR property does not

hold good for this family of distributions. **(5+4)**

6) a) Obtain MP test of level α for testing H : $\theta = \theta_0$ against K : $\theta = \theta_1$ ($\theta_1 > \theta_0$) in exponential distribution with mean θ.

b) Obtain VMP test of level α for testing H : $\theta \leq \theta_0$ against K : $\theta > \theta_0$ based on a random sample of size 'n' from Poisson P (θ) distribution. **(5+4)**

7) a) Discuss the differences between parametric and non-parametric tests and state the assumptions involved in a non-parametric tests.

b) Describe sign-test for paired observations. **(4+5)**

8) a) Explain Spearman's rank correlation test for independence.

b) Explain Wald-Wolfowitz Run test. **(4+5)**

9) a) What is Sequential Probability Ratio Test (SPRT) ? Explain Wald's SPRT.

b) Obtain SPRT of strength (α, β) for testing the mean of a normal population with unit variance. **(4+5)**

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$$\lambda = 0$$