Seat No. : _______________

AD-115

April-2015

B.Sc., Sem.-VI

308 : Statistics

(Statistical Inference & Design of Experiments)

Time : 3 Hours] **[Max. Marks : 70**

Instructions : (1) Attempt **all** questions.
(2) Each carry equal marks.
(3) Number on right hand side indicates marks.

1. (a) Define most powerful test and discuss how the Neymann-Pearson lemma enables us to obtain the most powerful critical region for testing a simple hypothesis against a simple alternative. **7**

OR

Let $X_1, X_2, X_3 \ldots. X_n$ be a random sample from N $(\theta, 1)$. Obtain most powerful test for testing $H_0 : \theta = \theta_0$ Vs. $H_1 : \theta = \theta_1$.

(b) Let X have a p.d.f of the form : **7**

$$f(x, \theta) = \begin{cases} \frac{1}{\theta} \exp(-x/\theta), 0 < x < \infty, \theta > 0 \\ 0 \quad \text{o.w.} \end{cases}$$

To test $H_0:\theta = 2$ against $H_1:\theta = 1$, use a random sample X_1, X_2 of size 2 and define a Critical region $C = \{(X_1, X_2) : 9.5 \le X_1 + X_2\}$. Find power function and significance level of the test.

OR

Let p be the probability that a coin will fall head in a single toss in order to test H_0: p = 1/2 vs. H_1: p = 3/4. The coin is tossed 6 times and H_0 is rejected if more than 3 heads are obtained. Find probability of type-I and type-II errors.

2. (a) Describe likelihood ratio test. Under what circumstances would you recommend this test ? **7**

OR

Let $X_1, X_2, X_3 \ldots X_n$ be a random sample from $N(\mu, \sigma^2)$, where σ is known. Obtain likelihood ratio test for testing $\mu = \mu_0$ Vs. $\mu \ne \mu_0$.

(b) Derive the likelihood ratio test for the equality of two population variances when both μ_1 and μ_2 are unspecified. **7**

OR

Describe the likelihood ratio test for the equality of two population means when $\sigma_1^2 = \sigma_2^2 = \sigma^2$.

3. (a) Explain Wilcoxon's signed rank test in detail. **7**

OR

Describe Mann-Whitney U-test in detail.

(b) The following are the weight gains (in pounds) of two random samples of young turkeys fed two different diets but otherwise kept under identical conditions : **7**

Diet-1 : 16.3, 10.1, 10.7, 13.5, 14.9, 11.8, 14.3, 10.2, 12.0, 14.7, 23.6, 15.1, 14.5, 18.4, 13.2, 14.0

Diet-2 : 21.3, 23.8, 15.4, 19.6, 12.0, 13.9, 18.8, 19.2, 15.3, 20.1, 14.8, 18.9, 20.7, 21.2, 15.8, 16.2.

Use U test at 0.01 level of significance to test the null hypothesis that the two populations sampled are identical against the alternative that on the average the second diet produces a greater gain in weight.

OR

Test for randomness for the following set of data :

15, 77, 01, 65, 69, 58, 40, 81, 16, 16, 20, 02, 84, 22, 28, 26, 46, 66, 36, 86, 66, 17, 43, 49, 85, 40, 51, 40, 10.

4. (a) Define factorial experiment. Construct 2^2 factorial experiment and explain its analysis. **7**

OR

Why confounding technique is adopted in factorial experiment ? Explain total confounding in 2^3 factorial experiment.

(b) How is latin square design is constructed ? State its merits and demerits. Give null hypothesis, assumptions, mathematical model and ANOVA table for this design. **7**

OR

What is randomized block design ? Derive the formula for one missing observation in R.B.D. How would you carry out its analysis ?

5. Answer the following in brief : **14**

(1) Give an example of simple and composite hypothesis.

(2) What is an unbiased test ?

(3) What is critical region ? How do we find best critical region ?

(4) Define UMP test.

(5) State any one advantage of randomized block design.

(6) Give statistical formulae for the efficiency of LSD over RBD and CRD.

(7) State any two applications of non-parametric tests.

(8) Give any one difference between parametric and non-parametric tests.

(9) State the assumptions for applying non-parametric tests.

(10) Define orthogonal contrast in factorial design.

(11) How many standard squares are formed with k number of treatments ?

(12) What is meant by statistical hypothesis ?

(13) State the formula for obtaining power function of the test.

(14) Give a layout of a replicate of a 2^3 factorial design in which the interaction ABC is confounded.