

# ARUNACHAL PRADESH PUBLIC SERVICE COMMISSION ITANAGAR

## SUBJECT : STATISTICS

Time : 3 hours

Full marks: 200

Note: Question No. 1 is compulsory and answer any four from the remaining seven questions. All questions carry equal marks.

1) Attempt any 10 (ten).

10 x 4 = 40

- a) What do you mean by mutually exclusive events? Give examples of two such events.
- b) Give the mathematical or classical definition of probability. Also mention its drawbacks.
- c) When are two events said to be independent? Explain if two independent events can also be mutually exclusive.
- d) Define distribution function of a random variable and mention its properties.
- e) What is a Bernoulli trial? Write down the pmf (probability mass function) of binomial distribution.
- f) Mention four important properties of normal distribution.
- g) What is correlation and what are its limits? How is correlation determined or calculated?
- h) What are the two lines of regression? Explain why there are two regression lines.
- i) Write briefly about the properties of a good estimator.
- j) Define Type 1 and Type 2 errors with examples.
- k) Formulate a general Linear Programming Problem (LPP). What are the limitations of LPP?
- l) Explain briefly the basic principles of design of experiments.

2) Attempt any 8 (eight)

8 x 5 = 40

- A. Define partial and multiple correlation with examples.
- B. State the Chebyshev's inequality and mention its importance.
- C. What is meant by censoring? State the different types of censoring.
- D. Define moment generating function. State its properties. Find the moment generating function of normal distribution.
- E. Show how Poisson distribution can be obtained as a limiting case of binomial distribution.
- F. Define the terms – hypothesis, simple hypothesis, composite hypothesis, null hypothesis and alternative hypothesis. Give examples.
- G. What is randomized block design? Write down its ANOVA table.
- H. What is a Markov Chain? When is a Markov Chain homogenous.
- I. What is dominance property in the solution of rectangular games? Discuss the rules of dominance and mention its advantages.
- J. Write down the simplex algorithm to solve a LPP.

3) Attempt any 5 (five).

5 x 8 = 40

- A. State and prove the memoryless property of exponential distribution.
- B. Differentiate between parameter and statistic with examples. Mention uses and applications of F statistic.
- C. What are the different methods of estimation? Describe any one of them in detail.
- D. What is a critical region? What is Most Powerful critical region and Uniformly Most Powerful critical region? Also distinguish between size and power of a test.
- E. Describe Wald's SPRT.
- F. What is the transportation problem? Give examples. Explain the North West corner rule.
- G. Write a note on  $2^3$  factorial design and write down its ANOVA table.

4. Attempt any 4 (four).

4 x 10 = 40

- A. Describe the simple random sampling procedure with and without replacement. Obtain standard errors of estimate of population mean and population total for simple random sampling for with as well as without replacement and compare.
- B. What is the problem of inventory control? Explain the ABC procedure.
- C. What is replacement? Describe some important replacement situations.
- D. What is a run test? Discuss any two types of run test.
- E. What do you mean by Monte Carlo simulation? Discuss some simulation techniques.

5. Attempt any 2 (two).

2 x 20 = 40

- A. Derive the likelihood ratio test for testing the equality of means of k normal populations.
  - B. Distinguish between two stage sampling and stratified random sampling. For two stage sampling where first stage units are of equal size, obtain an estimate of the population mean. Also obtain the expression for variance of the estimator.
  - C. Derive the distribution of the sample range.
6. A. Explain clearly what is meant by sampling unit and sampling frame in connection with a sample survey. Give the advantage of sample survey over complete census. 10
- B. When does one go for stratification in sample surveys? Explain briefly the different types of allocations in stratified random sampling. 10