

**NWFP PUBLIC SERVICE COMMISSION**  
**Competitive Examination for Provincial Management Service**

**STATISTICS**

**TIME ALLOWED: 3 HOURS**

**MAXIMUM MARKS: 100**

**NOTE:** Attempt FIVE questions in all. All question carry equal marks.

- Q.1**
- a) Explain different approaches to define probability.
  - b) A retail store receives 3, 4, 5, or 6 telephone orders per hour with respective probabilities of 0.1, 0.4, 0.3, and 0.2. If X denotes a random variable of telephone orders per hour, find mean and variance of X.
  - c) The probability that an integrated circuit chip will have defective etching is 0.12, the probability that it will have crack defect is 0.29, and the probability that it has both defects is 0.07.
    - (i) What is the probability that a newly manufactured chip will have either an electric or a crack defect?
    - (ii) What is the probability that a newly manufactured chip will have neither defect?  
(7+5+8=20)
- Q.2**
- a) State and prove addition theorem of probability.
  - b) Explain the difference between mutually exclusive and independent events. Hence also show that if two events A and B are independent then  $P(A|B) = P(A)$ .
  - c) Write the applications of Normal distribution.  
(8+7+5=20)
- Q.3**
- a) Differentiate between random and non-random sampling and also give the uses of non-random sampling.
  - b) What is a sampling frame? Also give the properties of a good sampling frame.
  - c) Where do we use Stratified Random Sampling? Write a general procedure to draw a stratified random sample. Also differentiate between stratum and cluster.  
(5+7+8=20)
- Q.4**
- a) Why do we need the phase of testing of hypothesis in research? Also explain the use of P-value in hypothesis testing.
  - b) Following are the potencies (in mg) of different tablets for the same disease:  
4    3    2    1    5    6    4    2    3    4    6    1  
Compute 95% confidence interval for the unknown mean potency of the tablets.
  - c) An analyst claims that more then 75% people have blood group O +ve. To check this claim, a researcher tests 113 samples blood samples of randomly selected donors and finds 67 to be of O +ve group. What should the researcher conclude using 5% level of significance about the claim of the analyst?  
(5+7+8=20)

(P.T.O)

- Q.5** a) What are the properties of good point estimators?  
 b) What is the use of Least significant Difference Test?  
 c) Complete the following ANOVA Table:

S.V	d.f	S.S	M.S	Fc
Treatments	2	.....	1.575	.....
Error	.....	2.44	.....	
Total	14	5.60		

- d) Explain the inferential statistics as a branch of Statistics. (5+5+5+5=20)

- Q.6** a) Differentiate between a regression problem and a correlation problem by giving examples.  
 b) Let X denotes the systolic blood pressure of men and Y denotes the body weights in Kg. Compute correlation coefficient between two variables X and Y given in the following table and interpret the result:

X:	118	128	125	122	110	135
Y:	52	75	81	71	65	92

- c) Consider the following fitted model  $Y = 20 + 3X_1 + 0.3X_2$  ( $R^2 = 0.92$ )

Where Y = Yield (tons) of a particular crop,  $X_1$  = Fertilizer (in bags),  $X_2$  = Water (cubic meters). Interpret the coefficients and  $R^2$ .

(5+10+5=20)

- Q.7** Write a note on any FOUR of the following:

- Type-I and Type-II Errors
- Contingency table
- Poisson Distribution
- Method of Maximum Likelihood
- Conditional Probability
- Uses of F-distribution
- Marginal and joint probabilities

(20)

(End)