UNIVERSITY OF BALOCHISTAN, QUETTA

MA/MSc, (ANNUAL) EXAMINATION, 2015

Attention:- 1- Possession & Use of mobiles & other electronic accessories are strictly prohibited .If any one possess / uses , his /her case will be sent to unfair means committee.

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SUBJECT : STATISTICS

PAPER: I (PREVIOUS) STATISTICAL METHODS

TIME ALLOWED : 3 HOURS **MAX.MARKS: 100**

NOTE : Attempt any FIVE Questions in all including Question number 1 which is Compulsory. Time for Question number 1 is only 40 minutes. (Calculator and Tables) allowed.

Q. NO.1: (a). Briefly explain (10) short questions? 20 Marks.

i) What is Statistical Hypothesis?
ii) Write two variable regression line, using X as a dependent variable.
iii) Differentiate between level of significance and level of confidence.
iv) Mention the difference between regressor and regressand.
v) Differentiate between Type-I and Type-II error.
vi) What is positive correlation?
vii) Write the formula of hyper geometric distribution.
viii) What is Perfect correlation?
ix) What is Scatter diagram?
x) Define an Estimator.
xi) Define Point Estimate.
xii) Define Degree of Freedom.
xiii) Define random sample.
xiv) What are the different types of Population? Name them.
xv) Differentiate between Parameter and Statistic.

(b). Tick the correct answers.

i) The standard deviation of any sampling distribution is called Type-II error. (T/F)
ii) Standard error is always positive. (T/F)
iii) Statistics deals with single observation. (T/F)
iv) Astronomy is one of the oldest branch of statistical study. (T/F)
v) A qualitative variable is also called a variable. (T/F)

(c). Fill in the blanks.

i) If we accept a false null hypothesis the error is called a _____.
ii) A statement about the value of a population parameter is called _____.
iii) The alternative hypothesis is also called _____.
iv) The range of test statistic Z is _____.
v) The range of test statistic T is _____.

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SUBJECTIVE PORTION . 80 Marks . Time allowed 2:20

Note :- Attempt any four Questions . All questions carry equal marks .

Q NO.2: (a) Construct confidence interval for the mean of normal population with known variance.

(b). Find a 95% confidence interval for the mean of normal distribution if $\delta = 4$ and if a sample sizes, 8 gave the values 8, 14, 12, 11, 7, 10, 13, and 14. What would be the confidence interval of δ were unknown? Marks 10 + 10

(a) Q NO.3: Describe Bartlett's test for homogeneity of variances?

(b) Suppose that four random samples of sizes $n_1 = 9$, $n_2 = 11$, $n_3 = 15$, and $n_4 = 12$ are selected from four normal populations and gave $S_1^2 = 427$, $S_2^2 = 392$, $S_3^2 = 667$, and $S_4^2 = 620$.test the hypothesis of homogeneity of variances? Marks 5 + 15

Q NO.4: a) Describe Fisher's exact test for 2x2 contingency table.

b) Use the Fisher's exact test for the following data. Marks 10 + 10

Classes	A_1	A_2
B_1	3	5
B_2	10	2

Q NO.5: a) Describe the general procedure for testing hypothesis about difference between two proportions.

b) In a random sample of 500 men from Peshawar city, 300 are found to be smokers in one of 1000 men from Islamabad city 550 are smokers. Do the data indicate that the two cities are significantly different with respect to the prevalence of smoking among men? Marks 5 + 15

Q NO.6: a) Explain the multiple and partial correlation.

b) A random sample of 20 pairs of observations gives a co-efficient of correlation of 0.45. Test the hypothesis at the 0.05 level of significance that the correlation co-efficient in the population is zero? Marks 10 + 10

Q NO.7: The amount of a chemical compound Y, which dissolved in 100 grams of water at various temperatures, X were recorded as follows: Marks 20

X°C	Y(grams)		
0	8	6	8
15	12	10	14
30	25	21	24
45	31	33	28
60	44	39	42
75	48	51	44

Q NO.8: (Marks 10 + 10)

(a) Describe the Sign test. When it is most appropriately used?

(b) Use the Sign test to test the hypothesis that the median of the population equals to against the alternative that it does not for the following samples.

2.55, 4.62, 2.93, 2.46, 1.95, 4.55, 3.11, and 0.90.

Q NO.9: (Marks 20)

Two random samples drawn from two normal populations are:

Sample I: 20, 16, 26, 27, 23, 22, 18, 24, 25, and 19.

Sample II: 27, 33, 42, 35, 32, 34, 38, 28, 41, 43, 30, and 37.

Obtain the estimates of variances of the populations and test whether the two populations have the same variance.

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Subject:- **STATISTICS .** Paper:- II **(Prev:)**

Time Allowed :- 3 Hours **Experimental Design .** Max : Marks : 100

Note :- Attempt 05 Questions. in All But Question No. 1- in section –I is compulsory and the time for Section-I is only 40 Minutes. After Expiry of the Time paper should be handed over to the supervisory staff.

SECTION –I (OBJECTIVE PORTION 20 MARKS)

Q1. Write Short Answer of the following .(Attempt any 20)

1. Define treatment.
2. Define Interaction.
3. What is BIB design?
4. Sketch the ANOVA table of split plot design.
5. Differentiate between critical and noncritical region.
6. Differentiate between Mixed and Random Effect Model.
7. Differentiate between Simple and composite Hypothesis.
8. What is the Model of one way ANOCOVA?
9. Write the formula of missing observation in Latin Square Design.
10. Differentiate between Complete and incomplete block Design.
11. Define Factor.
12. Multiple Comparison test is used when Ho is not rejected (T / F)
13. The value of SSE may greater then SST. (T / F)
14. What is main effect?
15. Differentiate between factor and level
16. Define Degree of Freedom.
17. Write the computational formula of SSC in Latin Square Design.
18. What is meant by Random Effect Model?
19. SSE stands for .....
20. What is Experimental Unit?
21. Define type II error.
22. Give a Lay Out of 4 x 4 Graeco latin Square Design.
23. Describe L S D test.
24. Make a sign table for 2^2 Factorial experiment.
25. What does ANOCOVA stands for?
26. Define experimental error
27. Define confounding.
28. Describe the importance of Replication .
29. Write the Statistical Model of Graeco Latin Square Design.
30. What is the d.f of error of latin Square design.

Section – II (80)

Note :- Attempt any four Questions . All Questions carry equal marks.

Q2. Stat and prove the formula for two missing observation in different row and different column in RCB design.

Q3. (a) Briefly describe the Experimental Design. What are the basic principle of experimental design?

(b) What are the basic assumption of tow way Analysis of variance?

Q4. Analyse the yield of the following 4 x 4 Graeco latine square Design at a = 0.01 level of significance.

Row / Column	1	2	3	4
1	Aα 11	Bγ 12	Dδ 17	Cβ 16
2	Dβ 14	Cδ 14	Aγ 15	Bα 15
3	Cγ 12	Dα 6	Bβ 14	Aδ 12
4	Bδ 9	Aβ 7	Cα 8	Cγ 7

Q5. Carry out an analysis of covariance with the data given below.

A		B		C	
Y	X	Y	X	Y	X
17	14	15	16	30	28
34	30	25	22	12	16
29	25	36	32	43	40
31	30	16	15	8	10

Q6. A 2^2 Factorial Experiment was carried out in RCB design with three replicates. The yields are given below.

Replicates	Treatment combination			
	V1m1	V1m2	V2m1	V2m2
1	4	4	7	5
2	6	4	9	12
3	5	7	8	10

Perform the AVOVA.

Q7. The following data is from an experiment involving a randomized block design .the value of treatment C in block II is missing . Estimate the missing observation , compute the appropriate ANOVA and test the hypothesis that the true effects of the three treatment A , B and C are equal at a = 0.05

I	II	III	IV
A1.7	C x	A0.1	B2.2
C2.3	A1.5	B 2.3	A0.6
B3.4	B 2.6	C 0.8	C1.6

Q8. Explain the procedure of analysis of variance for split plot design with factor (A) with p levels in main plots and factor (B) with q levels in subplot and in r replicates.

Q9. Write short note on any two of the following.

a) The Analysis of Covariance
b) Confounding
c) Split plot design
d) Scheffe's method for testing the significance.

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Subject:- **STATISTICS.** Paper:- III(Prev)

Time Allowed :- 3 Hours **PROBABILITY AND PROBABILITY DISTRIBUTIONS** Max : Marks : 100

Note :- Attempt 05 Questions. in All But Question No. 1- in section –I is compulsory and the time for Section- I is only 40 Minutes. After Expiry of the Time paper should be handed over to the supervisory staff.

SECTION –I (OBJECTIVE PORTION 20 MARKS)

ATTEMPT 20 QUESTIONS OUT OF 30 QUESTIONS. ALL QUESTIONS CARRY EQUAL MARKS.

Q.No. 1

1. What are the axioms of probability?
2. Define laws of counting sample points in the sample space.
3. Define posterior probability.
4. If $P(A \cap B) = P(A)$ then what does it mean?
5. What are the uses of mathematical expectation?
6. What is the relationship between p.d.f. and distribution function?
7. How does binomial distribution differ from hyper-geometric distribution?
8. Define characteristic function of a probability distribution.
9. Define Bernoulli trials.
10. When Poisson distribution approaches to normal distribution?
11. What are the uses of hyper-geometric distribution?
12. If A, B, and C are not mutually exclusive events in the sample space then write the formula to find the probability of at least one of these events occurring.
13. What is the significance of central limit theorem?
14. Write the p.d.f. of the distribution whose mean and variance are equal?
15. What are the points of inflexion of the normal curve?
16. How do you find the median of a continuous probability distribution?
17. What are the uses of exponential distribution?
18. What is the significance of normal distribution in the theory of probability?
19. Write the p.d.f. of standard Cauchy's distribution.
20. When Weibull distribution changes into exponential distribution?
21. What is the difference between normal distribution and standard normal distribution?
22. What is the measure of skewness of t-distribution?
23. Define χ^2 distribution.
24. Define transformation technique.
25. What is the parameter of χ^2 distribution?
26. What is the relationship between χ^2 distribution and F-distribution?
27. What are the assumptions of t-distribution?
28. What are the parameters of bivariate normal distribution?
29. Define order statistics.
30. Write the density function of smallest order statistic?

SECTION-II (MARKS :- 80) **TIME ALLOWED :- 2:20**

NOTE:- ATTEMPT ANY FOUR QUESTIONS. ALL QUESTIONS CARRY EQUAL MARKS.

Q.No.2.(a) If $A_1, A_2, \ldots, A_n$ are n events in a sample space S, then show that:
$P(A_1 \cup A_2 \cup \ldots \cup A_n) \leq P(A_1) + P(A_2) + \ldots + P(A_n)$.

(b) A box contains 4 red, 5 white, and 7 green balls, three balls are drawn from the box together. Find the probability that they may be:
(i) one white and 2 green (ii) all of same colour
(iii) all of different colours.

Q.No.3.(a) Find k, the mode and the mean for the distribution, the equation of whose p.d.f. is:
$f(x) = k(6 + x - x^2)$; $0 \leq x \leq 3$.
$= 0$ otherwise.
Also determine Var(X).

(b) Show that the Poisson distribution is the limiting form of the binomial distribution. State clearly the assumptions you make.

Q.No.4.(a) Calculate first four cumulants of negative binomial distribution.

(b) A homeowner plants 6 bulbs selected at random from a box containing 4 tulip bulbs and 4 deffodil bulbs. What is the probability that he planted 2 deffodil bulbs and 4 tulip bulbs?

Q.No.5.(a) If a random variable X is distributed as: $N(X; \mu, \sigma)$; then show that the quartile deviation is 0.6745 of its standard deviation.

(b) For the normal distribution given in part (a) find mean absolute deviation and the points of inflexion of this distribution.

Q.No.6.(a) If the random variable X has a Cauchy distribution, $f(x) = \frac{1}{\pi(1+x^2)}$; $-\infty < x < \infty$
Find its mode, median, and inter quartile range.

(b) If X has a standard Cauchy distribution as in part (a) then find the p.d.f. for x^2 and identify its distribution.

Q.No.7. If a random variable X is distributed as Rayleigh distribution, find the rth. moment about origin and hence find its mean and variance.

Q.No.8. Derive the student's t-distribution with n degrees of freedom. Also show that t tends to normality as n tends to infinity.

Q.No.9. If the random variable X has th distribution N(0, 1), then for n = 2, show that the distribution of range is: $g(R) = \frac{1}{\sqrt{\pi}} e^{-\frac{R^2}{4}}$; $-\infty < R < \infty$. Find the mean and variance of range R.

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Subject:- **STATISTICS .** Paper:- IV(Prev:)

Time Allowed :- 3 Hours **SAMPLING TECHNIQUES .** Max : Marks : 100

Note :- Attempt Five Questions. in All But Question No. 1- in section –I is compulsory and the time for Section- I is only 40 Minutes. After Expiry of the Time paper should be handed over to the supervisory staff.

SECTION –I (OBJECTIVE PORTION 20 MARKS)

Q.No.1 Give short answers:- (Attempt TEN)

i. Define BLUE?
ii. Define Survey ?
iii. Define Bias .
iv. Write formula S^2 = ------?
v. Define sampling frame ?
vi. Write 3 properties of good point estimator .
vii. What happen when FPC is ignored ?
viii. What do you mean by statistical population ?
ix. What is Random experiment ?
x. Define $E(\bar{y})$?
xi. Give one advantage & Disadvantage of SRS .
xii. What is Estimation ?
xiii. Differentiate between Bias and Error .
xiv. Define MSE ?
xv. $\frac{1}{N} + \frac{1}{N} + \cdots\cdots \frac{1}{N} = \text{——} ?$
xvi. What is the difference between strata and cluster ?
xvii. Define Random Sample ?
xviii. Define non – sampling error
xix. What is census ?
xx. Write formula $V(\hat{R}) =$ —— ?
xxi. Define precision and accuracy ?
xxii. What is Multistage sampling ?
xxiii. Limitation of sampling ?
xxiv. Define Sufficiency.
xxv. Is an estimator a random variable ? Why or why not ?
xxvi. Define SWR (Sampling with replacement)
xxvii. Define Systematic sampling ?
xxviii. Define sample design?
xxix. Write about b and bo in regression estimator .
xxx. Define Correlation .

SECTION –II(SUBJECTIVE PORTION 80- MARKS) TIME ALLOWED 2:20
Attempt any Four (04) questions.

Q.2. a) Explain survey – What are the main steps in a sample survey .

b) If **yi** , **xi** are a pair of variates defined on every unit in the population and $\bar{y}$, $\bar{x}$ are corresponding means for SRS of sample size n then .

$$E(\bar{y}-\bar{Y})(\bar{x}-\bar{X}) = \frac{N-n}{Nn}\cdot\frac{1}{N-1}\sum_{i=1}^{N}(y_i-\bar{Y})(x_i-\bar{X})$$

Q.3. a) Describe the practical utility of stratified random sampling explain how a sample in allocated in stratified random sampling .

b) If the term $\frac{1}{N_n}$ in negligible , relative to unity prove that

$$V_{ran} \geq V_{prop} \geq V_{opt}$$

Q.4. a) How to minimize (Avoid) Non sampling Error .

b) If variates **yi , xi ,** are measured on each unit of SRS of size n assumed large the MSE covariance of $\hat{R} = \bar{y}$ are each approximate .

$$MSE(\hat{R}) = V(\hat{R}) = \frac{1-f}{n\bar{x}^2}\cdot\frac{\sum_{i=1}^{n}(y_i-Rx_i)^2}{N-1} \quad \text{where } R=\frac{\bar{y}}{\bar{x}} \text{ \& } f=\frac{n}{N}.$$

Q.5. a) Discuss Multistage & Multiphase sampling ?

b) Prove that E $(\bar{y}_h) = \bar{Y}_n$.

Q.6. a) Elaborate main concept of systematic sampling with examples Also describe the merits and demerit of this technique .

b) Show that the mean of systematic sample is more precise than the mean of simple random sample **iff** $S_{wy} > S^2$.

Q.7. Explain the following terms :-
i) Bias and its effect 2) Probability and non Probability sampling 3) MSE

Q.8. a) How would you allocate the sample size in different strata ?

b) In stratified random sampling with the cost of the form **C= Co +** $C_n n_n$ the variance of mean is minimized when n_h is proportional to $N_h S_h / \sqrt{C_h}$

Q.9. a) Define Ratio Estimate .
b) In large sample with random sampling the ratio estimate : $\hat{\bar{Y}}_R$ has smaller variance then then the estimate $\hat{\bar{y}}_s = N\bar{y}$ obtained by simple expansion if $\rho_s > \frac{1}{2}\cdot\frac{S_x/\bar{x}}{S_y/\bar{y}}$

Q.10. Write note on any three of the following :-
a) Determination of sample size in proportion .
b) Limitation of sampling .
c) Proportional& Optimum Allocation
d) Ratio & Regression estimates .
e) Absolute Error .

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Subject:- **STATISTICS** Paper:- **VI(Final)**

Time Allowed :- 3 Hours **STATISTICAL INFERENCE** Max : Marks : 100

Note :- Attempt **05** Questions in All But Question No. 1- in section –I is compulsory and the time for Sec I is only 40 Minutes. After Expiry of the Time paper should be handed over to the supervisory staff.

SECTION –I (OBJECTIVE PORTION 20 MARKS)

Q.No.1 Write short answers of the followings. (Attempt All Questions)

1. **Estimators among all UBE having smallest variance are called _____**
2. **Define loss function_____**
3. **The p.d.f which belongs to exponential family is then in which form_____**
4. **If TI and TII, both U.B.E which one will you prefer and why?**
5. **Write down p.d.f of Geometric dist.**
6. **Write down p.d.f of Normal dist with Mean 3, Variance 9 _____**
7. **Define Cramer Rao inequelity_____**
8. **In test of Hypothesis if p-valuve is 0.0316 can the null hypothesis be rejected at 0.05 level.**
9. **U.M.V.U.E. Stands for _____**
10. **The p.d.f of UD distribution between (a,b) is _____**
11. **Define Minim ax Criteria.**
12. **Define Admissible decision function.**
13. **Hypothesis testing is significance testing T/F.**
14. **Write down p.d.f of Normal dist with var L**
15. **Write down linear equation involving two variable _____.**
16. **Define Risk function._____**
17. **Define Baysian Estimation.**
18. **Define Neyman pearson lemma.**
19. **Any U.B.E which is function of C.S.S will be _____**
20. **Single Number used to Estimate an unknown population parameter is _____.**

Subject: Statistics MARKS :- 80

Note: Attempt any four questions from section II

Question No. 2.

(I) Discuss the "usefulness" of statistical inference.

(II) List and describe briefly the criteria of a good estimator.

Question No. 3.

The number of customers that enter the corner grocery store during the noon hours has a Poisson distribution. Assume that $\{X_1, X_2, X_3, \ldots\ldots, X_n\}$ is a random sample from this Poisson population distribution. Drive the CRLB for unbiased estimation of the parameter λ. Is $\bar{X}$ the MVUE for estimating λ? Why or why not?

Question No. 4.

Assume that SAT mathematics scores of students who attended small liberal arts colleges are $N(\mu, 8100)$. We shall test $H_o: \mu = 530$ against the alternative hypothesis $H_1: \mu < 530$. Given a random sample of size $n = 36$ SAT mathematics scores, let the critical region be defined by $C = \{\bar{x}: \bar{x} \leq 510.77\}$, where $\bar{x}$ is the observed mean of the sample.

(I) Find power function for this test.

(II) Find significance level.

(III) What is the p-value associated (i) with $\bar{x} = 507.35$; (ii) with $\bar{x} = 497.45$?

Question No. 5.

Suppose X is a discrete random variable with sample space (0, 1) which has the distribution

$$p(x/\theta_i) = \binom{1}{x} \theta_i^x (1-\theta_i)^x, \quad \theta_1 = 1/4, \theta_2 = 1/2$$

and let the decision space A consist of two elements a_1, a_2. Let the loss function $L(\theta_i, a_j)$ be defined as

	a_1	a_2
θ_1	1	4
θ_2	3	2

Find the minimax solution.

Question No. 6.

Let $X_1, X_2, X_3, \ldots\ldots, X_n$ be a random sample from a normal population $N(\mu, 64)$.

(I) Show that $C = \{(x_1, x_2, \ldots\ldots x_n) : \bar{x} \leq c\}$ is a best critical region for testing H_o: $\mu = 80$ against $H_1 : \mu = 70$.

(II) Find n and c so that $\alpha = 0.05$ and $\beta = 0.05$ aproximately.

Question No. 7.

Write the p.d.f.

$$f(x;\theta) = \frac{1}{6\theta^4} x^3 e^{-x/\theta}, \qquad 0 < x < \infty, 0 < \theta < \infty$$

zero elsewhere, in the exponential form. If $X_1, X_2, X_3, \ldots\ldots, X_n$ is a random sample from this distribution, find a complete sufficient statistic.

Question No. 8.

If $x_1, x_2, x_3, \ldots\ldots$ and x_n are the values of a random sample of size n from a normal distribution with parameter μ. Find an estimate of μ using

(I) The method of moments,

(II) The method of maximum likelihood.

Question No. 9.

Briefly describe the following

(I) Bayesian method of point estimation.

(II) The OC curve.

(III) Uniformally most powerful test (UMPT).