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PGIS-N 1083 B-2K13

M.A./M.Sc. Ist Semester (CBCS) Degree Examination

Statistics

(Statistical Quality Control)

Paper - SCT- 1.1

(New)

Time :3 Hours Maximum Marks : 80

Instructions to Candidates:-

Answer any **six** questions from Part - A and any **five** from Part - B.

Part - A (6×5=30)

1. State the problem of design of a control chart,
2. Explain the terms.
   i) OC function
   ii) ARL
3. Distinguish between assignable and chance causes of quality variation.
4. Compare control chart technique with chi square test of homogeneity.
5. Distinguish between type A and type B OC curves.
6. Define OC function of an acceptance sampling plan obtain an exact expression for this function in a double sampling plan.
7. Explain the operation of multiple sampling plan.
8. Describe briefly CSP-2 and CSP-3 plans.

Part - B (5×10=50)

9. Explain the objectives basis of construction and inference with respect to $\overline{x}$ and s charts.
10. Discuss the main control charts for attributes.
11. What is a cusum chart? How are the constants of this chart determined?
12. Explain the importance of exponentially weighted moving average control chart. Also discuss its construction.
13. Define ASN and AOQ. obtain them for double sampling plan for attributes.
14. Explain:
    i) Curtailed and semicurtenled sampling plans
    ii) Sequential sampling plan.
15. Describe CSP-1 obtain ATI, AOQ and AOQL for this plan.
16. Describe an acceptance sampling plan by variables for normal distribution when its mean and variance are unknown.

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PGIS-N 1077 B-2K13

M.A./M.Sc. Ist Semester (CBCS) Degree Examination

Statistics

(Linear Algebra)

Paper - HCT - 1.1

(New)

Time : 3 Hours Maximum Marks : 80

Instructions to candidates:

*Answer any **six** questions from part-A and any **six** full questions from part-B.*

Part - A

Answer any **six** questions: **(6×5=30)**

1. Find the number of linearly independent vectors among the following:

   X_1=(1,2,3) ; X_2=(2,3,4) ; X_3=(3,4,5) and X_4=(4,5,6).

2. Obtain orthogonal vectors using the following

   X_1=(1,2,3) ; X_2=(2,3,4) and X_3=(3,4,6).

3. Obtain a basis for the subspace spanned by vectors of the type $X=(x_1,x_2,x_3,x_4,x_5)$ Where $x_1+x_2+x_3=x_4+x_5$.

4. Outline 'Swupont method'.

5. Prove that $R(A+B) \leq R(A)+R(B)$.

6. State and prove Caley-Hamilton theorem.

7. Prove that every non-null column of $adj(\lambda I - A)$ is a characteristic vector corresponding to the characteristic root of A.

8. Define different types of quadratic forms.

Part - B

Answer any **five** full questions. **(5×10=50)**

9. a) Examine whether $V = \{(x, y) : y = mx\}$ is a subspace where m is a real number.

b) Obtain a basis for the subspace spanned by

X_1=(1,1,1) ; X_2=(1,-1,1) ; X_3=(1,2,3) and X_4=(0,0,1). **(5+5)**

10. a) Prove that $k(\geq 2)$ non-null orthogonal vectors are linearly independent.

b) Extend X_1=(1,2,3) and X_2=(1,1,1) to form a basis for V_3. **(5+5)**

11. a) Outline 'Frame's method' for obtaining inverse of a non-singular matrix.

b) Find a g-inverse of $A = \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 2 \end{pmatrix}$. **(5+5)**

12. a) A and B are two square matrices of order n×n. Prove that $R(AB) \geq R(A) + R(B) - n$.

b) Reduce the following matrix to its normal form and find the rank $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{pmatrix}$.

(5+5)

13. a) State and prove a necessary and sufficient condition for a system of non-homogenous linear equations to be consistent.

b) Solve
$$\begin{aligned} x_1 + 2x_2 + x_3 &= 2 \\ 2x_1 + 3x_2 + x_3 &= 4 \\ 3x_1 + 4x_2 + 2x_3 &= 5 \end{aligned}$$
. **(5+5)**

14. a) If there exist n linearly independent eigen vectors corresponding to the n eigen values $\lambda_1, \lambda_2, \ldots\ldots, \lambda_n$ of A, prove that there exists a non-singular matrix p such that $P^{-1}AP = diag(\lambda_1, \lambda_2 \ldots \lambda_n)$.

b) Obtain the eigen values of $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 5 \end{pmatrix}$.

Also obtain eigen vectors corresponding to any one eigen value. (5+5)

15. a) Prove that eigen values of a Hermitian matrix are real.

b) Show that the eigen vectors corresponding to distinct eigen values of a unitary matrix are orthogonal. (5+5)

16. a) Prove that X^1AX is positive definits if and only if all the eigen values of A are positive.

b) Reduce the following quadratic form to its canonical form and deduce its nature $x_1^2 - 2x_1x_2 + x_2^2 + x_3^2$. (5+5)

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PGIS-N 1088 B-2K13

M.A./M.Sc. Ist Semester (CBCS) Degree Examination

Statistics

(Practical Based on paper SCT 1.1)

Paper - SCP 1.1

(New)

Time :2 Hours Maximum Marks : 30

Instructions to Candidates:-

1) Answer any **two** questions.
2) All question carry **equal** marks.

1. The following data gives measurements on a particular critical groove dimension. Due to the high volume of keys processed per hour, the sampling frequency is choosen to be five (keys) every 20 minutes. **(15)**

Sub group	Measurements				
1	78	98	81	62	84
2	89	90	79	87	90
3	87	75	89	76	81
4	84	83	72	100	69
5	74	91	83	78	77
6	69	93	64	60	64
7	77	89	91	68	94
8	89	81	73	91	79
9	81	90	86	87	80
10	74	84	92	74	103

a) Establish statistical control of this process using $\bar{x}$ *and* R charts and construct control charts for the same.

b) Find the upper and lower natural tolerance limits.

c) Assuming That dimension is normally distributed, find the percentage of nonconfirming keys produced by this process, if the upper and lower specification limits for the dimension are 100 and 60 respectively.

2. a) The following data represent the results of inspecting all units of a personal computer produced for the last 10 days. Does the process appear to be in control?

Day :	1	2	3	4	5	6	7	8	9	10
Units inspected:	80	110	90	75	130	120	70	125	105	95
Defective units:	4	7	5	8	6	6	4	5	8	7

b) the following data represent the number of nonconfirmities per 1000 meters in telephonecable. From analysis of these data, would you conclude that the process is in control? What control units would you recommend for controlling future production?

Sample No.:	1	2	3	4	5	6	7	8	9	10
Non confirmities:	1	1	3	7	8	10	5	13	0	19
Sample No.:	11	12	13	14	15	16	17	18	19	20
Non confirmities:	24	6	9	11	15	8	3	6	7	4

(7+8)

3. Illustrate the computation of OC curve for the multiple sampling plan with **(15)**

sample	sample size	Acceptance no.	Rejection number.
1	30	0	2
2	30	1	3
3	30	2	3

and also draw the same.

4. The current consumption of certain lamp is normally distributed with standard deviation 1.75. The lower specification limit on current consumption is 15 miliampers lamps with current consumption below this limit are classified as defective. Construct the sampling plan by variable that has $P_1 = 0.01, P_2 = 0.03, \alpha = 0.05 \, and \, \beta = 0.1$ .compare this with single sampling plan for attributes. **(15)**

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PGIS-N 1085 B-2K13

M.A./M.Sc. Ist Semester (CBCS) Degree Examination

Statistics

(Computer Programming in C language with Statistical Application)

Paper - HCP -1.1(Practical)

(New)

Time :2 Hours Maximum Marks : 30

Instructions to Candidates:-

Answer any **two** questions . All questions carry **equal** marks.

1. a) Draw a flow chart to find the roots of a quadratic equation $ax^2 + bx + c = 0$

   b) Explain basic structure of C program.

   c) identity the invalid constants from the following and give reasons.

   OX7B, 25,00, 7.1e4, 69834L, \$255, 1.5E + 2.5, -4.5e, 041, 1283L **(5+5+5)**

2. a) Discuss logical and assignment operators.

   b) Explain various components of scanf function along with an example.

   c) What is casting value? Give example. **(5+5+5)**

3. a) what is meant by formatted output? Write the output of the real number Y = 98.7654 under the following format specification.

   i) Printf (" % 7.4 f', Y);

   ii) Printf (" 7.2 f', Y);

   iii) Printf (" % f', Y);

   iv) Printf (" % - 7.2 f, Y);

   b) Discuss the uses of getchar ( ) function.

   c) Explain 'simple if' and 'if ... else, statements. **(6+4+5)**

4. a) Discuss the uses of 'Go to' statement in C.

   b) A survey of computer market show that personal computers are sold at varying costs by the vendors.

   c) Write a program to determine the average cost and the range values using if and Go to statements. **(5+5+5)**

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PGIS-N 1079 B-2K13

M.A./M.Sc. Ist Semester (CBCS) Degree Examination

Statistics

(Probability Theory)

Paper - HCT- 1.2

(New)

Time :3 Hours Maximum Marks : 80

Instructions to Candidates:-

Answer any **six** questions from **Part-A** and **five** questions from **Part-B**.

Part - A (6×5=30)

1. Define sequences and limits of events
2. Define measurable function and borel function.
3. If x is a random variable defined on (Ω, A) and a and b are constants then show that ax+b is also a random variable.
4. State an axiomatic definition of probability.
5. Define Lebesque measure and Lebesque stieltje's measures of probability.
6. Define expectation and show that if X $\geq$ Y a.s then EX $\geq$ EY.
7. Define convergence a.s and convergence in r^{th} mean.
8. Define characteristic function and obtain the characteristic function of gamma distribution.

Part - B (5×10=50)

9. a) Show that an intersection of arbitrary number of fields is a field. (6+4)

   b) Define partition. Let $\{A_i\}, i=1,2,3$ be partition then find minimal σ-field on this partition.

10. Show that if EX and EY exists. (6+4)

    i) $E(X \pm Y) = EX \pm EY$

    ii) E(CX) = CEX.

11. State and prove C_r - inequality. (10)

12. If $X_n \xrightarrow{p} X$ and $Y_n \xrightarrow{p} Y$ then show that (4+6)

i) $aX_n \xrightarrow{p} aX$, where a is real

ii) $X_n + Y_n \to X + Y$

13. State and prove fatous theorem of convergence. (10)

14. Prove any two properties of characteristic function. (10)

15. Define WLLN, state and prove Tchebychev's form of WLLN. (10)

16. State and prove Liapounov's form of C.L.T (10)

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PGIS-N 1086 B-2K13

M.A./M.Sc. Ist Semester (CBCS) Degree Examination

Statistics

(Computer Programming in C with statistical Applications)

Paper - Practical HCP-1.2

(New)

Time :2 Hours Maximum Marks : 30

Instructions to Candidates:-

Answer any **two** full questions

1. a) Discuss an exit controlled loop in detail. **(7+8)**

b) Explain for statement highlight its special features.

2. a) Distinguish between one dimensional and two dimensional arrays. **(5+10)**

b) Write a program to compute and print the standard deviation of grouped data.

3. a) Discuss the definition and declaration of a structure. How do you assign the values to the members using a dot operator? **(5+10)**

b) Write a program to compute and print the percentages of marks obtained by A and B in papers P_1 and P_2 using an array of structures.

4. Write short notes an any **three** of the following . **(3×5=15)**

a) user defined functions.

b) Unions.

c) Pointers.

d) Skipping apart of the program in a loop

e) Program to arrange observations in ascending order.

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PGIS-N 1087 B-2K13

M.A./M.Sc. Ist Semester (CBCS) Degree Examination

Statistics

(Based on HCT 1.1 and 1.3)

Paper - Practical - HCP 1.3

(New)

Time :2 Hours Maximum Marks : 30

Instructions to Candidates:-

Answer any **two** questions. All question carry **equal** marks.

1. For the following matrix A

$$A = \begin{bmatrix} 0.25 & 0.5 & 0.25 \\ 0.32 & 0.28 & 0.4 \\ 0.26 & 0.34 & 0.4 \end{bmatrix}$$

Find

i) A^{-1}

ii) $\text{adj}(\lambda I - A)$ and

iii) $|\lambda I - A|$ using Frames method.

2. In a genetic experiment the observed frequencies in four classes are 32, 102, 122, and 80 respectively. According to theory, probability of occurrences are

$(1-p)^3$, $3p(1-p)^2$, $3p^2(1-p)$ and p^3. Obtain MLE of p up to 3 decimal places and estimate its standard error.

3. The following data gives the values of index found in a random sample of 10 skulls.

74.1, 77.1, 74.4, 74.0, 73.8, 79.3, 75.8, 82.3, 72.2, 75.2 It is known that the distribution is normal with standard deviation 3. Find 95% confidence interval for populations mean μ

4. A chemical compound containing 12.5% of iron was given to two technician A and B for chemical analysis. A made 15 determination and B made 10 determination of percentage of iron. The result are given in the following table.

Determination.

By A:	12.46	11.89	12.76	11.95	12.77
	12.43	12.12	11.85	12.24	12.28
	12.77	12.33	12.56	12.65	12.12
By B:	12.05	12.22	12.45	11.97	12.21
	12.33	12.45	12.39	12.37	12.65

Assuming that the above two sets of observation are from normal distributions with equal variance constant 95% confidence interval for $\mu_A - \mu_B$.

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PGIS-N 1081 B-2K13

M.A./M.Sc. Ist Semester (CBCS) Degree Examination

Statistics

(Estimation Theory)

Paper - HCT - 1.3

(New)

Time :3 Hours Maximum Marks : 80

Instructions to Candidates:-

Answer any **six** questions from Part - A and any **five** from Part - B.

Part - A **(6×5=30)**

1. If two different unbiased estimators exist for the same parameter, show that there exist an infinite number of unbiased estimators for the same parameter.
2. State and prove a sufficient condition of consistency of an estimator
3. Verify whether $T = X_1 + 2X_2$ is sufficient for P if $X_1, X_2 \sim b(1, P)$ and are i.i.d r.v's
4. Define maximum likelihood estimator (m/e) and explain the method of m/e.
5. If $X \sim b(N, p)$, p unknown find m/e of P
6. Define minimal sufficient statistic and RPEF.
7. State Crammer Rao regularity condition and define MVB estimator.
8. Discuss shortest length confidence intervals.

Part - B **(5×10=50)**

9. a) Give an example to show that unbiased estimators do not alway's exist.

   b) Show that the sample mean $\bar{X}$ and $S^2 = \frac{1}{n-1}\sum(X_i - \bar{X})^2$ are unbiased estimators for μ and $\sigma^2 (< \infty)$ in $N(\mu, \sigma^2)$ **(5+5=10)**

10. If T_1 and T_2 are consistent estimators of g_1 and g_2 respectively, then show that $T_1 T_2$ is a consistent estimator of $g_1 g_2$. **(10)**

11. Let $X \sim N(\mu, \sigma^2)$ obtain sufficient statistic for **(10)**

    i) μ *if* σ^2 *is known*

    ii) σ^2 *if* μ *is known*

    iii) μ *and* σ^2 if both are unknown.

12. a) Define completeness and show that $\{b(n, p), 0 < p < 1\}$ is complete

b) Show that $I(\theta) = V\left(\frac{\partial \log L}{\partial \theta}\right) = -E\left(\frac{\partial^2 \log L}{\partial \theta^2}\right)$ **(5+5=10)**

13. State and prove Rao - Black well Theorem **(10)**

14. a) Define UMVUE.

b) Show that MVB estimator is unique, if it exists. **(5+5=10)**

15. State and prove Lehman - Scneff's theorem. **(10)**

16. Define UMA confidence set. Let $X_1, X_2 .....X_n$ be a sample from $U(o, \theta)$ obtain a confidence interval for parameter θ. **(10)**