LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc., B.COM DEGREE EXAMINATION – **MATHS, PHYSICS & COMMERCE**

THIRD SEMESTER – **NOVEMBER 2013**

ST 3205/3202 - ADVANCED STATISTICAL METHODS

Date : 13/11/2013 Dept. No. Max. : 100 Marks
Time : 9:00 - 12:00

PART – A

Answer all the questions **10 x 2 = 20 Marks**

1. Write down the class frequencies of all orders in case of 3 attributes A,B and C.
2. Provide the conditions for consistency of data involving three attributes.
3. Check whether A and B are independent for the following data:
   $(AB) = 256$, $(\alpha B) = 768$, $(A\beta) = 48$ and $(\alpha\beta) = 144$
4. Define Yule's coefficient of association and coefficient of colligation.
5. If $(AB) = 2340$, $(A\beta) = 230$, $(\alpha B) = 260$ and $(\alpha\beta) = 2340$ find the other class frequencies.
6. Write the sample space for the experiment of tossing three fair coins.
7. Define normal distribution.
8. If X has the probability mass function
   $f(x) = q^x p$, $x = 0,1,2 \dots$, $0<p\leq 1$; $f(x) = 0$, otherwise
   Compute E(X).
9. Write any two uses of chi-square statistic.
10. Write a note on mean and range control charts.

PART – B

Answer any five questions **5 x 8 = 40 Marks**

11. Show that for n attributes $A_1, A_2, \dots A_n$
    $(A_1 A_2 \dots A_n) \geq (A_1) + (A_2) + \dots + (A_n) - (n-1) N$, where N is the total number of observations.

12. If $\delta = (AB) - (AB)_0$ then with usual notations prove that
    $[(A) - (\alpha)] [(B) - (\beta)] + 2N\delta = (AB)^2 + (\alpha\beta)^2 - (A\beta)^2 - (\alpha B)^2$.

13. State and prove Boole's inequality.

14. (a) If $A_1, A_2, \dots A_n$ are independent events with $P(A_i) = 1-(1/\alpha^i)$, $i=1,2, \dots n$, find the value of $P(A_1 \cup A_2 \cup A_3 \cup \dots \cup A_n)$.
    (b) Suppose the events $A_1, A_2, \dots A_n$ are independent and that $P(A_i) = 1/(i+1)$ for $1\leq i\leq n$ find the Probability that none of the n events occurs. (4+4)

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15. A random variable X has the following probability distribution :

X=x:	0	1	2	3	4	5	6	7	8
P(x) :	k	3k	5k	7k	9k	11k	13k	15k	17k

(i) Determine the value of k.
(ii) Find $P(X<3)$, $P(X\geq3)$ and $P(0<X<5)$.

16. If X has the probability mass function
$P(x) = e^{-\lambda} \lambda^x/x!$, $x = 0,1,2 \ldots$, $\lambda>0$, find mean and variance of X.

17. Ten individuals were chosen at random from a normal population and their heights were found to be 63,63,66,67,68,69,70,71,71 inches. Test if the sample belongs to the population whose mean height is 66". Use 5% level of significance.

18. The following data give the number of defectives in 10 independent samples of varying sizes from a production process:

Sample No. :	1	2	3	4	5	6	7	8	9	10
Sample size :	2000	1500	1400	1350	1250	1760	1875	1955	3125	1575
No. of defectives:	425	430	216	341	225	322	280	306	337	305

Draw the control chart for fraction defective and comment on it.

PART – C

Answer any two questions **2 x20 = 40 marks**

19. (a) Find the remaining class frequencies given the following data:
N= 23713 ,(A) = 1618 , (B) =2015 ,(C) = 770 , (AB) =587 , (AC) =428 , (BC) = 335 and (ABC) =156.
(b) If Q and Y denote the Yule's coefficient of association and coefficient of colligation respectively,
Show that $Q = 2Y/(1+Y^2)$.

(15 +5)

20 (a) State and prove Bayes' theorem.
(b) Three urns I,II and III contain marbles as follows:
4 white , 5 black and 3 red marbles
2 white , 1 black and 1 red marbles
1 white , 2 black and 3 red marbles.
One urn was chosen at random and two marbles were drawn from it. They were found to be white and red . What is the probability that they have come from urn I, urn II or urn III ?
(c) If $P(A) = ½$, $P(B) = 1/3$ and $P(A\cap B) = 1/8$, find (i) $P(A \mid B)$ (ii) $P(B \mid A)$ (iii) $P(A^c \mid B)$ (iv) $P(A \mid B^c)$ (v) $P(A^c \mid B^c)$ (vi) $P(B^c \mid A)$ (vii) $P(B \mid A^c)$

(4+9+7)

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21 (a) The mean yield for one acre plot is 662 kgs with a standard deviation of 32 kgs. Assuming normal distribution how many one-acre plots in a batch of 1200 plots would you expect to have yield (i) over 700 kgs (ii) below 650 kgs (iii) what is the lowest yield of the best 100 plots ?
(b) Fit a Poisson distribution to the following data which gives the number of doddens in a sample of Clover seeds:

No. of doddens :	0	1	2	3	4	5	6	7	8
Observed frequency :	56	156	132	92	37	22	4	0	1

Also test the goodness of fit at 5% level of significance. (7 + 13)

22 (a) In a large city A , 20 percent of a random sample of 900 school children had defective

eye-sight. In another large city B, 15 percent of a random sample of 1600 children had the same defect. Is this difference between the two proportions significant ? Use 1% level of significance.

(b) Four experimenters determine the moisture content of samples of powder, each man taking a sample from each of six consignments. The assessments are :

Observer	Consignment					
	1	2	3	4	5	6
1	9	10	9	10	11	11
2	12	11	9	11	10	10
3	11	10	10	12	11	10
4	12	13	11	14	12	10

Carry out the ANOVA and discuss whether there is any significant difference between consignments and between observers. Use 5% significance level.

(5 + 15)