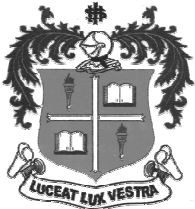# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – STATISTICS

FIFTH SEMESTER – APRIL 2013

ST 5507 - COMPUTATIONAL STATISTICS

Date : 13/05/2013   Dept. No.   Max. : 100 Marks
Time : 9:00 - 12:00

Answer any THREE of the following questions:

1) (a) A Textile manufacturer keeps a record of the defects that occur on the material by noting down the number of defects observed per 1000 meter of the cloth. The data collected from 150 such pieces of cloth are reported below.

No. of Defects	0	1	2	3	4	5
No. of Pieces	10	15	52	44	21	8

Fit a Poisson distribution to the number of defects per 1000 meter length and test for goodness of fit at 5% level of significance.

(b) The following table gives the distances that a particular brand of battery-operated vehicle ran before developing technical troubles. Data on 500 trial vehicles are available:

Distance in kms	150-250	250-350	350-450	450-550	550-650	650-750
	750-850					
No. of vehicles	2	4	14	40	55	95
	107					

Distance in kms	850-950	950-1050	1050-1150	1150-1250	1250-1350
	1350-1450				
No. of vehicles	77	41	33	22	8
	2				

Fit a normal distribution to the data and test for goodness of fit at 5 % level of significance. Estimate the probability for a randomly chosen vehicle to develop troubles before completing 150 kms.

(13 +20)

2) (a) A population consists of 6 units with 'Y' values 3, 5, 8, 11, 12, 15. By choosing simple random samples (WOR) of size 2, verify the results $E(\bar{y}) = \bar{Y}$ and $E(s^2) = S^2$.

(b) A population with 300 units is divided into three strata. A stratified random sample was drawn and the observed values in the sample are reported below:

Stratum No.	Stratum Size	Sample observations
1	75	21, 26
2	100	32, 35, 37
3	125	40, 48, 49, 45

Obtain the estimate $\bar{y}_{st}$ and get an estimate of its variance from the sample data. (18 + 15)

3) (a) Compute index number for the given data using the following methods (i) Laspeyre's method, (ii) Passche's method and (iii) fisher's ideal formula (8)

Item (Rs.)	Base year		Current year	
	Price (in Rs)	Expenditure	Price (in Rs)	Expenditure
A	6	360	10	460
B	2	240	4	240
C	4	240	6	360
D	10	350	12	360
E	8	320	12	432

(b) Construct Index number by chain base method from the following data of wholesale prices of a certain commodity: (5)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Price	75	50	65	60	72	70	69	75	84	80

(c) Given the following information, calculate the seasonal Indices using the method of ratios to moving averages. (Multiplicative model) (20)

Quarter

Year	I	II	III	IV
2000	106	124	104	90
2001	84	114	107	88
2002	90	112	101	85
2003	76	94	91	76
2004	80	104	95	83
2005	104	112	102	84

4) (a) Measurements of the fat content of two kinds of food item , Brand X and Brand Y yielded the sample data :

Brand X : 13.5   14.0   13.6 12.9   13.0   14.2   15.0   14.3   13.8
Brand Y :   12.9   13.0   12.8 143.5 12.7   15.0   18.7   11.8   14.3

Test the null hypothesis $\mu_1 = \mu_2$ against $\mu_1 < \mu_2$ at 5% level of significance.
(8marks)

(b) Two random samples drawn from two normal populations are :

Sample I   :   23   15   25   27   23   20   18   24   25
Sample II :   27   33   45   35   32   35   33   28   41   43

Test whether the two populations have the same variances. Use 5% significance level. (9marks)

(c) Seven coins were tossed and the number of heads noted. The experiment was repeated 130 times and the following distribution was obtained.

No. of heads : 0   1   2   3   4   5   6   7
Frequency   : 7   6   19   35   30   23   9   1

Fit a binomial distribution to the given data and test the goodness of fit at 1% level of significance. (16marks)

5) (a) Let X denote the length of time in seconds between two calls entering a college
switchboard. Let m be the unique median of this continuous-type distribution.
Test the null hypothesis $H_0 : m = 8$ against the alternative hypothesis
$H_1: m < 6.2$ using a random sample of size 20 given below:
6.8, 5.7, 6.9, 5.3, 4.1, 9.8, 1.7, 7.0, 2.1, 19.0, 18.9, 16.9, 10.4, 44.1, 2.9,
2.4, 4.8, 18.9, 4.8, 7.9.
Find the **significance level α** if the critical region **C = {y | y ≥ 12},** where **'y'** is
the number of lengths of time in a random sample of size 20 that are less than 8.
Find also the **p – value** of this sign test.   (13)

   (b) A vendor produces and sells low-fat milk powder to a company that
uses it to produce health drink formulae. In order to determine the fat
content of the milk powder , both the company and the vendor take a
sample from each lot and test it for fat content in percent. Ten sets of
paired test results are

Lot Number	Company Test Results (X)	Vendor Test Results (Y)
1	0.50	0.79
2	0.58	0.71
3	0.90	0.82
4	1.17	0.82
5	1.14	0.73
6	1.25	0.77
7	0.75	0.72
8	1.22	0.79
9	0.74	0.72
10	0.80	0.91
11	0.92	0.74
12	0.58	0.55

Test the hypothesis $H_0 : p = P[X > Y] = \frac{1}{2}$ against the one – sided alternative $H_1 : p > \frac{1}{2}$
using the critical region **C = { w | w ≥ 7 },** where **'w'** is the number of pairs for which
$X_i - Y_i > 0$. Find the **significance level α** and **p – value** of this test.   (20)

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