LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**B.Sc.** DEGREE EXAMINATION – **STATISTICS**

FIFTH SEMESTER – **APRIL 2012**

# ST 5507 - COMPUTATIONAL STATISTICS

Date : 03-05-2012 Dept. No. Max. : 100 Marks

Time : 9:00 - 12:00

**Answer any THREE of the following questions:**

(a) A Textile manufacturer keeps a record of the defects that occur on the material by noting down the number of defects observed per 500 meter of the cloth. The data collected from 180 such pieces of cloth are reported below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No. of Defects** | 0 | 1 | 2 | 3 | 4 | 5 |
| **No. of Pieces** | 10 | 25 | 62 | 54 | 21 | 8 |

Fit a Poisson distribution to the number of defects per 500 meter length and test for

goodness of fit at 5% level of significance.

(b) Data on the life-time of 250 machines are given below:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Life Time (in hrs)** | 0-1 | 1-2 | 2-3 | 3-4 | 4-5 | 5-6 | 6-7 | 7-8 | >8 |
| **No. of failed machines** | 85 | 51 | 35 | 24 | 18 | 15 | 12 | 7 | 3 |

Test at 5% level of significance whether the Life Time random variable follows

exponential distribution with p.d.f. f(x) = θe–θ x , x > 0.

(15 +18)

1. (a) A population consists of 5 units with ‘y’ values 1, 4, 6, 9, 12. Enlist all possible simple random samples of size 3 that can be drawn without replacement and verify the results E() = and E(s2) = S2.

(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  2  3 | 75  100  125 | 21, 26  32, 35, 37  40, 48, 49, 45 |

Obtain the estimate and get an estimate of its variance from the sample data.

(16 + 17)

1. (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 |
| Food | 10 | 600 | 20 | 1000 |
| Rent | 8 | 400 | 4 | 480 |
| Clothing | 8 | 480 | 12 | 600 |
| Fuel | 25 | 650 | 24 | 720 |
| Others | 16 | 640 | 20 | 960 |

(b) Change the base year 1996 to 2000 and rewrite the series of index numbers in the

following data:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2007 | 2008 | 2009 |
| Index | 100 | 112 | 125 | 160 | 140 | 165 | 170 | 175 | 182 |

(5)

(c) Calculate the seasonal indices by the method of least squares from the following data:

(Multiplicative model) (20)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Exports of cotton textiles (million Rs.) | | | |
| Year | I | II | III | IV |
| 2001 | 71 | 65 | 79 | 71 |
| 2002 | 76 | 66 | 82 | 75 |
| 2003 | 74 | 68 | 84 | 80 |
| 2004 | 76 | 70 | 84 | 79 |
| 2005 | 78 | 72 | 86 | 85 |

1. (a) On any given day at a warehouse, 14 trucks are loaded with a particular product.

It is claimed that the median weight m of each load of the product is 39,000 pounds.

On a particular day, the following observations were obtained:

41,195 39,485 41,229 36,840 38,050 40,890 35720

38,345 34,930 39,245 31,031 40,780 38,050 30,906

Test the null hypothesis H0 : m = 39,000 against the one-sided alternative hypothesis

H1 : m < 39,000 using the critical region **C = { y | y ≥ 9 }** where **‘y’** is the number of observations in the sample that are less than 39,000. Find the **significance level α** for the critical region **C.** Also find the **p –** value of this 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 as follows:

|  |  |  |
| --- | --- | --- |
| Lot Number | Company Test Results (X) | Vendor test results( Y) 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 H0 : p = P[X > Y] = against the one – sided alternative H1 : p >

using the critical region **C = { w | w ≥ 7 },** where **‘w’** is the number of pairs for which

Xi – Yi  > 0. Find the **significance level α**  and **p – value** of this test. (20)

1. (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 μ1 = μ2 against μ1 μ2 at 5% level of significance.

(9)

( 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.

(8)

(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)

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