LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

 FIFTH SEMESTER – NOVEMBER 2010

 **ST 5507 - COMPUTATIONAL STATISTICS**

 Date : 09-11-10 Dept. No. Max. : 100 Marks

 Time : 9:00 - 12:00

Answer all the questions (5 X 20 =100)

1 a) Consider the population of 7 units with values 1, 2, 3, 4, 5, 6,7 Write down all possible of sample of 2 ( without replacement) from this population and verify that this sample population mean is an unbiased estimate of the population mean.

Also calculate its sample variance and verify that

1. It agrees with the formula for the variance of the sample mean, and
2. This variance is less than the variance obtained from the sampling with replacement.

 (Or )

 b) The table given below presents the summary of data for complete census of all the the 2010 farms in region. The farms were stratified according to the farm size in acres into seven strata, as shown in column 2 of the table. The number of farms in the different strata Ni are given in the column 3. The population values of the strata means ( $\overbar{Y}\_{N\_{i}}$ ) and the strata standard deviation ( Si) for the area under wheat are given the frequency table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Stratum No. | Farm size( in acres ) | No. of farms Ni | Average area under wheat per farm in acres ( $\overbar{Y}\_{N\_{i}}$ ) | St. Deviation of area under wheat per farm in acres (Si) |
| 1 | 0 – 40  | 394 | 5.4 | 8.3 |
| 2 | 41 – 80  | 461 | 16.3 | 13.3 |
| 3 | 81 – 120  | 391 | 24.3 | 15.1 |
| 4 | 121 – 160  | 334 | 34.5 | 19.8 |
| 5 | 161 – 200  | 169 | 42.1 | 24.5 |
| 6 | 201 – 240  | 113 | 50.1 | 26.0 |
| 7 | More than 240 | 148 | 63.8 | 35.2 |

Calculate the sampling variance of the estimated area under wheat for the region from a sample of 150 farms if the farms are selected by the method of simple random sampling without stratification.

2. a) A random variable takes values 0, 1, 2 with probabilities

$\frac{θ}{4N}$**+** $\frac{1}{2}\left[1- \frac{θ}{N}\right], \frac{θ}{2N}$ **+** $\frac{α}{2}\left[1- \frac{θ}{N}\right], \frac{θ}{4N}$ **+** $\frac{1- α}{2}\left[1- \frac{θ}{N}\right]$where N is a known number and **α** and**θ** are unknown parameters. If **75** independent observations on **X** yielded the values 0, 1, 2 with frequencies 27, 38, 10 estimate **α** and **θ** by the method of moments.

b) If 6,11,4,8,7,6 is a sample from a normal population with mean 6. Find the maximum likelihood estimate for the variance $σ^{2}$.

 **(or)**

c) Given below is a random sample from normal population. Determine 95% confidence interval for the population standard deviation.

 160, 175, 161, 181, 158, 166, 174, 165, 172, 184, 170, 159, 169, 175, 179, 164

d) A random sample of size 17 from a normal population is found to have 4.7 and $S^{2}=5.76 ,$

find a 90% confidence interval for the mean of the population.

3(a) Calculate seasonal indices by using Ratio to trend method for the following data:

|  |  |
| --- | --- |
|  | Quarter |
| Year  | I | II | III | IV |
| 2006 | 8 | 16 | 24 | 32 |
| 2007 | 48 | 36 | 24 | 12 |
| 2008 | 48 | 16 | 32 | 64 |
| 2009 | 72 | 108 | 114 | 36 |
| 2010 | 56 | 28 | 84 | 112 |

 (OR)

 (b) Calculate 3 yearly moving averages and also draw the graph for the following data:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Sales | 200 | 120 | 280 | 240 | 160 | 320 | 360 | 400 | 320 | 360 | 360 |

 (c) Fit a straight line by the method of least square and also forecast the production for the year 2010 for the following data:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | 2000 | 2001 | 2002 | 2003 | 2004 |
| Production  | 10 | 20 | 30 | 50 | 40 |

4 (a) Two random samples were drawn from two normal populations and the observations are:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| A | 66 | 67 | 75 | 76 | 82 | 84 | 88 | 90 | 92 | - | - |
| B | 64 | 66 | 74 | 78 | 82 | 85 | 87 | 92 | 93 | 95 | 97 |

Test whether the two populations have the same variance at 5% level of significance.

b) The following table show the association between the performance and training of 870persons.Is the association significant.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Training |  |  |  |
| Performance | Intensive | Average | Normal | Total |
| Above average | 100 | 150 | 40 | 290 |
| Average | 100 | 100 | 100 | 300 |
| Poor | 50 | 80 | 150 | 280 |
| Total | 250 | 330 | 290 | 870 |

 (or)

(c)Apply the mann-whitney -wilcoxon test to the following data to test



|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| X | 25 | 30 | 45 | 52 | 65 | 75 | 80 | 42 | 50 | 60 |
| Y | 60 | 40 | 35 | 50 | 60 | 72 | 63 | 40 | 55 | 62 |

(d) A group of 5 patients treated with machine A weighted 42, 39, 48, 60, 41. A second group of 5 patients treated with machine B weighted 38, 42, 48, 67, 40 kg. Do the two machine differ significantly with regard to their effect in increasing weight?

5) a) From the following data compute price index by applying weighted average of price relatives method using:

(i) Arithmetic mean, and

 (ii) Geometric mean. (8)

|  |  |  |  |
| --- | --- | --- | --- |
| Commodities  | p0Rs. | q0  | p1Rs. |
| Sugar | 6.0 | 10 kg. | 8.0 |
| Rice | 3.0 | 20 kg. | 3.2 |
| Milk | 2.0 | 5 lt. | 3.0 |

b)Construct index number of price from the following data by applying

1. Laspeyre’s method
2. Paasche’s method
3. Bowleys method,
4. Fisher’s ideal method, and
5. Marshall edgeworth method

|  |  |  |
| --- | --- | --- |
| Commodity | 2007 | 2006 |
| Price Rs. | Quantity | Price | Quantity |
| ABCD | 2542 | 8101419 | 4652 | 651013 |

 Or

c) From the following data, calculate Fisher’s ideal index and prove that it satisfies both the time reversal test and factor reversal tests. (10)

|  |  |  |
| --- | --- | --- |
| Commodity | 2007 | 2006 |
| Price Rs. | Quantity | Price | Quantity |
| ABCD | 4538 | 81065 | 56410 | 81274 |

d)From the following data of the wholesale prices of wheat for the ten years construct index numbers (a) taking 1999 as base, and (b) by chain base method. (10)

|  |  |
| --- | --- |
| Year | Price of wheat ( Rs. Per 10 kg ) |
| 1999 | 50 |
| 2000 | 60 |
| 2001 | 62 |
| 2002 | 65 |
| 2003 | 70 |
| 2004 | 78 |
| 2005 | 82 |
| 2006 | 84 |
| 2007 | 88 |
| 2008 | 90 |