

DEPARTMENT OF MATHEMATICS
End Term Examination 2015-16
B. Tech (V Sem)- Biotechnology

Subject: Biostatistics
 Time: 3 Hours

30-11-15

Course Code: MA 1501
 Maximum Marks: 60

Note: Attempt ALL questions. Each question carries equal marks. Statistical tables and calculator are allowed.

1. (a) There are two bags A and B. A contains n white and 2 black balls and B contains 2 white and n black balls. One of the bag is selected at random and 2 balls are drawn from it without replacement. If both the balls are white and probability that bag A was used to draw the balls is $\frac{6}{7}$, find the value of n .

(b) Given $f(x, y) = \begin{cases} e^{-(x+y)}; & x \geq 0, y \geq 0 \\ 0 & \text{elsewhere.} \end{cases}$. Are X and Y are independent? Find (i) $P(x > 1)$

(ii) $P\left(x < y / x < 2y\right)$ (iii) $P(1 \leq x + y \leq 2)$.

2. (a) Given the joint density function of X and Y as: $f(x, y) = \begin{cases} \frac{1}{2}x e^{-y}; & 0 < x < 2, y \geq 0 \\ 0 & \text{elsewhere.} \end{cases}$

Find the probability density function of $X + Y$.

- (b) If X and Y are two random variables with variances σ_x^2 and σ_y^2 respectively and r is the coefficient of correlation between them. If $u = x + ky$ and $v = x + \left(\frac{\sigma_x}{\sigma_y}\right)y$. Find the value of k so that u and v are uncorrelated.

3. (a) The following marks have been obtained by a class of students in Statistics (out of 100):

Paper I	80	45	55	56	58	60	65	68	70	75	85
Paper II	82	56	50	48	60	62	64	65	70	74	90

Compute the coefficient of correlation for the above data. Find the lines of regression.

- (b) Fit a second degree parabola to the following data, where x is the independent variable:

x	1	2	3	4	5	6	7	8	9
y	2	6	7	8	10	11	11	10	9

4. (a) A test of the mean breaking strengths of 6 ropes manufactured by a company showed a mean breaking strength of 3515 kg and a standard deviation of 66 kg, whereas the manufacturer claimed a mean breaking strength of 3630 kg. Can we support the manufacturer's claim at a level of significance of (i) 0.05 (ii) 0.01?

- (b) How large a sample should one take in order to be (i) 95%, (ii) 99.73% confident that a population standard deviation will not differ from a sample standard deviation by more than 2%?
5. (a) It has been found from experience that the mean breaking strength of a particular brand of thread is 275.6 grams with a standard deviation of 39.7 grams. Recently a sample of 36 pieces of thread showed a mean breaking strength of 253.2 grams. Can one conclude at a significance level of (i) 0.05 and (ii) 0.01 that the thread has become inferior?
- (b) The standard deviations of the diameters of ball bearings produced by two machines were found to be 0.042 cm and 0.035 cm respectively, based on samples of sizes 10 each. Find (i) 98% and (ii) 90% confidence intervals for the ratio of the variances.
6. (a) Random samples of 200 bolts manufactured by machine A and 100 bolts manufactured by machine B showed 19 and 5 defective bolts respectively. Test the hypothesis that (i) the two machines are showing different qualities of performance and (ii) machine B is performing better than A. Use a 0.05 level of significance.
- (b) The standard deviation of the breaking strengths of certain cables produced by a company is given as 109 kilograms. After a change was introduced in the process of manufactures of these cables, the breaking strengths of a sample of 8 cables showed a standard deviation of 136 kilograms. Investigate the significance of apparent increase in variability, using a significance level of (i) 0.05, (ii) 0.01.