B.Tech Vth Semester Biotechnology End-term Examination 2017-18

Subject: Biostatistics
Course Code: MA 1501
Time: 3 Hours
Date: 23-11-2017
Maximum Marks: 60

Note: Attempt **ALL** questions. Each question carries equal marks. Statistical Tables and calculator allowed.

1. (a) Urn I contains 2 white and 3 black balls, Urn II contains 4 white and 1 black balls and Urn III contains 3 white and 4 black balls. An Urn is selected at random and a ball drawn at random is found to be white. What is the probability that urn I was selected?

(b) The incidence of occupational disease in an industry is such that the workers have a 25% chance of suffering from it. What is the probability that out of 13 workers chosen at random six or more will suffer from the disease?

(c) In a distribution exactly normal, 7% of the items are under 35 and 89% items are under 63. What are the mean and standard deviation of the distribution?

2. (a) Let X and Y have joint p.d.f. $f(x,y) = \begin{cases} \frac{e^{-(x+y)}x^3y^4}{144}, & x,y \geq 0 \\ 0 & \text{ew.} \end{cases}$, find the density function of $U = \frac{X}{X+Y}$ also find the mean and variance of U.

(b) If the random variables X and Y have joint density function $f(x,y) = \begin{cases} kxy\ ;\ 0 < x < 3,\ 1 < y < 4 \\ 0 \quad elsewhere. \end{cases}$. Find the value of k and density function of $2X + Y$.

3. (a) A machine produces bolts which are 10% defective. Find the probability that in a random sample of 400 bolts produced by this machine (i) at most 30, (ii) between 30 and 50, (iii) 55 or more, of the bolts will be defective.

(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.

4. (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.

(b) Fit a curve $y = ab^x$ to the following data:

x	2	3	4	5	6
y	144	172.8	207.4	248.8	298.5

5. (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%?

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.**