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October 2010

Bachelor of Computer Application (BCA) Examination

II Semester

Statistical Methods

Time : 3 Hours] [Max. Marks : 40

Note : *Attempt all the Five questions. All questions carry equal marks.*

1. (i) What are estimators? When is an estimator said to be (a) unbiasec, (b) consistent (c) minimum variance bound estimator.

(ii) State Cramer's Rao inequality and state the condition when equality sign is attained.

(iii) For a random sample of size n from a normal distribution with mean μ and variance σ^2, if $\bar{X}_n$ is the sample mean, then discuss with reasons the statements :

(a) $\bar{X}_n$ is an unbiased estimator of μ

(b) $\frac{n-1}{n}\bar{X}_n$ Is a consistent estimator of μ.

Or

(i) What are maximum likelihood estimators? State their important properties.

(ii) For the distribution with p.d.f. given by :

$$f(x)=\frac{1}{\theta^p}\overline{|p}\, e^{-(x/\theta)}x^{p-1} \qquad 0\le x<\infty;\ p>0,\ \theta>0$$

find the maximum likelihood estimator of θ on the basis of a random sample of size n from the distribution, when p is known.

2. (i) Explain in short, the procedure of test of statistical hypothesis. Explain the terms :

(a) Null hypothesis and alternative hypothesis

(b) Simple and composite hypothesis with illustrative examples.

(ii) If $x \ge 1$ is the critical region for testing $H_0 : \theta = 2$ against the alternative $\theta = 1$, on the basis of a single observation from the population with p.d.f.

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$f(x) = \lambda e^{-\lambda x}; 0 \leq x < \infty$

Obtain the probability of type I error and power of the test.

Or

State and prove Neymann Pearsons's fundamental lemma.

Outline its use in obtaining a critical region of a given size for testing $H_0 : \mu = 1$ against $H_1 : \mu = 2$ on the basis of a single observation from $N(\mu, 1)$ distribution.

3. What are the two types of beta distributions? Obtain the rth moment about origin for any one of them and hence or otherwise, find the mean and variance of the distribution.

Or

In an experiment conducted on eight pigs to compare two types of pig foods A and B, the following increase in weights were observed in pigs :

Pig Number		:	1	2	3	4	5	6	7	8
Increase in weight	Food A	:	49	53	51	52	47	50	52	53
in lbs due to	Food B	:	52	55	52	53	50	54	54	53

Can we conclude that food B is better than food A ($P\{t > t_{0.05}\}$ at 7 d.f. is 1.90, at 14 d.f. is 1.76)

4. What are non-parametric tests? Write short notes on :
   (i) Run test
   (ii) Wilcoxon's Signed Rank Test.

Or

What are contingency tables? The first and second rows in the followings table show for three age groups of boys and girls, the number affected by a certain non-infectious disease and the total number exposed to risk respectively. Test whether boys and girls are equally susceptible :

		Boys			Girls		
Age Group	:	I	II	III	I	II	III
Number Affected	:	60	25	48	96	18	42
Total no. exposed to risk	:	240	470	350	530	200	210

You may use the fact that at 5% level of significance, χ^2 for 2 degrees of freedom is 5.991 and χ^2 for 1 degree of freedom is 3.841. $P\{|t| > t_{0.05}\}$ at 5 d.f. is 2.57).

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5. (i) What is a completely randomized design (CRD)? Which of the basic principles of design of experiments are not used in CRD (if any)?

(ii) Weight gains of 20 similar chicken when fed with four food-stuffs A, B, C, D are given in the following table, where each food-stuff is given to five chicken chosen at random. Analyse the data to check whether the four foods are all alike as regards increase in weight. (At 5% level of significance, $F_{3,16} = 3.24$ $F_{(3,19)} = 3.13$)

i	Food						Table Ti
1	A	55	49	42	21	52	219
2	B	61	112	30	89	63	355
3	C	42	97	81	95	92	407
4	D	169	137	169	85	154	714
						Grand Total	=1695

You may use the result that in usual notations, $\sum_i \sum_j y_{ij}^2 = 1,81,445$

OR

What is meant by analysis of variance with one way and two way classifications? Which of these applies to RBD, LSD. Explain how ANOVA is carried out for LSD, specially mentioning the layout, hypothesis to be tested, the ANOVA table and how to draw inference from this analysis.

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