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3 SEM TDC STSH (CBCS) C 5 (N/O)

2025

(Nov/Dec)

STATISTICS

(Core)

Paper : C-5

(Sampling Distribution)

*The figures in the margin indicate full marks
for the questions*

(New Course)

Full Marks : 55

Pass Marks : 22

Time : 3 hours

1. Choose the correct answer from the following alternatives : 1×6=6

(a) If X is a continuous random variable with mean μ and variance σ^2 , then for any positive number k

$$P\{|x - \mu| \geq k\sigma\} \leq \frac{1}{k^2}$$

(2)

is known as

- (i) Chebychev's inequality
 - (ii) weak law of large numbers
 - (iii) strong law of large numbers
 - (iv) None of the above
- (b) The SE of mean of a random sample of size n from a population with variance 4 is
- (i) 2
 - (ii) $\frac{2}{n}$
 - (iii) $\frac{2}{\sqrt{n}}$
 - (iv) $\frac{n}{2}$
- (c) Level of significance is the probability of
- (i) type I error
 - (ii) type II error
 - (iii) not committing error
 - (iv) Any of the above

(3)

(d) The range of χ^2 -variate is

- (i) $-\infty$ to ∞
 - (ii) 0 to ∞
 - (iii) 0 to 1
 - (iv) $-\infty$ to 0
- (e) The mean of Chi-square distribution with 12 d.f. is
- (i) 12
 - (ii) 11
 - (iii) $\sqrt{12}$
 - (iv) 24
- (f) The variance of Student's t -distribution is
- (i) n
 - (ii) $2n$
 - (iii) $\frac{\nu}{\nu-2}$ where ν = degrees of freedom
 - (iv) None of the above

(4)

2. Answer the following questions in brief :

2×6=12

- (a) Define convergence in probability.
- (b) What do you mean by standard error of a statistic?
- (c) Distinguish between parameter and statistic.
- (d) State additive property of χ^2 -variate.
- (e) State the assumptions of Student's t-test.
- (f) Define F-statistic.

3. (a) Distinguish between weak law of large numbers and strong law of large numbers. Give the statement of De-Moivre-Laplace central limit theorem. A coin is tossed 200 times. Find the approximate probability that the number of heads obtained is between 80 and 120.

2+2+5=9

Or

- (b) Obtain the cumulative distribution function of a single-order statistic and find the probability density function.

4+5=9

26P/184

(Continued)

(5)

4. (a) Obtain the sampling distribution of mean of a random sample drawn from a normal population with mean μ and variance σ^2 . Define null and alternative hypothesis with examples.

5+3=8

Or

- (b) Illustrate with examples two types of error occurred in testing of hypothesis. Describe how you would test the difference of two means in large samples.

4+4=8

5. (a) Prove that the sum of independent χ^2 -variate is also a χ^2 -variate. How do you test the independence of attribute with it?

5+5=10

Or

- (b) Obtain moment generating function and cumulant generating function of χ^2 -distribution. Obtain its first four cumulants and hence its mean and variance.

5+5=10

26P/184

(Turn Over)

(6)

6. (a) Define Student's t -statistic. Mention some applications of Student's t -test in tests of significance. Explain the t -test for testing the significance of the difference between two sample means.

1+4+5=10

Or

- (b) Write down the probability density function of F -distribution. Obtain the mode of F -distribution with (n_1, n_2) d.f. Establish the relationship between t and F distributions.

1+4+5=10

(7)

(Old Course)

Full Marks : 50

Pass Marks : 20

Time : 2 hours

1. Choose the correct answer from the following alternatives : 1×5=5

- (a) If X is a continuous random variable with mean μ and variance σ^2 , then for any positive number k

$$P\{|x - \mu| \geq k\sigma\} \leq \frac{1}{k^2}$$

is known as

- (i) Chebychev's inequality
 - (ii) weak law of large numbers
 - (iii) strong law of large numbers
 - (iv) None of the above
- (b) The SE of mean of a random sample of size n from a population with variance 4 is
- (i) 2
 - (ii) $\frac{2}{n}$
 - (iii) $\frac{2}{\sqrt{n}}$
 - (iv) $\frac{n}{2}$

(8)

(c) Level of significance is the probability of

- (i) type I error
- (ii) type II error
- (iii) not committing error
- (iv) Any of the above

(d) The mean Chi-square distribution with 12 d.f. is

- (i) 12
- (ii) 11
- (iii) $\sqrt{12}$
- (iv) 24

(e) The variance of Student's t -distribution is

- (i) n
- (ii) $2n$
- (iii) $\frac{v}{v-2}$ where v = degrees of freedom
- (iv) None of the above

(9)

2. Answer the following questions in brief :

2×5=10

- (a) Define convergence in probability.
- (b) What do you mean by standard error of a statistic?
- (c) State additive property of χ^2 -variate.
- (d) State the assumptions of Student's t -test.
- (e) Define F -statistic.

3. (a) Distinguish between weak law of large numbers and strong law of large numbers. Give the statement of De-Moivre-Laplace central limit theorem. A coin is tossed 200 times. Find the approximate probability that the number of heads obtained is between 80 and 120.

2+2+5=9

Or

- (b) Obtain the cumulative distribution function of a single-order statistic and find the probability density function.

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(10)

4. (a) Obtain the sampling distribution of mean of a random sample drawn from a normal population with mean μ and variance σ^2 . Define null and alternative hypothesis with examples. 5+3=8

Or

- (b) Illustrate with examples two types of error occurred in testing of hypothesis. Describe how you would test the difference of two means in large samples. 4+4=8

5. (a) Prove that the sum of independent χ^2 -variate is also a χ^2 -variate. How do you test the independence of attribute with it? 5+4=9

Or

- (b) Obtain moment generating function and cumulant generating function of χ^2 -distribution. Obtain its first four cumulants and hence its mean and variance. 5+4=9

(11)

6. (a) Define Student's t -statistic. Mention some applications of Student's t -test in tests of significance. Explain the t -test for testing the significance of the difference between two sample means. 1+4+4=9

Or

- (b) Write down the probability density function of F -distribution. Obtain the mode of F -distribution with (n_1, n_2) d.f. Establish the relationship between t and F distributions. 1+4+4=9
