141637

D 11878 **(Pages : 3)** **Name.......................................**

Reg. No...................................

THIRD SEMESTER (CUCBCSS–UG) DEGREE EXAMINATION NOVEMBER 2021

Statistics

STS 3C 03—STATISTICAL INFERENCE

(2014—2018 Admissions)

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions in* **one word**.

Each question carries 1 *mark.*

Name the following :

1. An estimator which contains all information about the parameter contained in the sample.
2. The error of accepting null hypothesis when it is false.
3. This distribution is used in testing of independence of attributes.

Fill up the blanks :

4. An efficient estimator is an estimator with minimum ————————.
5. ———————— is the method of estimating a particular value for an unknown parameter.
6. If X_1 and X_2 are two independent standard normal variables, then $t = \frac{X_1}{X_2}$ follows ————————.
7. The statistic used to test the mean of a normal population follows ———————— distribution.

Write True *or* False :

8. If $E(t) \neq \theta$, and V (t) tends to infinity as n tends to infinity, then t is a consistent estimator of θ.
9. There may exist more than one unbiased estimators for a parameter.
10. A statistical hypothesis which completely specifies the population is simple hypothesis.

(10 × 1 = 10 marks)

Turn over

141637

Section B

Answer **all** *questions in* **one sentence** *each.*
Each one carries 2 marks.

11. Define interval estimation.
12. Define unbiased estimator.
13. Identify the distribution of the ratio of the squares of two independent standard normal random variables.
14. Define power of a test.
15. Define Parameter.
16. State Fisher-Neymaan factorization theorem.
17. What is the test statistics used in small sample test to test the mean of a normal population when σ^2 is unknown ?

(7 × 2 = 14 marks)

Section C

Answer any **three** *questions.*
Each one carries 4 marks.

18. Obtain the mode of a Chi-square random variable with n degrees of freedom.
19. Distinguish between one tailed and two tailed test.
20. For a Poisson distribution with parameter λ, show that sample mean $\bar{x}$ is the sufficient estimator of λ.
21. Explain the method of moments in estimation.
22. A sample of size 17 taken from $N(\mu, \sigma^2)$. Mean of the sample is 22 and the sample variance is 16. Using the data, find a 90% confidence interval for μ.

(3 × 4 = 12 marks)

Section D

Answer any **four** *questions.*
Each one carries 6 marks.

23. For a random variable of size 16 from $N(\mu, \sigma)$ population, the sample variance is 16. Find a and b such that $P(a < \sigma^2 < b) = 0.60$.

24. Find the mean of a random variable follow t-distribution with n degrees of freedom.

25. Explain the method of M L E. List the properties of a M L Estimator.

26. Derive the confidence interval for the mean of a normal population when population variance is known.

27. State and prove sufficient conditions for a consistent estimator.

28. Explain the method of Chi-square test of independence of attributes.

(4 × 6 = 24 marks)

Section E

Answer any **two** *questions.*
Each one carries 10 *marks.*

29. (i) If F follows F-distribution with (m, n) degrees of freedom. Derive the probability distribution of Y = 1/F.

(ii) Derive any one statistic following F-distribution.

30. Use Neymaan-Pearson Theorem to find a most powerful test with significance level α for testing the hypothesis $H_0 : \mu = \mu_0$ against, $H_1 : \mu = \mu_1, (\mu_1 > \mu_0)$ using a random sample $x_1, x_2, ..., x_n$ drawn from the population with pdf $f(x) = \frac{1}{\sqrt{18\pi}} e^{-\frac{1}{18}(x-\mu)^2}, -\infty < x < \infty$.

31. Explain Chi-square test of goodness of fit. The theory predicts the proportion of four groups A, B, C and D of individuals watching a particular TV programme is 10 : 4 : 4 : 2. In a survey among 1600 individuals, the members in the four groups were 850, 350, 250 and 100. Does the data support the ratio suggested ?

32. (i) Explain the paired t-test of equality of means of two normal populations when the population standard deviations are unknown and the sample size is small.

(ii) Marks obtained by two sets of 8 students undergone two different type of training mode is given below :

Diet A	:	23	30	40	35	26	36	25	28
Diet B	:	28	35	32	38	25	31	30	29

Test whether the trainings are different as far as the marks after the trainings are concerned, ts at 5% level of significance.

(2 × 10 = 20 marks)

D 71705-B (Pages : 3) Name.................................

Reg. No..............................

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2019

(CUCBCSS—UG)

Statistics

STS 3C 03—STATISTICAL INFERENCE

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions each in* **one word.**
Each question carries 1 mark.

Name the following :

1. The function of sample values, which gives a good approximation for the required parameter.
2. A statistical hypothesis which completely specifies the population.
3. Any function of the statistical population (or population) values.

Fill up the blanks :

4. The distribution of statistic is known as the ———— of that statistic.
5. For the random sample of size 15 is taken from N (5, 2), $P(\bar{x} > 5)$ = ————.
6. In a statistical testing of hypothesis, the hypothesis is to be tested is termed as ————.
7. If X follow N (0,1), then X^2 follows Chi-square distribution with ———— d.f.

Write True *or* False :

8. If T is a consistent estimator of θ, then E (T) need not be θ.
9. Fisher-Neyman theorem helps to obtain sufficient estimator.
10. Size of test is 1 – P (Type II error).

(10 × 1 = 10 marks)

Section B

Answer **all** *questions in* **one sentence** *each.*
Each question carries 2 marks.

11. Define Statistic.
12. Define confidence coefficient.
13. Write any two statistics following *t* - distribution.
14. Define efficient estimator.

Turn over

15. State Fisher-Neyman factorization theorem.

16. Define most powerful test

17. State Neyman-Pearson lemma.

($7 \times 2 = 14$ marks)

Section C

Answer any **three** *questions.*
Each question carries 4 *marks.*

18. Obtain the mean of a random variable t distribution with n degrees of freedom.

19. What are the steps involved in testing of a hypothesis ?

20. Find the moment estimator of λ using n random samples $x_1, x_2, ..., x_n$ taken from a Poisson population with the parameter λ.

21. A sample of size 17 taken from $N(\mu, \sigma)$. Mean of the sample is 15 and the sample variance is 9. Using the data, find a 90% confidence interval for μ.

22. Define significance level and power of a test in testing of hypothesis.

($3 \times 4 = 12$ marks)

Section D

Answer any **four** *questions.*
Each question carries 6 *marks.*

23. Find the m.g.f. of X following Chi-square distribution with n d.f., and hence state and prove the additive property of Chi-square distribution.

24. If X_1 and X_2 are two independent standard normal variables, obtain the distribution of

(i) $\dfrac{\sqrt{2}X_1}{\sqrt{X_1^2 + X_2^2}}$ (ii) $\dfrac{X_1}{X_2}$.

25. Define MLE. Obtain the MLE of the parameter θ, using random samples $x_1, x_2, ..., x_n$ taken from the population with p.d.f. $f(x,\theta) = \dfrac{1}{\sqrt{2\pi\theta}} e^{-\frac{x^2}{2\theta^2}}, -\infty < x < \infty$.

26. In a sample of 60 items, 8 are damaged. Construct a 95% confidence interval for the true proportion of damaged items.

27. In a coin tossing experiment, let p be the probability of getting a head. The coin is tossed 10 times to test the hypothesis $H_0 : p = 0.5$ against the alternative $H_1 : p = 0.7$ Reject H_0, if 6 or more tosses out of 10 result in head. Find significance level and power of the test.

28. Explain the Chi-square test of independence.

($4 \times 6 = 24$ marks)

Section E

Answer any **two** *questions.*
Each question carries 10 *marks.*

29. Define F- distribution. If t follows student's t-distribution with n degrees of freedom, show that t^2 follows F distribution with (1 , n) degrees of freedom.

30. x_1, x_2 are two random sample taken trom a population with p.d.f. $f(x) = \frac{1}{\theta} e^{-\frac{x}{\theta}}, 0 < x < \infty; \theta > 0$. To test $\theta = 2$ against $\theta = 4$, the critical region is $x_1, x_2 \geq 9.5$. Obtain the significance level and power of the test.

31. (i) Explain Chi-square test of goodness of fit.

(ii) The theory predicts the proportion of beans in the four groups A. B, C and D should be 9:3:3:1. In an experiment among 1600 beans, the numbers in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory ?

32. (i) Explain the method of small sample testing of equality of means of two normal populations when the population standard deviations are unknown.

(ii) Gain in weights for two groups of rates fed on two types of diets are as follows :

Diet A	:	13	14	10	11	12	16	10	8	
Diet B	:	7	10	12	8	10	11	10	9	11

Test the effect of diet in gain in weights at 5% level of significance.

(2 × 10 = 20 marks)

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2018

(CUCBCSS—UG)

Complementary Course

STS 3C 03—STATISTICAL INFERENCE

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions each in* **one word.**
Each question carries 1 *mark*

Name the following :—

1. The probability distribution of the sample mean of 16 random samples taken from a normal population with mean 5 and SD 4.
2. The probability distribution of the ratio of two independent standard normal random variables.
3. The value of a statistic representing the value of a population parameter.

Fill up the blanks :

4. The interval for the value of an unknown parameter with a specified probability is called ————.
5. ———— distribution is derived as the ratio of two independent Chi-square random variables.
6. In a statistical testing of hypothesis, the hypothesis is to be tested is termed as ————.
7. The rejection region in testing of hypothesis is called ————.

Write True *or* False :

8. If T is an unbiased estimator of θ, then $E(T) = \theta^2$.
9. F-test is used to test the equality of variances of two normal populations.
10. In a testing procedure, type II error is more serious.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions in* **one sentence** *each.*
Each question carries 2 *marks.*

11. Define Sampling Distribution.
12. Define Statistical Inference.

13. Show that p.d.f. of exponential distribution with parameter ½ and Chi-square distribution with 2 d.f. are same.

14. A random sample of size 16 is taken from a normal population with mean 30 and variance 64. Find the probability that the sample variance S^2 will be less than the population variance.

15. Let $\bar{X}$ be the mean of n random samples taken from $N(\mu, \sigma)$ and S^2 be the sample variance.

Establish that $\dfrac{(\bar{x} - \mu)\sqrt{n-1}}{S} \sim t_{(n-1)}$.

16. Define most powerful test.

17. For the random sample $x_1, x_2, \ldots, x_n$ taken from Poisson population with parameter λ, show that $\dfrac{n\bar{x}}{n+1}$ is a biased estimator λ.

(7 × 2 = 14 marks)

Section C

Answer any **three** *questions.*
Each question carries 4 marks.

18. Obtain the mean and variance of a Chi-square random variable with n degrees of freedom.

19. Let x_1 and x_2 denote random samples from a normal population with mean θ and variance unity. Show that $y_1 = x_1 + x_2$ is a sufficient statistic for θ.

20. Explain the method of moment estimation.

21. Distinguish between point and interval estimation.

22. Define size and power of a test in testing of hypothesis.

(3 × 4 = 12 marks)

Section D

Answer any **four** *questions.*
Each question carries 6 marks.

23. Define Students t-distribution. If X_1 and X_2 are two independent standard normal variables, prove that $t = \dfrac{\sqrt{2}\, X_1}{\sqrt{X_1^2 + X_2^2}}$ follow t-distribution with 2 d.f.

24. If X is a random variable following F distribution with (n_1, n_2) degrees of freedom. Prove that the distribution of $Y = \frac{1}{X}$ is F distribution with (n_2, n_1) degrees of freedom.

25. Obtain the MLE of α and β using the random samples $x_1, x_2, \ldots, x_n$ taken from the population with p.d.f. $f(x) = \frac{1}{\beta} e^{-\frac{(x-\alpha)}{\beta}}, x \geq \alpha, \beta > 0.$

26. Estimate a 95 % confidence interval for μ, based on 10 random samples

22, 25, 30, 21, 24, 26, 24, 28, 25, 26 taken from N (μ, 5).

27. Hemoglobin levels of children under age 6 are distributed as normal population N (μ ,0.85). To test $H_0 : \mu = 12.3g/100\ ml$ against $H_A : \mu = 11.5g/100\ ml$. It is decided to reject null hypothesis, if $\bar{x} \leq 11.8$, where $\bar{x}$ is the sample mean of 25 samples. Find significance level and power of the test.

28. Explain the small sample test to test the mean of a normal population when σ is unknown.

(4 × 6 = 24 marks)

Section E

Answer any **two** *questions.*
Each question carries 10 *marks.*

29. (i) Derive the sampling distribution of means of samples taken from a normal population N (μ, σ).

(ii) A random sample of size 25 is taken from a normal population with mean 1 and variance 9. What is the probability that the sample mean is negative ?

30. x_1, x_2 are two random sample taken from a population with p.d.f. $f(x) = \frac{1}{\theta} e^{-\frac{x}{\theta}}, 0 < x < \infty ; \theta > 0.$

To test $\theta = 2$ against $\theta = 4$, the critical region is $x_1 + x_2 \geq 9.5$. Obtain the significance level and power of the test.

Turn over

31. (a) Explain Chi-square test of independence.

(b) The following table gives the classification of 100 workers according to sex, and the nature of work. Test whether nature of work is independent of the sex of the worker at 5 % level of significance.

	Skilled	*Unskilled*	*Total*
Male ...	40	20	60
Female ..	10	30	40
Total ..	50	50	100

32. (a) Explain F-test of equality of variances of two normal populations.

(b) Following are the set of observations from two normal populations. Test the equality of their population variances at 5 % of significance level :

From first population	:	39	41	43	41	45	39	42	44
From second population	:	40	42	40	44	39	38	40	

(2 × 10 = 20 marks)

C 31166

(Pages : 3)

Name.......................................

Reg. No...................................

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2017

(CUCBCSS—UG)

Complementary Course

STS 3C 03—STATISTICAL INFERENCE

Time : Three Hours

Maximum : 80 Marks

Section A

*Answer **all** questions in **one** word.*
Each question carries 1 mark.

Name the following :

1. The process of making inference about the population based on samples taken from it.
2. The probability of rejecting null hypothesis when it is false.
3. The distribution used in testing goodness of fit.

Fill up the blanks :

4. An efficient estimator is an estimator with minimum ———.
5. If X follow standard normal distribution, then $Y = X^2$ follows ———.
6. If X_1 and X_2 are two independent standard normal variables, then $t = \frac{\sqrt{2}\,X_1}{\sqrt{X_1^2 + X_2^2}}$ follows ———.
7. The standard deviation of any statistic is called its ———.

Write True *or* False :

8. If $t_n \xrightarrow{p} \theta$, then t_n is a sufficient estimator of θ.
9. Fisher-Neyman theorem helps to obtain sufficient estimator.
10. A statistical hypothesis which completely specifies the population is simple hypothesis.

(10 × 1 = 10 marks)

Turn over

Section B

Answer **all** *questions in* **one** *sentence each.*
Each one carries 2 *marks.*

11. Define point estimator.
12. Define confidence coefficient.
13. Identify the distribution of the ratio of two independent standard normal random variables.
14. Define critical region.
15. Define consistent estimator.
16. State Fisher-Neymaan factorization theorem.
17. What is meant by paired t-test ?

(7 × 2 = 14 marks)

Section C

Answer any **three** *questions.*
Each one carries 4 *marks.*

18. Obtain the m.g.f. of a Chi-square random variable with n degrees of freedom.
19. Distinguish between one tailed and two tailed test.
20. Describe any two statistics following student's t-distribution.
21. Explain the method of maximum likelyhood estimation.
22. Explain the procedure of testing equality of variances.

(3 × 4 = 12 marks)

Section D

Answer any **four** *questions.*
Each one carries 6 *marks.*

23. For a random variable of size 16 from $N(\mu, \sigma)$ popuiation, the sample variance is 16.

    Find a and b such that $P(a < \sigma^2 < b) = 0.60$.
24. Find the mode of a random variable follow t-distribution with n degrees of freedom.
25. Explain the method of moment estimation. List the properties of a moment estimator.
26. Derive the confidence interval for the variance of a normal population.
27. In a sample of 60 items, 8 are damaged. Construct a 95% confidence interval for the true proportion of damaged items.
28. Explain the method of Chi-square test of independence.

(4 × 6 = 24 marks)

Section E

Answer any **two** *questions.*
Each one carries 10 *marks.*

29. (i) If t follows t-distribution with n degrees of freedom, prove that $Y = t^2$ follows $F(1, n)$.

(ii) Derive a statistic following F-distribution.

30. Use Neymaan-Pearson Theorem to find a most powerful test with significance level α for testing the hypothesis $H_0 : \mu = \mu_0$ against, $H_1 : \mu = \mu_1, (\mu_1 > \mu_0)$ using a random sample $x_1, x_2, ..., x_n$ drawn from the population with pdf $f(x) = \frac{1}{\sqrt{18\pi}} e^{-\frac{1}{18}(x-\mu)^2}, -\infty < x < \infty.$

31. Explain Chi-square test of goodness of fit. The theory predicts the proportion of beans in the four groups A, B, C and D should be 9 : 3 : 3 : 1. In an experiment among 1600 beans, the members in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory ?

32. (i) Explain the method of small sample testing of equality of means of two normal populations when the population standard deviations are unknown.

(ii) Gain in weights for two groups of rates fed on two types of diets are as follows :

Diet A	:	13	14	10	11	12	16	10	8	
Diet B	:	7	10	12	8	10	11	10	9	11

Test the effect of diet in gain in weights at 5% level of significance.

(2 × 10 = 20 marks)

D 14154 (Pages : 4) Name.................................

Reg. No...............................

THIRD SEMESTER B.Sc. DEGREE (SUPPLEMENTARY) EXAMINATION NOVEMBER 2016

(UG—CCSS)

Complementary Course

ST 3C 03—STATISTICAL INFERENCE

Time : Three Hours Maximum : 30 Weightage

Use of Calculator and Statistical table is permitted.

I. Answer all *twelve* questions :

1 If $X \sim N(0,1)$, then X^2 follows :

(a) χ^2. (b) $t_{(1)}$.

(c) $F_{(1, 1)}$. (d) None of these.

2 Sampling distribution of the mean of 16 random samples taken from N (17, 8) is ————.

(a) N (17, 1/8). (b) N (17, 1).

(c) N (0, 1). (d) N (17, 2).

3 Mean of a Chi-square random variable with n degrees of freedom is ————.

(a) n. (b) $1/n$.

(c) $2n$. (d) $1/2n$.

4 The median of $X \sim t_{(n)}$ is :

(a) n. (b) $n - 1$.

(c) 1. (d) 0.

5 An estimator with minimum variance for a parameter is ———— estimator.

(a) Unbiased. (b) Consistent.

(c) Efficient. (d) Sufficient.

6 MLE of using random samples $x_1, x_2, \ldots\ldots, x_n$ taken from U (0, θ) is ————.

(a) *Min* (x_1). (b) *Max* (x_1).

(c) $\bar{x}$. (d) $\sum x_1^2$.

Turn over

7 Length of the confidence interval for μ, using n random samples taken from N (μ, 4) is ————.

(a) $2t_{\frac{\alpha}{2}} \frac{4}{\sqrt{n}}$.   (b) $2t_{\frac{\alpha}{2}} \frac{16}{\sqrt{n}}$.

(c) $2t_{\alpha} \frac{4}{\sqrt{n}}$.   (d) None of these.

8 Probability distribution of the statistic used for finding the confidence interval for the variance of a normal population is ————.

(a) Normal.   (b) t.

(c) Chi-square.   (d) F.

9 Among the following hypothesis based on random samples taken from N (μ, σ), which is a simple hypothesis ?

(a) $H_0 : \mu = 4$.   (b) $H_0 : \mu > 4$.

(c) $H_0 : \sigma = 4$.   (d) $H_0 : \mu = 4, \sigma = 2$.

10 If the power of a test is e^{-1}. Type II error is ————.

(a) $1 - e^{-1}$.   (b) $1 + e^{-1}$.

(c) e^{-1}.   (d) $2e^{-1}$.

11 Small sample test to test the mean of a normal population when σ is unknown involves ———— distribution.

(a) Normal.   (b) t.

(c) F.   (d) Chi-square.

12 In Chi-square test of goodness of fit, the critical region with significance level α is ————.

(a) $\chi^2 > \chi^2_{\alpha}$.   (b) $\chi^2 < \chi^2_{\alpha}$.

(c) $\chi^2 > \chi^2_{\alpha/2}$.   (d) $\chi^2 < \chi^2_{\alpha/2}$.

(12 × ¼ = 3 weightage)

II. Short answer type questions. Answer all *nine* questions :

13 Define statistic and sampling distribution.

14 A random sample of size 16 was taken from N (8, 4). Obtain $P(\bar{x} > 7)$.

15 If $t \sim t_{(5)}$, find 'a' such that, $P(-a < t < a) = 0.98$.

16 What are the sufficient conditions for a consistent estimator.

17 State Fisher Neman Factorization theorem.

18 Define confidence coefficient.

19 Define critical region.

20 Find the power of the test for testing $H_0 : \theta = 2$ against $H_1 : \theta = 3$ using a random sample from U (0, θ) with a critical region $x > 1$.

21 State Neyman-Person Fundamental lemma.

(9 × 1 = 9 weightage)

III. Short essay type questions. Answer any *five* questions :

22 Define Chi-square distribution and obtain the m.g.f. of $X \sim \chi^2_{(n)}$.

23 Define sufficient estimator. For a Poisson distribution with parameter λ, show that sample mean $\bar{x}$ is the sufficient estimator of λ.

24 Explain the method of moments in estimation. Obtain the moment estimator of θ, if

$f(x, \theta) = \frac{1}{\theta^p \Gamma p} x^{p-1} e^{-\frac{x}{\theta}}, 0 < x < \infty$ where p is known based on the random samples $x_1, x_2, ... x_n$

from the population.

25 Obtain the confidence interval for the variance σ^2 with confidence coefficient $(1 - \alpha)$ based on the random sample of size n taken from N (μ, σ).

26 In a packet of 100 items, 13 had some damages. Construct a 95% confidence interval for the proportion of damaged items.

27 Explain the large sample test of the equality of the means of two populations.

28 Explain the F-test for the equality of variance of two normal populations.

(5 × 2 = 10 weightage)

IV. Essay type questions. Answer any *two* questions :

29 Define Student's *t*-distribution. Prove that $X^2 \sim F_{(1,n)}$, where X follow *t* distribution with *n* degrees of freedom.

30 The gain in weight of two random samples of rats of sizes 8 and 9 respectively fed on two different diets A and B are given below. Examine whether difference in gain is significant.

Diet A	:	13	14	10	11	12	16	10	8	
Diet B	:	7	10	12	8	10	11	9	10	11

31 Explain the Chi-square test of (1) goodness of fit ; (ii) Independence of attributes.

(2 × 4 = 8 weightage)

D 12427 (Pages : 3) Name.......................................

Reg. No.......................................

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2016

(CUCBCSS—UG)

Complementary Course

STS 3C 03—STATISTICAL INFERENCE

Time : Three Hours Maximum : 80 Marks

Section A

Answer all the **ten** *questions.*
1 mark each.

1. Give the pdf of t distribution with 2 degrees of freedom.
2. What is meant by degrees of freedom ?
3. Define unbiased estimator.
4. What is the variance of Chi-square distribution with 2 degrees of freedom ?
5. What is a null hypothesis ?
6. Suggest an estimator of size 1 from Poisson distribution with parameter θ which is consistent and biased for θ^2.
7. How sufficiency is related to conditional distribution ?
8. What is critical region ?
9. Name the distribution used for testing the equality of two population variances for small samples.
10. Give one example of a statistic.

(10 × 1 = 10 marks)

Section B

Answer all the **seven** *questions.*
2 marks each.

11. Distinguish between Null and Alternative hypotheses.
12. What is meant by interval estimation ?
13. Give one example of a statistic following F distribution.
14. What is a statistical hypothesis ? Give an example.
15. Mention the test and the test statistic employed for testing whether population mean has a specified value in case of large samples.

Turn over

16. How we compare the efficiencies of two estimators ?

17. Let $x_1, x_2, \ldots, x_n$ be a random sample from $N(0, \theta^2)$. Give a point estimator of θ^2.

(7 × 2 = 14 marks)

Section C

Answer any **three** *questions.*
Each carries 4 marks.

18. Explain the method of moment estimation.

19. Obtain the confidence interval for the mean of a normal population when variance is known.

20. Explain :
    (i) Two types of errors ; and
    (ii) Power of test.

21. Define sufficiency with an example.

22. Explain the test procedure for testing equality of means based on large sample.

(3 × 4 = 12 marks)

Section D

Answer any **four** *questions.*
Each carries 6 marks.

23. Distinguish between simple and composite hypotheses with two examples each.

24. Derive the distribution of sample mean if samples are taken from Normal distribution with mean 0 and variance 4.

25. Give a rough sketch of Chi-square distribution for $n = 1, 2$.

26. Derive maximum likelihood estimates of μ, σ^2 of a normal population.

27. To test $H_0 : \theta = 1$ against $H_1 : \theta = 2$, a random sample of size 1 is taken from an exponential distribution with parameter θ. Compute probabilities of two types of errors and power of the test for the critical region, $X \geq 1$.

28. State the interrelation among Normal, Chi-square, t and F distributions.

(4 × 6 = 24 marks)

Section E

Answer any **two** *questions.*
Each carries 10 *marks.*

29. (i) Distinguish between point estimation and interval estimation with examples.

    (ii) What are the uses of t distribution ?

30. (i) The observed frequencies of cells such as (1, 1), (1, 2), (1, 3), (2, 1), (2, 2) and (2, 3) are respectively 40, 35, 55, 30, 65 and 75. Obtain the value of χ^2.

    (ii) How F table is prepared ?

31. (i) Explain the test procedure for testing equality of population proportions based on large samples.

    (ii) Obtain the 95 % confidence interval for $\mu_1 - \mu_2$ if samples are taken from two normal populations with :

    $\bar{x}_1 = 20, \bar{x}_2 = 16, \sigma_1^2 = 9, \sigma_2^2 = 16, n_1 = 30$ and $n_2 = 50$.

(2 × 10 = 20 marks)

D 72409 (Pages : 3) Name..............................

Reg. No..............................

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2014

(UG-CCSS)

Complementary Course—Statistics

ST 3C 03—STATISTICAL INFERENCE

Time : Three Hours Maximum : 30 Weightage

Part A

Answer **all** *questions.*
Each question carries ¼ weightage.

Fill in the blanks :

1. Moment generating function of Chi-square distribution with 10 degrees of freedom is ———.
2. If X has F-distribution with (n, m) degrees of freedom, then the distribution of X^{-1} is ———.
3. Probability of first kind of error is called ———.
4. Range of variation of Student's t-distribution is ———.

State True *or* False :

5. Population variance is an example for a statistic.
6. Bias of an estimator is always positive.
7. Consistency is a large sample property.
8. Equality of variances of two normal populations can be tested by F-statistic.

Choose the correct answer :

9. Student's t distribution is :
   - (a) Positively skewed.
   - (b) Negatively skewed.
   - (c) Symmetric.
   - (d) None of the above.
10. If T is a consistent estimate of θ, then :
    - (a) T is a consistent estimator θ^2.
    - (b) T^2 is a consistent estimator of θ.
    - (c) T^2 is a consistent estimator of $\theta - 1$.
    - (d) None of the above.
11. In large sample test for testing the equality of proportions, the test statistic follows :
    - (a) Normal distribution.
    - (b) t-distribution.
    - (c) F-distribution.
    - (d) Chi-square distribution.

Turn over

12. The maximum likelihood estimator are necessarily :

(a) Unbiased. (b) Sufficient.

(c) Most efficient. (d) None of the above.

(12 × ¼ = 3 weightage)

Part B

Answer **all** *nine questions.*
Each question carries 1 *weightage.*

13. 13.Distinguish between parameter and statistic.
14. Define Student's t-statistic.
15. What do you meant by standard error ?
16. If X_1, X_2, is a random sample of size three taken from a population with mean μ and variance σ^2, compare the efficiencies of the estimators $X_1 + X_2$ and $3X_1 - 2X_2$.
17. State the Fisher Neyman factorization theorem for sufficiency.
18. What are the properties satisfied by maximum likelihood estimator ?
19. Estimate the parameters of the binomial distribution if the mean of the sample is 6 and variance 3/2.
20. Distinguish between simple and composite hypothesis.
21. What do you meant by two sided test ?

(9 × 1 = 9 weightage)

Part C

Answer any **five** *questions.*
Each question carries 2 *weightage.*

22. Define chi-square statistic and give its probability density function
23. State the relation between chi-square and F-distribution.
24. Discuss the applications t-distribution
25. If T is an unbiased estimate of a parameter μ, check whether T^2 is unbiased for μ^2.
26. Obtain the maximum likelihood estimator of the parameter λ of Poisson distribution based on the sample values 6, 2, 1, 9, 4, 2,3.
27. Describe the method moments estimation.
28. Explain the general procedure for parametric interval estimation.

(5 × 2 = 10 weightage)

Part D

Answer any **two** *questions.*
Each question carries 4 weightage.

29. What are the desirable properties to be satisfied by a good estimate ? Give *one* example each of estimates possessing each of the desirable properties.

30. Obtain the most powerful test for testing $H_0 : \theta = \theta_0$ against $H_0 : \theta = \theta_1$, where θ is the parameter of a distribution having pdf $f(x) = \theta x^{\theta-1}, 0 < x < 1, \theta > 0$.

31. Explain Chi-square test for goodness of fit.

(2 × 4 = 8 weightage)