2016

Set No. : 1 Question Booklet No.

**RET/16/TEST-B** **896 Statistics (Science)**

*(To be filled up by the candidate by blue/black ball point pen)*

Roll No. | | | | | | | | | | |

Roll No. (Write the digits in words) .....

Serial No. of OMR Answer Sheet .....

Day and Date .....

( Signature of Invigilator )

## *INSTRUCTIONS TO CANDIDATES*

***(Use only blue/black ball-point pen in the space above and on both sides of the Answer Sheet)***

1. Within 30 minutes of the issue of the Question Booklet, Please ensure that you have got the correct booklet and it contains all the pages in correct sequence and no page/question is missing. In case of faulty Question Booklet, Bring it to the notice of the Superintendent/Invigilators immediately to obtain a fesh Question Booklet.
2. Do not bring any loose paper, written or blank, inside the Examination Hall ***except the Admit Card without its envelope.***
3. ***A separate Answer Sheet is given. It should not be folded or mutilated. A second Answer Sheet shall not be provided.***
4. Write your Roll Number and Serial Number of the Answer Sheet by pen in the space provided above.
5. ***On the front page of the Answer Sheet, write by pen your Roll Number in the space provided at the top, and by darkening the circles at the bottom. Also, wherever applicable, write the Question Booklet Number and the Set Number in appropriate places.***
6. ***No overwriting is allowed in the entries of Roll No., Question Booklet No. and Set No. (if any) on OMR sheet and Roll No. and OMR sheet no. on the Question Booklet.***
7. ***Any change in the aforesaid entries is to be verified by the invigilator, otherwise it will be taken as unfair means.***
8. ***This Booklet contains 40 multiple choice questions followed by 10 short answer questions. For each MCQ, you are to record the correct option on the Answer Sheet by darkening the appropriate circle in the corresponding row of the Answer Sheet, by pen as mentioned in the guidelines given on the first page of the Answer Sheet. For answering any five short Answer Questions use five Blank pages attached at the end of this Question Booklet.***
9. For each question, darken only **one** circle on the Answer Sheet. If you darken more than one circle or darken a circle partially, the answer will be treated as incorrect.
10. ***Note that the answer once filled in ink cannot be changed. If you do not wish to attempt a question, leave all the circles in the corresponding row blank (such question will be awarded zero marks).***
11. For rough work, use the inner back pages of the title cover and the blank page at the end of this Booklet.
12. ***Deposit both OMR Answer Sheet and Question Booklet at the end of the Test.***
13. You are not permitted to leave the Examination Hall until the end of the Test.
14. If a candidate attempts to use any form of unfair means, he/she shall be liable to such punishment as the University may determine and impose on him/her.

**Total No. of Printed Pages : 20**

SEAL

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ROUGH WORK
रफ़ कार्य

# Research Entrance Test-2016

## No. of Questions : 50

## प्रश्नों की संख्या : 50

*Time : 2 Hours* | *Full Marks : 200*

*समय : 2 घण्टे* | *पूर्णाङ्क : 200*

**Note: (1)** This Question Booklet contains **40** Multiple Choice Questions followed by **10** Short Answer Questions.

इस प्रश्न पुस्तिका में **40** वस्तुनिष्ठ व **10** लघु उत्तरीय प्रश्न हैं।

**(2)** Attempt as many MCQs as you can. Each MCQ carries **3 (Three)** marks. **1 (One)** mark will be deducted for each incorrect answer. **Zero** mark will be awarded for each unattempted question. If more than one alternative answers of MCQs seem to be approximate to the correct answer, choose the closest one.

अधिकाधिक वस्तुनिष्ठ प्रश्नों को हल करने का प्रयत्न करें। प्रत्येक वस्तुनिष्ठ प्रश्न **3** (तीन) अंकों का है। प्रत्येक गलत उत्तर के लिए **1** (एक) अंक काटा जायेगा। प्रत्येक अनुत्तरित प्रश्न का प्राप्तांक **शून्य** होगा। यदि वस्तुनिष्ठ प्रश्नों के एकाधिक वैकल्पिक उत्तर सही उत्तर के निकट प्रतीत हों, तो निकटतम सही उत्तर दें।

**(3)** Answer only **5** Short Answer Questions. Each question carries **16 (Sixteen)** marks and should be answered in **150-200** words. Blank **5 (Five)** pages attached with this booklet shall only be used for the purpose. Answer each question on separate page, after writing Question No.

केवल **5** (**पाँच**) लघुउत्तरीय प्रश्नों के उत्तर दें। प्रत्येक प्रश्न **16** (**सोलह**) अंकों का है तथा उनका उत्तर **150-200** शब्दों के बीच होना चाहिए। इसके लिए इस पुस्तिका में लगे हुए सादे **5** (**पाँच**) पृष्ठों का ही उपयोग आवश्यक है। प्रत्येक प्रश्न का उत्तर एक नए पृष्ठ से, प्रश्न संख्या लिखकर शुरू करें।

**01.** Which is not true for reactions by the $S_N2$ mechanism ?

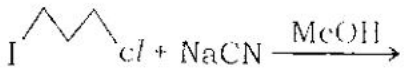
(1) proceeds through a backside attack and results in inversion

(2) tends to proceed with weak nucleophiles solvents like $CH_3OH$, $H_2O$, $CH_3CH_2OH$.

(3) rate of reaction proceeds from primary (fastest) > secondary >> tertiary (slowest)

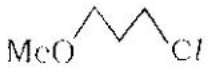
(4) occurs in one step

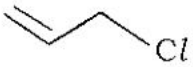
**02.** Which is the main product of the following reaction ?



(1) 

(2) 

(3) 

(4) 

**03.** Which of the following conditions is necessary for a reaction to be spontaneous ?

(1) $\Delta S_{sur} > 0$

(2) $\Delta S_{sys} > 0$

(3) $\Delta S_{sur} + \Delta S_{sys} > 0$

(4) $\Delta S_{sur} + \Delta S_{sys} < 0$

**04.** Dead organs are generally stored in formalin. Formalin is :

(1) aqueous formaldehyde

(2) aqueous ferrous sulphate

(3) aqueous formic acid

(4) aqueous ferric alum

**05.** Regarding "carbon credits", which one of the following statement is **not** correct :

(1) The carbon credit system was ratified in conjunction with the Kyoto Protocol.

(2) Carbon credits are awarded to countires or groups that have reduced greenhouse gases below their emission quota.

(3) The goal of the carbon credit system is to limit the increase of carbon dioxide emission.

(4) Carbon credits are traded at a price fixed from time to time by the United Nations Environment Progrmme.

**06.** Ball bearings are used in bicycles, cars, etc., because :

(1) the actual area of contact between the wheel and axle is increased.

(2) the effective area of contact between the wheel and axle is increased

(3) the effective area of contact between the wheel and axle is reduced

(4) the actual area of contact between the wheel and axle is reduced.

**07.** During respiration, energy is released. It is stored in the form of :

(1) ADP (2) ATP (3) NADP (4) APP

**08.** Which of the following is known as Royal disease :

(1) Sickle cell anemia (2) Haemophilia

(3) Alzheimers disease (4) Colour blindness

**09.** The xylem in plants is responsible for :

(1) transport of water (2) transport of food

(3) transport of oxygen (4) transport of amino acids

**10.** Two wires, of the same material, have their lenghts in the ratio 1:2 and their diameters in the ratio 2:1. If both are stretched separately by equal weights, the ratio of increase in their lengths, $L_1 : L_2$ would be :

(1) 1:2 (2) 2:1 (3) 1:8 (4) 8:1

**11.** Which of the following index is used to measure the extent of preference for ages ending with 0 and 5 ?

(1) Myers index (2) Whipple index

(3) UN age sex accuracy index (4) All three

**12.** A married women having 2 still births and one live birth is said to have parity :

(1) 1 (2) 2

(3) 3 (4) None of the above

**13.** Interval between survey point and last birth is called :

(1) Forward birth interval (2) Open birth interval

(3) Inter live birth interval (4) None of the above

**14.** In any country mortality rate is very high, the pattern of age-specific death rate is :

(1) S shapped (2) J shapped

(3) U shapped (4) Interted U shapped

**15.** For the calculation of maternal mortality rate. The denominator is :

(1) Total number of women in reprodutive ages

(2) Total number of pregnancies in given time

(3) Total number of live births in given time

(4) Total population in given time

**16.** Bias of ratio estimater is :

(1) $\text{cov.}\left(\bar{y},\bar{x}\right)$ (2) $-\text{cov.}\left(\bar{y},\hat{R}\right)$

(3) $-\text{cov.}\left(\hat{R},\bar{x}\right)/\bar{x}$ (4) $\text{cov.}\left(\hat{R},\bar{x}\right)*\bar{x}$

**17.** The Bowley's formula for proportional allocation is

(1) $n_i \alpha N_i S_i$ (2) $n_i \alpha \frac{N_i S_i}{C_i}$

(3) $n_i \alpha S_i$ (4) $n_i \alpha N_i$

**18.** When an investigator wants a sample containing m units which possess a rare attribute, the appropriate sample procedure is :

(1) SRSWOR (2) Stratified Sampling

(3) Inverse Sampling (4) Syotematic Sampling

**19.** If the sample values are 1, 3, 5, 7, 9 the S.E. of sample mean is :

(1) $\sqrt{2}$ (2) $1/\sqrt{2}$

(3) 2 (4) $\frac{1}{2}$

**20.** The variance of the warner's RRT model is given by :

(1) $\frac{\pi(1-\pi)}{n}+\frac{P(1-P)}{n(2P-1)^2}$ (2) $\frac{\pi}{n}+\frac{P}{n}$

(3) $\frac{P\pi}{n}+\frac{(1-P)(1-\pi)}{n}$ (4) $\frac{\pi+P}{n(1-n)}$

**21.** On the basis of random sample $x_1, x_2, \ldots, x_n$ of size n from :

$$f_\theta = \frac{1}{2} e^{-|x-\theta|}, \quad -\infty < x < \infty$$

the maximum likelihood estimator of $\theta$ is :

(1) $\bar{X}$ (2) $\sum_{i=1}^{n} Xi$

(3) $\sum_{i=1}^{n} |Xi)$ (4) Median (Xi)

**22.** Cramer – Rao inequality provides a lower bound $\frac{\{\psi'(\theta)\}^2}{I(\theta)}$ to the variance of the estimator of $\psi(\theta)$ where is estimator is :

(1) Consistent for (2) Sufficient for

(3) Unbaised for (4) None of the above

**23.** Under general conditions the estimators obtained by the method of moments are :

(1) Always normal and efficient

(2) Asymptotically normal and efficient

(3) Always normal but not in general efficient

(4) Asymptotically normal but not in general efficient

**24.** The Basu's theorem states that is $S(\underline{X})$ is a complete sufficient statistics for $\theta$, then any ancilliary statistics $A(\underline{X})$ is independent of S

(1) The converse is true

(2) The converse is not necessary true

(3) The converse is never true

(4) None of the above

**25.** If $T(\underset{\sim}{x}) = T(x_1, x_2, \ldots x_n)$ be an unbaised estimater of $Y(\theta)$ where $\theta \in (H)$ then :

(1) Y may be vector valued

(2) Y may be only real valued

(3) Both (i) and (ii) are true

(4) None of the above

**26.** In a fertilizer experiment the doses of the fertilizer tried were 0, 20, 40, 60 and 80. Using the yield data by principle of least squares, the following model was fitted :

$Y = 25 + 4.50\ F - 0.05\ F^2$

Where F is the fertilizer dose, which one of the following is the best :

(1) 80 (2) 60

(3) 45 (4) 40

**27.** Consider the following statements :

(A) Analysis of variance is a systematic procedure of partitioning the total variation present in a set of data into a number of components associated with the nature of classification.

(B) In a linear hypothesis model the true value of $i^{th}$ unit is a linear combination of a fixed effect treated as contrasts .

Which of the statement given above is/ are correct ?

(1) A only (2) B only

(3) Both A and B (4) Neither A nor B

**28.** Under the Guass-Markov model, if $\lambda'\beta$ is an estimable function of $\beta$ then consider the following statements :

(A) $\lambda$ belongs to row space

(B) $.\lambda$ belongs to column space

Which of the statements given above is/are correct ?

(1) A only (2) B only

(3) Both A and B (4) Neither A nor B

**29.** An urn contains 10 balls of which M are white and 10-M are black. To test M =5 against the alternative hypothesis that M = 6, one draws 3 balls from the urn without replacement. The null hypothesis is rejected if the sample contains 2 or 3 white balls, otherwise it is accepted. What will be the size of the test ?

(1) 1/9 (2) 2/9

(3) 1/5 (4) 1/2

**30.** Let $x_1, x_2, \ldots\ldots, x_n$ be a random sample of size n from N $(\mu, \sigma^2)$ where $\sigma^2$ is known. Using the method of Likelihood ratio test what will be the critical region for the test of hypothesis $H_0 : \mu = \mu_0$ against $H_1 \; \mu > \mu_0$

(1) $\frac{\sqrt{n}}{\sigma}(\bar{x} - \mu_0) > -z_\alpha$ (2) $\frac{\sigma}{\sqrt{n}}(\bar{x} - \mu_0) < z_\alpha$

(3) $\frac{\sqrt{n}}{\sigma}(\bar{x} - \mu_0) > z_\alpha$ (4) $\frac{\sigma^2}{n}(\bar{x} - \mu_0) < - z_\alpha$

**31.** Suppose you have a Beta (4, 4) prior distribution on the probability $\theta$ that a coin will yield a 'head' when spun in specified manner. The coin is independently spun ten times, and 'head's appear fewer than 3 times. You are not told how many heads were seen, only that the number is less than 3. The exact posterios density (upto a proportionality constant) for $\theta$ will be :

(1) $p(\theta/\text{data}) \alpha\, \theta^3 (1-\theta)^{10} + 10\,\theta (1-\theta)^9 + 45\,\theta^2 (1-\theta)^8$

(2) $p(\theta/\text{data}) \alpha\, \theta^3 (1-\theta)^{13} + 10\,\theta^4 (1-\theta)^{12} + 45\,\theta^5 (1-\theta)^{11}$

(3) $p(\theta/\text{data}) \alpha\, (1-\theta)^{10} + 10\,\theta^4 (1-\theta)^9 + 45\,\theta^5 (1-\theta)^8$

(4) $p(\theta/\text{data}) \alpha\, (1-\theta)^{13} + 10\,\theta (1-\theta)^{12} + 45\,\theta^5 (1-\theta)^{11}$

**32.** If A and B are any two events of a random experiment, then $P(A/B) + P(\bar{A}/B)$ is :

(1) equal to '0'

(2) less than '1'

(3) greater than '0' but less than '1'

(4) equal to '1'

**33.** For a distribution, the cumulants are given by :

$K_r = n\{(r-1)!\}; n > 0$

Then the characteristic function of the distribution is :

(1) $\phi(t) = (1-it)^{n/2}$ (2) $\phi(t) = (1-it)^{n}$

(3) $\phi(t) = (1-it)^{-n/2}$ (4) $\phi(t) = (1-it)^{-n}$

**34.** If A and B are two events, the probability that exactly ore of them occurs is given by :

(1) $P(\bar{A})+P(\bar{B})-2P(\bar{A}\cap\bar{B})$ (2) $P(A)+P(B)-P(A\cap B)$

(3) $P(A)+P(B)-2P(A\cap B)$ (4) $P(A)+P(B)+P(A\cap B)$

**35.** E (x/y= y) exists if :

(1) E(x) exists (2) E (|x|/V = y) exists

(3) E (y) exists (4) none of the above

**36.** Let $(x_1, x_2, x_3) \sim N_p(0, \Sigma)$ where $\Sigma = \begin{pmatrix} 7 & 3 & 2 \\ 3 & 4 & 1 \\ 2 & 1 & 2 \end{pmatrix}$ then the distribution of $x_1 + 2x_2 - 3x_3$ is :

(1) N (0,9) (2) N (0,27)

(3) N (0,18) (4) N (0,25)

**37.** If $x_1, x_2, \ldots\ldots x_N$ is i.i.d. $N(\mu, \Sigma)$ the distribution of $N(\bar{x} - \mu)' \Sigma^{-1} (\bar{x} - \mu)$ is :

(1) Chi – square with p d.f.

(2) Hotelling $T^2$ with p d.f.

(3) Chi – square with (N – 1) d.f.

(4) Hotelling $T^2$ with (N-1) d.f.

**38.** $R = R1.23 \ldots p$ is sample multiple correlation coefficient is computed from a random sample of size N from multivariate normal population with population multiple correlation coefficient zero. The distribution of $\frac{R^2}{1 - R^2} \frac{N - p}{p - 1}$ is :

(1) t – distribution with (N – p) d.f.

(2) F – distribution with (N – p) d.f.

(3) F – distribution with (p – 1) (N – p) d.f.

(4) Hotelling $T^2$ with (N-p) d.f.

**39.** If there are n jobs to be performed one at a time on each of m machines, the possible sequences would be :

(1) $(m)^n$ (2) $(m!)^n$

(3) $(n)^m$ (4) $(n!)^m$

**40.** For a maximization problem, the objective function coefficient for an artificial variable is :

(1) + M (2) - M

(3) zero (4) none of the given

## *Short Answer Questions*

**Note:** Attempt any **five** questions. Write answer in **150-200** words. Each question carries **16** marks. Answer each question on separate page, after writing Question Number.

**1.** Describe Singulate Mean Age at Marriage (SMAM) method briefly.

**2.** When do you use indirect method for standardizing age composition ? Explain this method.

**3.** Let $<x_n>$ be a sequence of random variables defined by

$$P(X_n = \pm n^{\alpha}) = \frac{1}{2}$$

obtain the values of $\alpha$, if any, for which SLLN, hold for the above sequence.

**4.** Give the algorithm of Gibbs sampler when the parameter vector has three components.

**5.** Let $x_1, x_2, \ldots, x_n$ be a random sample from Poisson distribution with parametor $\theta$. Considering Gamma distributions G (a, b) as prior distribution for the parameter $\theta$, obtain the Bayes estimator of $\theta$ under squared error loss function.

**6.** Explain likelihood ratio test and show that it does not provide always an unbaised test.

**7.** Write the Gauss Morkov lineov model. Under this model, show that the least square estimates are the best linear estimators (BLVEs).

**8.** Obtain the expression of variance of Hansen-Huruitz estimator.

**9.** State and prove reproductive property of Wishart distribution.

**10.** Define crash time and crash cost.

| Question No. | Page for Short Answer |
|---|---|

| Question No. | Page for Short Answer |
|---|---|

| *Question No.* | Page for Short Answer |
|---|---|

Question No. Page for Short Answer

| Question No. | Page for Short Answer |
|---|---|

**ROUGH WORK**

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# अभ्यर्थियों के लिए निर्देश

***(इस पुस्तिका के प्रथम आवरण पृष्ठ पर तथा उत्तर-पत्र के दोनों पृष्ठों पर केवल नीली-काली बाल-प्वाइंट पेन से ही लिखें)***

1. प्रश्न पुस्तिका मिलने के 30 मिनट के अन्दर ही देख लें कि प्रश्नपत्र में सभी पृष्ठ मौजूद हैं और कोई प्रश्न छूटा नहीं है। पुस्तिका दोषयुक्त पाये जाने पर इसकी सूचना तत्काल कक्ष-निरीक्षक को देकर सम्पूर्ण प्रश्नपत्र की दूसरी पुस्तिका प्राप्त कर लें।
2. परीक्षा भवन में ***लिफाफा रहित प्रवेश-पत्र के अतिरिक्त,*** लिखा या सादा कोई भी खुला कागज साथ में न लायें।
3. ***उत्तर-पत्र अलग से दिया गया है। इसे न तो मोड़ें और न ही विकृत करें। दूसरा उत्तर-पत्र नहीं दिया जायेगा। केवल उत्तर-पत्र का ही मूल्यांकन किया जायेगा।***
4. अपना अनुक्रमांक तथा उत्तर-पत्र का क्रमांक प्रथम आवरण-पृष्ठ पर पेन से निर्धारित स्थान पर लिखें।
5. ***उत्तर-पत्र के प्रथम पृष्ठ पर पेन से अपना अनुक्रमांक निर्धारित स्थान पर लिखें तथा नीचे दिये वृत्तों को गाढ़ा कर दें। जहाँ-जहाँ आवश्यक हो वहाँ प्रश्न-पुस्तिका का क्रमांक तथा सेट का नम्बर उचित स्थानों पर लिखें।***
6. ***ओ० एम० आर० पत्र पर अनुक्रमांक संख्या, प्रश्नपुस्तिका संख्या व सेट संख्या (यदि कोई हो) तथा प्रश्नपुस्तिका पर अनुक्रमांक और ओ० एम० आर० पत्र संख्या की प्रविष्टियों में उपरिलेखन की अनुमति नहीं है।***
7. ***उपर्युक्त प्रविष्टियों में कोई भी परिवर्तन कक्ष निरीक्षक द्वारा प्रमाणित होना चाहिये अन्यथा यह एक अनुचित साधन का प्रयोग माना जायेगा।***
8. ***प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार वैकल्पिक उत्तर दिये गये हैं। प्रत्येक प्रश्न के वैकल्पिक उत्तर के लिए आपको उत्तर-पत्र की सम्बन्धित पंक्ति के सामने दिये गये वृत्त को उत्तर-पत्र के प्रथम पृष्ठ पर दिये गये निर्देशों के अनुसार पेन से गाढ़ा करना है।***
9. प्रत्येक प्रश्न के उत्तर के लिए केवल एक ही वृत्त को गाढ़ा करें। एक से अधिक वृत्तों को गाढ़ा करने पर अथवा एक वृत्त को अपूर्ण भरने पर वह उत्तर गलत माना जायेगा।
10. ***ध्यान दें कि एक बार स्याही द्वारा अंकित उत्तर बदला नहीं जा सकता है। यदि आप किसी प्रश्न का उत्तर नहीं देना चाहते हैं, तो संबंधित पंक्ति के सामने दिये गये सभी वृत्तों को खाली छोड़ दें। ऐसे प्रश्नों पर शून्य अंक दिये जायेंगे।***
11. रफ कार्य के लिए प्रश्न-पुस्तिका के मुखपृष्ठ के अंदर वाला पृष्ठ तथा उत्तर-पुस्तिका के अंतिम पृष्ठ का प्रयोग करें।
12. परीक्षा के उपरान्त केवल ***ओ एम आर उत्तर-पत्र*** परीक्षा भवन में जमा कर दें।
13. परीक्षा समाप्त होने से पहले परीक्षा भवन से बाहर जाने की अनुमति नहीं होगी।
14. यदि कोई अभ्यर्थी परीक्षा में अनुचित साधनों का प्रयोग करता है, तो वह विश्वविद्यालय द्वारा निर्धारित दंड का/की, भागी होगा/होगी।