Seat No.

M.Sc. (Part – I) (Semester – II) Examination, 2016
STATISTICS (Paper – X)
Sampling Theory (New CBCS)

Day and Date : Saturday, 9-4-2016   Total Marks : 70
Time : 10.30 a.m. to 1.00 p.m.

Instructions : 1) Attempt **five** questions.
2) Q. No. **(1)** and Q. No. **(2)** are **compulsory**.
3) Attempt **any three** from Q. No. **(3)** to Q. No. **(7)**.
4) Figures to the **right** indicate **full** marks.

1. A) Select the correct alternative :

   1) How often does the census bureau in India take a complete population count ?
      a) Every year   b) Every five years
      c) Every ten years   d) Twice a year

   2) Which one of the following estimator is generally biased ?
      a) Difference estimator   b) Ratio estimator
      c) Horvitz-Thompson estimator   d) Hansen-Hurwitz estimator

   3) If n units are selected in a sample from N population units, then sampling fraction is

      a) $\dfrac{1}{n}$ b) $\dfrac{1}{N}$ c) $\dfrac{n}{N}$ d) $\dfrac{n-1}{N}$

   4) A city is subdivided into 200 non-overlapping blocks. Ten are selected at random and completely enumerated. The procedure is
      a) Systematic sampling   b) Cluster sampling
      c) Stratified sampling   d) SRSWR

   5) Harvitz-Hansen technique is used to deal with
      a) Sampling errors   b) Non sampling errors
      c) Non response errors   d) None of the above

P.T.O.

B) Fill in the blanks :

1) In simple random sampling the finite population correction for variance is

2) Under SRSWOR, the sample unit can occur _____ in the sample.

3) Deming's technique deals with _____

4) A random start automatically fixes the subsequent selection of sample units in _____ sampling method.

5) The basic principle of stratifying a population is that, the strata should be internally _____

C) State whether following statements are **true** or **false**.

1) Desraj ordered estimators are biased.

2) Lahiri's method is convenient for PPSWR sampling.

3) Regression estimators are generally biased.

4) Midzuno system of sampling is used in systematic sampling. **(5+5+4)**

2. a) Answer the following :

   i) Explain circular systematic sampling.

   ii) Describe Lahiri's method for drawing PPSWR samples.

   b) Write short note on the following :

   i) Two stage sampling

   ii) Murthy's unordered estimator. **(6+8)**

3. a) Define :

   i) Sampling unit

   ii) Sampling frame

   iii) Non-sampling error.

   b) In SRSWR scheme, show that $\mathrm{Var}(\overline{y}) = \dfrac{\sigma^2}{n}$. **(6+8)**

4. a) Explain the problem of allocating the sample size in stratified random sampling. Derive the proportional allocation.

   b) Define cluster sampling. Develop a basic theory for single stage cluster sampling for estimating a population mean by assuming SRSWOR of clusters.

   (7+7)

5. a) Define PPSWR sampling design. Obtain an unbiased estimator of population total and its variance when PPSWR sample of size n is drawn from a population of size N.

   b) Explain ordered and unordered estimators. Develop Murthy's unordered estimator for n = 2. **(7+7)**

6. a) Describe linear systematic sampling. Derive the sampling variance of unbiased estimator of population mean under this scheme.

   b) Define ratio estimator and derive the approximate expression for bias. Assume SRSWOR scheme. **(7+7)**

7. a) Explain the problem of non response and any one technique to deal with non-response.

   b) Outline regression method of estimating a population mean. Assuming SRSWOR, derive the MSE of the estimator. **(7+7)**

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Seat
No.

M.Sc. (Part – I) (Semester – II) Examination, 2015
STATISTICS (Paper – X)
Sampling Theory (Old)

Day and Date : Saturday, 25-4-2015   Total Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions : 1) Attempt **five** questions.
                           2) Q. No. **1** and Q. No. **2** are **compulsory**.
                           3) Attempt **any three** from Q. No. **3** to Q. No. **7**.
                           4) Figures to the **right** indicate **full** marks.

1. a) Choose the correct alternative :   **5**

    1) If an investigator selects districts from a state and farmers from selected
       districts then such a sampling procedure is _____
       a) systematic sampling   b) double sampling
       c) two-stage sampling   d) cluster sampling

    2) Systematic sampling means _____
       a) selecting n continuous units
       b) selecting n units situated at equal intervals
       c) selection of n largest units
       d) selection of any n units

    3) Under proportional allocation, the sample size for i^{th} stratum is proportional
       to _____

       a) N_i b) $N_i S_i$ c) $N_i S_i^2$ d) $\dfrac{N_i}{S_i}$

    4) Which of the following estimators is generally biased ?
       a) Horvitz-Thompson Estimator
       b) Des Raj estimator
       c) Heartly-Ross estimator
       d) Ratio estimator

P.T.O.

5) Non sampling errors occurs in _____

   a) only sample surveys

   b) only complete enumeration

   c) sample surveys as well as complete enumeration

   d) none of these

b) Fill in the blanks : **5**

1) Horvitz-Thompson estimator is used when sample selection is done with _____ probabilities.

2) Errors introduced in editing, coding and tabulating the results are _____ errors.

3) Strata in stratified sampling should be internally _____

4) Under SRSWOR, the sample unit can occur _____ in the sample.

5) If 30 units are drawn in a population of 300 units then sampling fraction is _____

c) State whether the following statements are **True** or **False** : **4**

1) Des Raj estimators are unbiased.

2) In PPSWR sampling design, an unbiased estimator of the population means does not exist.

3) In two-stage sampling, second stage units should be always equal sized.

4) Lahiri's method is convenient for PPSWR sampling.

2. a) Answer the following : **6**

  i) Explain sampling method and census method.

  ii) In SRSWOR, show that the probability of drawing a specified unit at every draw is same.

b) Write short notes on the following : **8**

  i) Circular systematic sampling.

  ii) Cumulative total method.

3. a) In SRSWOR examine whether sample mean is an unbiased estimator of population mean. Derive its variance.

   b) Define linear systematic sampling. Derive the sampling variance of the traditional unbiased estimator of a population mean under this scheme. **(6+8)**

4. a) Explain two stage sampling. Give a practical situation where such a design can be used.

   b) Explain a cluster sampling. In SRSWOR of n clusters each containing M elements from a population of N clusters. Show that sample mean is unbiased estimator of population mean. **(7+7)**

5. a) Describe stratified random sampling. Explain various sample allocation criteria in stratified sampling.

   b) Explain the concept of formation of strata. Derive the proportional allocation for the best value of the boundary point Y_h of hth stratum. **(7+7)**

6. a) Explain the ratio and regression methods of estimation.

   b) Make a comparison between the ratio and regression estimators in terms of MSE and state when the ratio estimator can be more efficient than regression estimator. Justify your answer. **(7+7)**

7. a) What is the problem of non response ? Discuss Hansen-Hurwitz technique for dealing this problem.

   b) Define ordered and unordered estimators. Develop Murthy's unordered estimator for n = 2. **(7+7)**

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Seat No.		Set	P

M.Sc. (Semester - II) (CBCS) Examination Oct/Nov-2019
Statistics
SAMPLING THEORY

Day & Date: Monday, 11-11-2019　　　　　　　　　　　　Max. Marks: 70
Time: 11:30 AM To 02:00 PM

Instructions: 1) All questions are compulsory.
　　　　　　　　2) Figures to the right indicate full marks.

Q.1　Fill in the blanks by choosing correct alternatives given below.　　14

1) If a heterogeneous population can be easily divided into sub populations with relatively small variability between the subpopulations then appropriate sampling design is _____.
   a) Stratified　　　　　　　　　　b) Two stage
   c) Systematic　　　　　　　　　　d) Cluster

2) In SRSWOR, the probability that a particular unit will be selected at r^{th} draw is _____.
   a) $\dfrac{r}{N}$　　　　　　　　　　b) $\dfrac{1}{N-r}$
   c) $\dfrac{1}{N}$　　　　　　　　　　d) $\dfrac{1}{N-r+1}$

3) In a linear systematic sampling with interval 40 from a population of 1000 units, the probability that a specified units is included in the sample is _____.
   a) $\dfrac{1}{35}$　　　　　　　　　　b) $\dfrac{1}{40}$
   c) $\dfrac{25}{40}$　　　　　　　　　　d) $\dfrac{1}{1000}$

4) A population of size $N = 5$ units has mean $\bar{Y}_N = 12$ and $S^2 = 100$. A simple random sample of size $n = 2$ units is drawn without replacement and sample mean is denoted by $\bar{Y}_n$. Then $E[\bar{Y}_n^{\,2}]$ is _____.
   a) 30　　　　　　　　　　　　b) 50
   c) 144　　　　　　　　　　　d) 174

5) In simple random sampling, the ratio estimator is _____.
   a) Always biased　　　　　　　　b) Always unbaised
   c) Minimum variance unbiased　　d) None of these

6) In SRSWR scheme, the variance of sample mean is given by _____.
   a) $\left(\dfrac{N-1}{N}\right)\dfrac{\sigma^2}{n}$　　　　　　b) $\dfrac{\sigma^2}{n}$
   c) $\left(\dfrac{N-n}{N-1}\right)\dfrac{\sigma^2}{n}$　　　　　d) $\left(\dfrac{N-1}{N}\right)\sigma^2$

7) Stratified sampling is more precise than the systematic sampling if serial correlation coefficients are _____.
   a) Positive　　　　　　　　　　b) Negative
   c) Nearly equal to one　　　　　d) Equal to zero

8) Non sampling errors occurs in _____.
   a) Only sample surveys
   b) Only complete enumeration
   c) Both a and b
   d) None of these

9) A city is divided into 100 non-overlapping blocks. Ten blocks are selected at random and completely enumerated. The procedure adopted is _____.
   a) Systematic sampling
   b) Double sampling
   c) Cluster sampling
   d) Stratified sampling

10) In sampling with probability proportional to size, the units are selected with probability proportional to _____.
    a) Size of the unit
    b) Size of the sample
    c) Population size
    d) None of these

11) The census Bureau in India takes a complete population count at every _____ years.
    a) 5
    b) 10
    c) 12
    d) None of these

12) Simple regression estimator of population mean is given by _____.
    a) $\bar{X} + b(\bar{x} - \bar{y})$
    b) $\bar{y} + b(\bar{X} - \bar{x})$
    c) $\bar{x} + b(\bar{X} - \bar{y})$
    d) $\bar{X} + b(\bar{y} - \bar{x})$

13) If n units are selected in a sample from N population units, the sampling fraction is _____.
    a) $\dfrac{1}{n}$
    b) $\dfrac{1}{N}$
    c) $\dfrac{n}{N}$
    d) $\dfrac{n-1}{N}$

14) Under Neyman allocation, the sample size for i^{th} stratum is proportional to _____.
    a) $N_i S_i$
    b) $N_i S_i^2$
    c) N_i
    d) $\dfrac{N_i}{S_i}$

Q.2 A) Answer the following questions. (Any Four) 08
   1) Give advantages of sampling method over census method.
   2) Specify proportional allocation in stratified sampling.
   3) Define probability proportional to size (PPS) sampling.
   4) Distinguish between ration and regression estimators.
   5) Describe Murthy's unordered estimator.

B) Write short notes. (Any Two) 06
   1) Midzuno system of sampling
   2) Non-sampling errors
   3) Circular systematic sampling

Q.3 A) Answer the following questions. (Any Two) 08
   1) Describe a procedure for obtaining a sample of size n from a population of size N using SRSWOR method.
   2) Describe cumulative total method for PPS sampling.
   3) Define a two-stage sampling design and give a practical situation where such a design can be used.

B) **Answer the following questions. (Any One)** **06**
1) Derive the sampling variance of the systematic sample mean in terms of intraclass correlation.

2) Define Horvitz-Thompson estimator for the population total. Show that it is unbiased and obtain an unbiased estimator of its variance.

Q.4 **A)** **Answer the following questions. (Any Two)** **10**
1) In SRSWOR of n clusters each containing M elements from a population of N clusters. Obtain mean and variance of estimator of sample mean.
2) Explain the benefits of stratifying a population before sampling. Derive the optimum allocation for the sample size assuming a linear cost function.
3) In SRSWOR, show that the sample mean $\bar{y}$ is unbiased for population mean. Obtain the sampling variance of $\bar{y}$.

B) **Answer the following questions. (Any One)** **04**
1) In SRSWOR, show that the probability of drawing a specified unit at every draw is same.
2) Define PPSWR sampling design. Explain Lahiri's method for drawing a PPSWR sample.

Q.5 **Answer the following questions. (Any Two)** **14**
1) Define ratio estimator and derive the approximate expression for bias. Assume SRSWOR scheme.
2) Discuss Hansen-Hurwitz technique in the presence of non-response in surveys.
3) Define systematic sampling. Discuss situations when systematic sampling is more efficient than SRSWOR.

SLR-BP – 486

Seat No.	

M.Sc. (Part – I) (Semester – II) Examination, 2015
STATISTICS (Paper – X)
Sampling Theory (Old)

Day and Date : Saturday, 25-4-2015   Total Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions : 1) Attempt **five** questions.
2) Q. No. **1** and Q. No. **2** are **compulsory**.
3) Attempt **any three** from Q. No. **3** to Q. No. **7**.
4) Figures to the **right** indicate **full** marks.

1. a) Choose the correct alternative :   5

   1) If an investigator selects districts from a state and farmers from selected districts then such a sampling procedure is _____
      a) systematic sampling   b) double sampling
      c) two-stage sampling   d) cluster sampling

   2) Systematic sampling means _____
      a) selecting n continuous units
      b) selecting n units situated at equal intervals
      c) selection of n largest units
      d) selection of any n units

   3) Under proportional allocation, the sample size for i^{th} stratum is proportional to _____

      a) N_i b) $N_i S_i$ c) $N_i S_i^2$ d) $\dfrac{N_i}{S_i}$

   4) Which of the following estimators is generally biased ?
      a) Horvitz-Thompson Estimator
      b) Des Raj estimator
      c) Heartly-Ross estimator
      d) Ratio estimator

5) Non sampling errors occurs in _____

   a) only sample surveys

   b) only complete enumeration

   c) sample surveys as well as complete enumeration

   d) none of these

b) Fill in the blanks : **5**

   1) Horvitz-Thompson estimator is used when sample selection is done with _____ probabilities.

   2) Errors introduced in editing, coding and tabulating the results are _____ errors.

   3) Strata in stratified sampling should be internally _____

   4) Under SRSWOR, the sample unit can occur _____ in the sample.

   5) If 30 units are drawn in a population of 300 units then sampling fraction is _____

c) State whether the following statements are **True** or **False** : **4**

   1) Des Raj estimators are unbiased.

   2) In PPSWR sampling design, an unbiased estimator of the population means does not exist.

   3) In two-stage sampling, second stage units should be always equal sized.

   4) Lahiri's method is convenient for PPSWR sampling.

2. a) Answer the following : **6**

   i) Explain sampling method and census method.

   ii) In SRSWOR, show that the probability of drawing a specified unit at every draw is same.

b) Write short notes on the following : **8**

   i) Circular systematic sampling.

   ii) Cumulative total method.

SLR-BP – 481

Seat No.	

M.Sc. (Part – I) (Semester – II) Examination, 2015
STATISTICS (Paper – X)
Sampling Theory (New)

Day and Date : Saturday, 25-4-2015   Total Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions : 1) Attempt **five** questions.
2) Q. No. **1** and Q. No. **2** are **compulsory**.
3) Attempt **any three** from Q. No. **3** to Q. No. **7**.
4) Figures to the **right** indicate **full** marks.

1. a) Choose the correct alternative.   **5**

   1) If n units are selected in a sample from N population units, then sampling fraction is _____

   a) $\dfrac{1}{N}$ b) $\dfrac{1}{n}$ c) $\dfrac{n}{N}$ d) $1 - \dfrac{n}{N}$

   2) In a stratified sampling with strata sizes N_1 and N_2, stratum variances S_1^2, S_2^2 under Neyman allocation the ratio of sample size $\dfrac{n_1}{n_2}$ is _____

   a) $\dfrac{N_1}{N_2}$ b) $\dfrac{N_1 S_1}{N_2 S_2}$ c) $\dfrac{S_1}{S_2}$ d) $\dfrac{N_1 S_1^2}{N_2 S_2^2}$

   3) In simple random sampling the ratio estimator is _____
   a) always biased
   b) always unbiased
   c) minimum variance unbiased
   d) none of these

P.T.O.

4) If 100 students are selected out of 500, and 15 students are then selected from the 100 selected students. The procedure adopted is _____

   a) cluster sampling
   b) systematic sampling
   c) two-stage sampling
   d) stratified sampling

5) Hurwitz-Hansen technique is used to deal with _____

   a) non response errors
   b) non sampling errors
   c) sampling errors
   d) none of these

b) Fill in the blanks : **5**

   1) Cluster sampling helps to _____ cost of survey.

   2) A basic principle of stratifying a population is that the strata should be internally _____

   3) Under SRSWR, the sample unit can occur _____ times in the sample.

   4) In Midzuno sampling scheme, the unit at first draw is selected with _____ probabilities.

   5) Failure to measure some of the units in the selected sample is _____ error.

c) State whether the following statements are **true** or **false** : **4**

   1) Regression estimators are generally biased.

   2) Deep stratification is a technique used to deal with non sampling errors.

   3) Systematic sampling is equal probability sampling.

   4) In PPS sampling some units may be selected with probability one.

2. a) Answer the following : **6**

   i) What are basic principles of sample survey ? Write in brief advantages of sampling over census method.

   ii) Define circular systematic sampling. Give an example.

b) Write short notes on the following : **8**

   i) Cumulative total method

   ii) Midzuno system of sampling.

3. a) Explain and illustrate the benefits of stratifying a population before sampling.

   b) Describe any two methods for allocating a sample of size n to different strata of population. **(6+8)**

4. a) Explain the concept of systematic sampling. Derive the sampling variance of unbiased estimator of population mean under the linear systematic sampling.

   b) Explain cluster sampling and clearly specify the advantages of the scheme. **(7+7)**

5. a) Explain the ratio and regression methods of estimation. When are these methods considered to be efficient ?

   b) Define unbiased and almost unbiased ratio-type estimators. **(8+6)**

6. a) Define PPSWR sampling design. Obtain an unbiased estimator of the population mean and its variance when a PPSWR sample of size n is drawn from a population of size n.

   b) Define Horvitz-Thompson estimator of population mean and establish its unbaisedness under an arbitrary sampling design. Also derive its sampling variance. **(7+7)**

7. a) Explain the problem of non response and any one technique to deal with the non response.

   b) What is double sampling ? Explain any one practical situation where double sampling is appropriate. **(8+6)**

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Seat No.

M.Sc. (Part – I) (Semester – II) Examination, 2015
STATISTICS (Paper – X)
Sampling Theory (Old)

Day and Date : Saturday, 25-4-2015   Total Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions : 1) Attempt **five** questions.
　　　　　　　 2) Q. No. **1** and Q. No. **2** are **compulsory**.
　　　　　　　 3) Attempt **any three** from Q. No. **3** to Q. No. **7**.
　　　　　　　 4) Figures to the **right** indicate **full** marks.

1. a) Choose the correct alternative :   **5**

　　1) If an investigator selects districts from a state and farmers from selected
　　　 districts then such a sampling procedure is _____

　　　　a) systematic sampling　　　　　　b) double sampling

　　　　c) two-stage sampling　　　　　　 d) cluster sampling

　　2) Systematic sampling means _____

　　　　a) selecting n continuous units

　　　　b) selecting n units situated at equal intervals

　　　　c) selection of n largest units

　　　　d) selection of any n units

　　3) Under proportional allocation, the sample size for i^{th} stratum is proportional
　　　 to _____

　　　　a) N_i　　　　　b) $N_i S_i$　　　　c) $N_i S_i^2$　　　　d) $\dfrac{N_i}{S_i}$

　　4) Which of the following estimators is generally biased ?

　　　　a) Horvitz-Thompson Estimator

　　　　b) Des Raj estimator

　　　　c) Heartly-Ross estimator

　　　　d) Ratio estimator

5) Non sampling errors occurs in _____

    a) only sample surveys

    b) only complete enumeration

    c) sample surveys as well as complete enumeration

    d) none of these

b) Fill in the blanks : **5**

1) Horvitz-Thompson estimator is used when sample selection is done with _____ probabilities.

2) Errors introduced in editing, coding and tabulating the results are _____ errors.

3) Strata in stratified sampling should be internally _____

4) Under SRSWOR, the sample unit can occur _____ in the sample.

5) If 30 units are drawn in a population of 300 units then sampling fraction is _____

c) State whether the following statements are **True** or **False** : **4**

1) Des Raj estimators are unbiased.

2) In PPSWR sampling design, an unbiased estimator of the population means does not exist.

3) In two-stage sampling, second stage units should be always equal sized.

4) Lahiri's method is convenient for PPSWR sampling.

2. a) Answer the following : **6**

    i) Explain sampling method and census method.

    ii) In SRSWOR, show that the probability of drawing a specified unit at every draw is same.

b) Write short notes on the following : **8**

    i) Circular systematic sampling.

    ii) Cumulative total method.

3. a) In SRSWOR examine whether sample mean is an unbiased estimator of population mean. Derive its variance.

   b) Define linear systematic sampling. Derive the sampling variance of the traditional unbiased estimator of a population mean under this scheme. **(6+8)**

4. a) Explain two stage sampling. Give a practical situation where such a design can be used.

   b) Explain a cluster sampling. In SRSWOR of n clusters each containing M elements from a population of N clusters. Show that sample mean is unbiased estimator of population mean. **(7+7)**

5. a) Describe stratified random sampling. Explain various sample allocation criteria in stratified sampling.

   b) Explain the concept of formation of strata. Derive the proportional allocation for the best value of the boundary point Y_h of hth stratum. **(7+7)**

6. a) Explain the ratio and regression methods of estimation.

   b) Make a comparison between the ratio and regression estimators in terms of MSE and state when the ratio estimator can be more efficient than regression estimator. Justify your answer. **(7+7)**

7. a) What is the problem of non response ? Discuss Hansen-Hurwitz technique for dealing this problem.

   b) Define ordered and unordered estimators. Develop Murthy's unordered estimator for n = 2. **(7+7)**

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SLR-BP – 481

Seat No.	

M.Sc. (Part – I) (Semester – II) Examination, 2015
STATISTICS (Paper – X)
Sampling Theory (New)

Day and Date : Saturday, 25-4-2015   Total Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions : 1) Attempt **five** questions.
              2) Q. No. **1** and Q. No. **2** are **compulsory**.
              3) Attempt **any three** from Q. No. **3** to Q. No. **7**.
              4) Figures to the **right** indicate **full** marks.

1. a) Choose the correct alternative.   **5**

    1) If n units are selected in a sample from N population units, then sampling fraction is _____

       a) $\dfrac{1}{N}$ b) $\dfrac{1}{n}$ c) $\dfrac{n}{N}$ d) $1 - \dfrac{n}{N}$

    2) In a stratified sampling with strata sizes N_1 and N_2, stratum variances S_1^2, S_2^2 under Neyman allocation the ratio of sample size $\dfrac{n_1}{n_2}$ is _____

       a) $\dfrac{N_1}{N_2}$ b) $\dfrac{N_1 S_1}{N_2 S_2}$ c) $\dfrac{S_1}{S_2}$ d) $\dfrac{N_1 S_1^2}{N_2 S_2^2}$

    3) In simple random sampling the ratio estimator is _____
       a) always biased
       b) always unbiased
       c) minimum variance unbiased
       d) none of these

P.T.O.

4) If 100 students are selected out of 500, and 15 students are then selected from the 100 selected students. The procedure adopted is _____
   a) cluster sampling
   b) systematic sampling
   c) two-stage sampling
   d) stratified sampling

5) Hurwitz-Hansen technique is used to deal with _____
   a) non response errors
   b) non sampling errors
   c) sampling errors
   d) none of these

b) Fill in the blanks : **5**

1) Cluster sampling helps to _____ cost of survey.

2) A basic principle of stratifying a population is that the strata should be internally _____

3) Under SRSWR, the sample unit can occur _____ times in the sample.

4) In Midzuno sampling scheme, the unit at first draw is selected with _____ probabilities.

5) Failure to measure some of the units in the selected sample is _____ error.

c) State whether the following statements are **true** or **false** : **4**

1) Regression estimators are generally biased.

2) Deep stratification is a technique used to deal with non sampling errors.

3) Systematic sampling is equal probability sampling.

4) In PPS sampling some units may be selected with probability one.

2. a) Answer the following : **6**

i) What are basic principles of sample survey ? Write in brief advantages of sampling over census method.

ii) Define circular systematic sampling. Give an example.

b) Write short notes on the following : **8**

i) Cumulative total method

ii) Midzuno system of sampling.

3. a) Explain and illustrate the benefits of stratifying a population before sampling.

   b) Describe any two methods for allocating a sample of size n to different strata of population. **(6+8)**

4. a) Explain the concept of systematic sampling. Derive the sampling variance of unbiased estimator of population mean under the linear systematic sampling.

   b) Explain cluster sampling and clearly specify the advantages of the scheme. **(7+7)**

5. a) Explain the ratio and regression methods of estimation. When are these methods considered to be efficient ?

   b) Define unbiased and almost unbiased ratio-type estimators. **(8+6)**

6. a) Define PPSWR sampling design. Obtain an unbiased estimator of the population mean and its variance when a PPSWR sample of size n is drawn from a population of size n.

   b) Define Horvitz-Thompson estimator of population mean and establish its unbaisedness under an arbitrary sampling design. Also derive its sampling variance. **(7+7)**

7. a) Explain the problem of non response and any one technique to deal with the non response.

   b) What is double sampling ? Explain any one practical situation where double sampling is appropriate. **(8+6)**

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Seat No.

M.Sc. (Semester - II) (CBCS) Examination March/April-2019
Statistics
SAMPLING THEORY

Day & Date: Thursday, 25-04-2019   Max. Marks: 70
Time: 12:00 PM To 02:30 PM

Instructions: 1) All questions are compulsory.
                2) Figures to the right indicate full marks.

Q.1 Choose Correct Alternative from the following.   **14**

1) In stratified random sampling, optimum allocation reduces to proportional allocation when the strata have _____.
   a) equal standard deviations
   b) equal size and equal standard deviation
   c) equal standard deviation and equal per unit cost
   d) equal size and equal per unit cost

2) A random start automatically fixes the subsequent selection of sample units in _____ sampling method.
   a) random   b) stratified
   c) cluster   d) systematic

3) A sample survey is to be conducted to estimate the average size of land holding of households in a district. Then which one of the following will be most appropriate procedure of sampling?
   a) Stratified   b) Systematic
   c) Cluster   d) Multistage

4) A population consisting of 50 units divided into two strata such that $N_1 = 30$, $N_2 = 20$, $S_1 = 2$, $S_2 = 3$. If by Nayman allocation $n_1 = 6$ then the sample size n will be _____.
   a) 6   b) 12
   c) 25   d) 30

5) A large city is subdivided into 150 non-overlapping blocks. Five blocks are selected at random and completely enumerated. This procedure is known as _____.
   a) Partial Census   b) Systematic sampling
   c) Cluster sampling   d) Stratified sampling

6) Which of the following estimators is generally biased?
   a) Horvitz-Thompson   b) Des Raj
   c) Heartly – Ross   d) Ratio

7) Variance of proportional allocation is always _____ that of optimum allocation.
   a) equal to   b) greater than
   c) less than   d) none of these

8) Under Neyman allocation, the sample size for i^{th} stratum is proportional to _____.
   a) $N_i S_i$ b) $N_i S_i^2$
   c) N_i d) N_i / S_i

9) Simple regression estimator of population mean is given by _____.

a) $\frac{\bar{y}_n}{\bar{x}_n} \cdot \bar{X}_N$

b) $\bar{y}_n - \hat{\beta}(\bar{x}_n - \bar{X}_N)$

c) $$\sum_{i=1}^{K} Pi[\bar{y}_{n_i} + \hat{\beta}_i(\bar{x}_{n_i} - \bar{X}_{N_i})]$$

d) None of these

10) Precision of random sample _____.
   a) increases with increase in the sample size
   b) decreases with increase in the sample size
   c) has no relation with sample size
   d) none of the above

11) Nonresponse in survey means _____.
   a) non availability of respondent
   b) non return of questionnaire by the respondent
   c) refuse to give information by the respondent
   d) all the above

12) Which one of the following is not an example of non-sampling?
   a) measurement error
   b) refusal by a unit to respond
   c) editing error
   d) error due to selecting only a part of the population as sample

13) In cluster sampling, it is better to have _____.
   a) cluster which are homogenous within
   b) cluster which are heterogenous within
   c) small cluster size
   d) variance of cluster means is same for all the clusters

14) If n units are selected in a sample from N population units then sampling fraction is _____.

a) $\frac{1}{n}$

b) $\frac{1}{N}$

c) $\frac{n}{N}$

d) $\frac{n-1}{N}$

Q.2 A) Answer the following (Any Four) 08
   1) What do you understand by non-response error?
   2) Explain the equal allocation in stratified sampling with the help of suitable example.
   3) Define Des Raj ordered estimator for the population total.
   4) Give two advantages of sampling method over census method.
   5) Define PPSWR sampling design.

B) Write Notes on (Any two) 06
   1) Cluster sampling
   2) Method of collapsed strata
   3) Circular systematic sampling

Q.3 A) Answer the following (Any two) 08
   1) Define ratio estimator of population mean and obtain its bias.
   2) Describe cumulative total method for drawing PPSWR samples. What are its limitations?
   3) Define midzuno sampling design. Obtain single and double inclusion probabilities.

B) Answer the following (Any one) 06
   1) Define Horvitz-Thompson estimator for population total. Examine it for unbiasedness.

2) In SRSWR, derive an unbiased estimator of population mean and its sampling variance.

Q.4 A) Answer the following (Any two)   **10**

1) Develop Murthy's unordered estimator for n = 2.
2) Describe non-sampling errors. Describe main sources of these errors.
3) Explain the concept of systematic sampling. Derive the sampling variance of unbiased estimator of a population mean under the linear systematic sampling.

B) Answer the following (Any one)   **04**

1) In SRSWOR, show that the probability of drawing a specified unit at every draw is same.
2) Define a two-stage sampling design and give a practical situation where such a design can be used.

Q.5 Answer the following (Any two)   **14**

a) What is proportional allocation? Derive the variance of the estimator of the population mean under this allocation.
b) Explain the problem of non-response and any one technique to deal with the non-response.
c) Explain the regression method for estimation. Assuming SRSWOR, derive the MSE of the estimator of population mean.

Seat
No.

M.Sc. (Part – I) (Semester – II) Examination, 2016
STATISTICS (Paper – X)
Sampling Theory (Old CGPA)

Day and Date : Saturday, 9-4-2016   Total Marks : 70
Time : 10.30 a.m. to 1.00 p.m.

Instructions : 1) Attempt **five** questions.
2) Q. No. **(1)** and Q. No. **(2)** are **compulsory**.
3) Attempt **any three** from Q. No. **(3)** to Q. No. **(7)**.
4) Figures to the **right** indicate **full** marks.

1. a) Choose the correct alternative.   **5**

   1) Under Neyman allocation, the sample size for i^{th} stratum is proportional to _____

      a) $N_i S_i$ b) $N_i S_i^2$ c) $\dfrac{N_i}{S_i}$ d) N_i

   2) For SRSWOR with 10 draws from population size 100 and $S^2 = 100$, the standard error of sample mean is _____

      a) 1.25   b) 1.50   c) 2.50   d) 3.00

   3) Sample regression estimator of population mean is given by

      a) $\overline{X} + b(\overline{x} - \overline{y})$ b) $\overline{y} + b(\overline{X} - \overline{x})$ c) $\overline{x} + b(\overline{X} - \overline{y})$ d) $\overline{X} + b(\overline{y} - \overline{x})$

   4) Systematic sampling is more precise than SRSWOR if _____

      a) $\rho_{wsy} = \dfrac{1}{n-1}$ b) $\rho_{wsy} > \dfrac{-1}{nk-1}$ c) $\rho_{wsy} < \dfrac{-1}{nk-1}$ d) $\rho_{wsy} < \dfrac{1}{n-1}$

   5) Hurwitz-Hansen technique is used to deal with _____

      a) non sampling errors   b) non response errors

      c) sampling errors   d) none of these

b) Fill in the blanks : **5**

1) In Midzuno sampling scheme the units from second draw are selected with _____ probabilities.

2) The difference between variances of sample mean in SRSWR and SRSWOR is _____

3) Stratified sampling is not preferred when the population is _____

4) Non response errors introduce _____ in the estimator.

5) A random start automatically fixes the subsequent selection of sample unit in _____ sampling method.

c) State whether the following statements are **true** or **false**. **4**

1) Des Raj ordered estimators are pairwise uncorrelated.

2) SRSWOR scheme is always more precise than the SRSWR scheme for a given sample size.

3) In PPS sampling the probability of drawing any specified unit at a given draw is same.

4) Proportional allocation of sample in stratified sampling is more precise than optimal allocation.

2. a) Answer the following. **6**

i) Describe a procedure for obtaining a sample of size n from a population of size N using SRSWOR method.

ii) Explain Lahiri's method for PPSWR sampling.

b) Write short notes on the following : **8**

i) Neyman allocation.

ii) Deming's technique.

3. a) Explain the concept of systematic sampling. Derive the sampling variance of unbiased estimator of a population mean under linear systematic sampling.

b) Describe two stage sampling design. Give a practical situation where such a design can be used. **(6+8)**

4. a) What is proportional allocation ? Derive the variance of estimator of the population mean under this allocation.

   b) With usual notations prove that $V_{opt} \leq V_{prop} \leq V_{ran}$. **(7+7)**

5. a) Define PPSWR sampling design. Obtain an unbiased estimator of population total and its variance when PPSWR sample of size n is drawn from a population of size N.

   b) Define Horvitz-Thompson estimator for population total. Show that it is unbiased. Obtain its variance. **(7+7)**

6. a) Describe Midzuno system of sampling design. Under this sampling design, derive the first and second order inclusion probabilities.

   b) Define cluster sampling. Develop a basic theory for single stage cluster sampling for estimating a population mean assuming SRSWOR of clusters. **(7+7)**

7. a) Define the ratio method of estimation of population total. Assuming SRSWOR, derive approximate expression for bias of ratio estimator.

   b) Define linear regression estimator for population mean. Investigate its properties under SRSWOR scheme. **(7+7)**

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Seat No.

M.Sc. (Part – I) (Semester – II) Examination, 2015
STATISTICS (Paper – X)
Sampling Theory (New)

Day and Date : Saturday, 25-4-2015　　　　　　　　　　Total Marks : 70
Time : 11.00 a.m. to 2.00 p.m.

Instructions : 1) Attempt **five** questions.
　　　　　　　　2) Q. No. **1** and Q. No. **2** are **compulsory**.
　　　　　　　　3) Attempt **any three** from Q. No. **3** to Q. No. **7**.
　　　　　　　　4) Figures to the **right** indicate **full** marks.

1. a) Choose the correct alternative.　　　　　　　　　　　　　　　**5**

　　1) If n units are selected in a sample from N population units, then sampling fraction is _____

　　　　a) $\dfrac{1}{N}$　　　　b) $\dfrac{1}{n}$　　　　c) $\dfrac{n}{N}$　　　　d) $1 - \dfrac{n}{N}$

　　2) In a stratified sampling with strata sizes N_1 and N_2, stratum variances S_1^2, S_2^2 under Neyman allocation the ratio of sample size $\dfrac{n_1}{n_2}$ is _____

　　　　a) $\dfrac{N_1}{N_2}$　　　　b) $\dfrac{N_1 S_1}{N_2 S_2}$　　　　c) $\dfrac{S_1}{S_2}$　　　　d) $\dfrac{N_1 S_1^2}{N_2 S_2^2}$

　　3) In simple random sampling the ratio estimator is _____
　　　　a) always biased
　　　　b) always unbiased
　　　　c) minimum variance unbiased
　　　　d) none of these

4) If 100 students are selected out of 500, and 15 students are then selected from the 100 selected students. The procedure adopted is _____

   a) cluster sampling   b) systematic sampling

   c) two-stage sampling   d) stratified sampling

5) Hurwitz-Hansen technique is used to deal with _____

   a) non response errors   b) non sampling errors

   c) sampling errors   d) none of these

b) Fill in the blanks :   **5**

1) Cluster sampling helps to _____ cost of survey.

2) A basic principle of stratifying a population is that the strata should be internally _____

3) Under SRSWR, the sample unit can occur _____ times in the sample.

4) In Midzuno sampling scheme, the unit at first draw is selected with _____ probabilities.

5) Failure to measure some of the units in the selected sample is _____ error.

c) State whether the following statements are **true** or **false** :   **4**

1) Regression estimators are generally biased.

2) Deep stratification is a technique used to deal with non sampling errors.

3) Systematic sampling is equal probability sampling.

4) In PPS sampling some units may be selected with probability one.

2. a) Answer the following :   **6**

   i) What are basic principles of sample survey ? Write in brief advantages of sampling over census method.

   ii) Define circular systematic sampling. Give an example.

b) Write short notes on the following :   **8**

   i) Cumulative total method

   ii) Midzuno system of sampling.

3. a) Explain and illustrate the benefits of stratifying a population before sampling.

   b) Describe any two methods for allocating a sample of size n to different strata of population. **(6+8)**

4. a) Explain the concept of systematic sampling. Derive the sampling variance of unbiased estimator of population mean under the linear systematic sampling.

   b) Explain cluster sampling and clearly specify the advantages of the scheme. **(7+7)**

5. a) Explain the ratio and regression methods of estimation. When are these methods considered to be efficient ?

   b) Define unbiased and almost unbiased ratio-type estimators. **(8+6)**

6. a) Define PPSWR sampling design. Obtain an unbiased estimator of the population mean and its variance when a PPSWR sample of size n is drawn from a population of size n.

   b) Define Horvitz-Thompson estimator of population mean and establish its unbaisedness under an arbitrary sampling design. Also derive its sampling variance. **(7+7)**

7. a) Explain the problem of non response and any one technique to deal with the non response.

   b) What is double sampling ? Explain any one practical situation where double sampling is appropriate. **(8+6)**

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