

Assignment MST-020

for

**M.Sc. (Applied Statistics)
(MSCAST)**

Valid from January 2026 to December 2026

SCHOOL OF SCIENCES

Indira Gandhi National Open University
New Delhi - 110068

Dear Learner,

Welcome to the M.Sc. (Applied Statistics) Programme.

As per the university guidelines, you need to complete the assignment for each theory course. Note that there are no assignments for lab courses in the MSCAST programme, namely, MSTL-011, MSTL-012, MSTL-013, MSTL-014, and MSTL-015. You should remember that writing answers to an assignment's questions will improve your writing skills and prepare you for the term-end examination.

It is compulsory to submit the assignments within the stipulated time to be eligible to appear in the term-end examination. You will not be allowed to appear for the term-end examination for a course if you do not submit the assignment for that course by the due date. As per the University guidelines, if you appear in the term-end examination of a course without submitting its assignment, the result of the term-end examination is liable to be cancelled/ withheld.

The assignments constitute the continuous component of the evaluation process and have 30% weightage in the final grading.

Before you write the assignments, you are advised to first go through the self-learning material for that course and then prepare the assignments carefully by following the instructions pertaining to the assignments. Your responses should not be a verbatim reproduction of the textual materials provided for self-learning purposes, but it should be in your own words.

If you have any doubts or problems pertaining to the course material and assignments, contact the programme in charge or the academic counsellor at your study centre. If you still have problems related to this assignment, feel free to contact the course coordinator.

Wishing you all the best in successfully completing the programme.

(Prof. Manish Trivedi)
Course Coordinator, MST-020
Email: manish_trivedi@ignou.ac.in

Instructions:

- Submit the assignments within the stipulated time. Otherwise, you will not be permitted to appear for the term-end examination.
- Solve the latest assignments uploaded for the current year/session.
- Read the instructions related to the assignments mentioned in the Programme Guide.
- Use only A-4 size paper to write your responses. It is mandatory to write all assignments neatly in your own handwriting. Typed or printed copies of the assignments will not be accepted. Note that you may use the printout only if a question specifically asks for the output of a program in MST-015 and MST-024.
- All questions given in the assignments are compulsory for each course.
- Express your response in your own words. You are advised to restrict your response based on the marks assigned to it. This will also help you to distribute your time in writing or completing your assignments on time.
- Securely fasten multiple pages together (you can staple or tie them) and number them carefully for each assignment separately.
- Do not forget to enclose the assignment question sheet of that course after the cover page of the assignment response (answer sheets). It is not compulsory to write each question separately before answering the question. Mention the question number for each answer.
- The solved assignment must be submitted at the Study Centre allotted to you before the due date set by the University. Please check the IGNOU website for updated information regarding the due date of assignment submission.
- You are advised to mention all information on the first page of the assignment response sheet, given on the next page.
- **Keep a copy of the assignment answer sheets with you before submission for future reference.**

ASSIGNMENT CODE: MST-020/TMA/2026

NAME: _____

ENROLLMENT NO: _____

ADMISSION CYCLE: _____

PROGRAMME CODE: MSCAST

COURSE CODE: MST-020

COURSE TITLE: SURVEY SAMPLING AND DESIGN OF EXPERIMENTS-II

REGIONAL CENTRE CODE: _____

STUDY CENTRE CODE: _____

ADDRESS: _____

CONTACT NUMBER: _____

EMAIL ID: _____

DATE OF SUBMISSION: _____



School of Sciences

Indira Gandhi National Open University

Maidan Garhi, New Delhi-110068 (INDIA)

TUTOR MARKED ASSIGNMENT

MST-020: Survey Sampling and Design of Experiments-II

Course Code: MST-020

Assignment Code: MST-020/TMA/2026

Maximum Marks: 100

Note: All questions are compulsory. Answer in your own words.

1. State whether the following statements are true or false and also give the reason in support of your answer: (2×5=10)
 - a) In Two-Stage Sampling if $N = n$, it becomes the Cluster Sampling.
 - b) Among all the members of the General Class of the estimators only Product estimator is an unbiased estimator of the Population mean.
 - c) With the following parameters $b = 10, k = 5, \vartheta = 10, r = 5$, an Incomplete Block Design is found to be a Balanced Incomplete Block Design.
 - d) a 2^3 Factorial design is One-half fractional factorial design of a 2^6 full factorial design.
 - e) If M_i and \bar{Y}_i are correlated, the Cluster estimator $\bar{\bar{y}}_n$ becomes an unbiased estimator of the Population Mean.

2. In a population of size 500, the population mean of the auxiliary variable X was observed to be 950.00. On the basis of a sample of size 30, the following sample values were obtained:
$$\bar{y} = 700.00; \bar{x} = 800.00; s_y^2 = 10560.00; s_x^2 = 25375.00; s_{xy} = 40540.2; \hat{R} = 0.740.$$
Obtain the value of the Ratio estimate of population mean as obtained on the basis of the sample drawn. Also, find the estimated value of the Sample Mean Squared Error of the estimate. (15)

3. In a population of size 500, the population mean of the auxiliary variable X was observed to be 834.00. On the basis of a sample of size 40, the following sample values were obtained:
$$\bar{y} = 740.00; \bar{x} = 865.00; s_y^2 = 9560.00; s_x^2 = 15300.00; s_{yx} = 30540.2.$$
Obtain the values of the regression estimate and the ratio estimate of the population mean as obtained on the basis of the sample drawn. (08)

4. Following data presents a population of 10 clusters of size 3 each. Each cluster represents a bunch of students of standard IV in a school. The marks obtained by students in a competitive test (out of 75 marks) have been shown in the data set. Find the Relative Efficiency (R.E.) of the Cluster Sampling with respect to the Simple Random Sampling without Replacement scheme:

1	56, 34, 28	2	70, 56, 30	3	12, 57, 30	4	24, 70, 35	5	9, 44, 59
6	25, 69, 70	7	14,38, 50	8	74, 47, 65	9	14, 48, 62	10	56,59,39

(15)

5. A crime reporter wishes to publish a report in a national crime magazine highlighting crime of tax evasion happened in the hotel industry in a specific district in the preceding year. For this purpose, in order to estimate the proportion of owners of 3-star hotels, he selected a sample of size 350 hotel owners using simple random sampling with replacement scheme out of a population of 2000 hotels. Every owner in the sample was asked to randomly pick a card from a deck of cards, in which 86% of the cards were marked "I cheated on last year's income tax return" and the remaining 14% were marked "I did not cheat on last year's income tax return". The survey gave 100 "True" responses and 250 "False" responses.

Find the value of the unbiased estimator of the unknown population proportion of tax evaders. Also, find the variance of the estimator. (08)

6. In order to obtain the idea of interactions effects of two factors, A and B, each available at two levels; a 2^2 -factorial experiment was conducted in six randomized blocks. The two levels of the factors A and B are denoted respectively by (a_1, a_2) and (b_1, b_2) . Below is given the plan and yields of the experiment. Analyze the design for finding out if there are any significant treatment effects- either main or interaction:

Block I				Block II				Block III			
a_1b_1	a_1b_2	a_2b_2	a_2b_1	a_2b_2	a_1b_1	a_1b_2	a_2b_1	a_1b_1	a_2b_1	a_1b_2	a_2b_2
50	46	52	40	39	42	47	49	47	51	42	45
Block IV				Block V				Block VI			
a_2b_2	a_2b_1	a_1b_2	a_1b_1	a_2b_2	a_1b_2	a_1b_1	a_2b_1	a_2b_1	a_1b_1	a_2b_2	a_1b_2
51	50	47	40	55	48	53	57	55	52	47	54

(12)

7. Explain what is meant by the one-half fraction of a 2^k factorial experiment. Considering a 2^3 - factorial design, show how would you get a one-half fractional factorial design. (10)
8. What is a Complimentary B.I.B.D. of a given symmetric B.I.B.D.? Explain the method of obtaining a complimentary B.I.B.D. given the following B.I.B.D.:

Block	I	II	III	IV	V	VI	VII
Design	2 7 6	5 3 2	4 3 6	2 1 4	1 5 6	4 5 7	7 3 1

(12)

9. Let us consider a B.I.B. design as given below with parameters $\mathfrak{S} = b = 7, r = k = 3, \lambda = 1$:

Block	Treatment
I	2 7 6
II	5 3 2
III	4 3 6
IV	2 1 4
V	1 5 6
VI	4 5 7
VII	7 3 1

Given the above Balanced Incomplete Block Design (B.I.B.D.), construct a residual design and find the parameters of this design. (10)