

Assignment MSTE-012

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, MSTE-012
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: MSTE-012/TMA/2026

NAME: _____

ENROLLMENT NO: _____

ADMISSION CYCLE: _____

PROGRAMME CODE: MSCAST

COURSE CODE: MSTE-012

COURSE TITLE: STOCHASTIC PROCESSES

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

MSTE-012: STOCHASTIC PROCESSES

Course Code: MSTE-012
Assignment Code: MSTE-012/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) The probability that a random walk of 12 steps with probability $p = 0.8$ ends at position $x = 6$ is 0.88.
- b) A Markov chain X_0, X_1, X_2, \dots has the transition probability matrix

$$P = \begin{bmatrix} 0.1 & 0.1 & 0.8 \\ 0.2 & 0.2 & 0.6 \\ 0.3 & 0.3 & 0.4 \end{bmatrix}$$

Then the conditional probabilities $P[X_1 = 1, X_2 = 1 | X_0 = 0] = 0.02$.

- c) Suppose that customers arrive at a facility according to a Poisson process having rate $\lambda = 2$. If $N(t)$ be the number of customers that have arrived up to time t . Then the probability $P\{N(1)=2, N(3)=6\} = 2e^{-2}$.
- d) In the classical gambler's ruin problem, given that $a = 80, k = 70, p = 0.45$. Then, the probability of ruin of the gambler is 0.868.
- e) The number of customers at time t waiting in the queue including the one being served, if any, is called arrival rate.
- 2(a) A Markov chain X_0, X_1, X_2, \dots has the transition probability matrix

$$P = \begin{bmatrix} 0.6 & 0.3 & 0.1 \\ 0.3 & 0.3 & 0.4 \\ 0.4 & 0.1 & 0.5 \end{bmatrix}$$

Find the limiting distribution of the chain. (12)

- (b) In a game of chance, gambler A starts the game with stake Rs. 5.00 against his/her opponent B whose stake is Rs. 95.00. The probability of winning the game by the gambler A in each play is 0.6. Find the expected duration of the game. (08)
3. A fire and emergency rescue service receives calls for assistance at a rate of ten per day. Teams man the service in twelve hour shifts. Assume that requests for help form a Poisson process.

- (i) What is the probability that a team would receive six requests for help in a shift?
- (ii) What is the probability that a team has no requests for assistance in a shift? (12)
4. Customers arrive in a certain store according to a Poisson process of rate $\lambda = 4$ per hour. Given that the store opens at 9:00 A.M., what is the probability that exactly one customer has arrived by 9:30 and a total of five have arrived by 11:30 A.M.? (08)
5. A pure birth process starting from $X(0) = 0$, has birth parameters $\lambda_0 = 1, \lambda_1 = 3, \lambda_2 = 2, \lambda_3 = 5$. Determine the probabilities $p_n(t)$ for $n = 0$ and 1. (10)
6. Explain the three types of renewal processes:
- (i) Ordinary Renewal process;
- (ii) Modified Renewal process and
- (iii) Equilibrium Renewal process.
- Under what condition the equilibrium renewal process is appropriate for its application? (15)
7. Consider a renewal process in which the inter-occurrence times have an exponential distribution with parameter λ :
- $f(x) = \lambda e^{-\lambda x}$, and $F(x) = 1 - e^{-\lambda x}$ for $x > 0$.
- Calculate $F_2(t)$ and then determine $P[N(t) = 1]$. (15)
8. Describe the M/M/k: ∞ / FIFO Waiting line model with examples and their waiting time distributions. (10)