

Poisson Questions

Question 1

A student is collecting data on traffic arriving at a motorway service station during weekday lunchtimes. The random variable X denotes the number of cars arriving in a randomly chosen period of ten seconds.

- (i) State two assumptions necessary if a Poisson distribution is to provide a suitable model for the distribution of X . Comment briefly on whether these assumptions are likely to be valid. [4]

The student counts the number of arrivals, x , in each of 100 ten-second periods. The data are shown in the table below.

x	0	1	2	3	4	5	>5
Frequency, f	11	29	29	12	6	3	0

- (ii) Show that the sample mean is 1.62 and calculate the sample variance. [4]
 (iii) Do your calculations in part (ii) support the suggestion that a Poisson distribution is a suitable model for the distribution of X ? Explain your answer. [3]

For the remainder of this question you should assume that X may be modelled by a Poisson distribution with mean 1.62.

- (iv) Find $P(X = 2)$. Comment on your answer in relation to the data in the table. [4]
 (v) Find the probability that at least ten cars arrive in a period of 50 seconds during weekday lunchtimes. [3]

June 2005

Question 2

Ann is watching a display of motorcars entering stalls. During the display, she sees motorcars at an average rate of 1.3 per minute.

- (i) State conditions required for a Poisson distribution to be a suitable model for the number of motorcars which Ann sees during a randomly selected minute. [2]

You may assume that these conditions are satisfied.

- (ii) Find the probability that, during one minute, Ann sees
 (a) exactly one motorcar, [4]
 (b) at least 4 motorcars. [4]
 (iii) Find the probability that, in a period of 10 minutes, Ann sees exactly 16 motorcars. [3]

June 2009

Question 3

A public water supply contains bacteria. Each day an analyst checks the water quality by counting the number of bacteria in a random sample of 5 ml of water.

Throughout this question, you should assume that the bacteria occur randomly at a mean rate of 0.37 bacteria per 5 ml of water.

- (i) Use a Poisson distribution to
 (A) find the probability that a 5 ml sample contains exactly 2 bacteria, [2]
 (B) show that the probability that a 5 ml sample contains more than 2 bacteria is 0.0064. [3]
 (ii) The month of September has 30 days. Find the probability that during September there is at most one day when a 5 ml sample contains more than 2 bacteria. [4]

The daily 5 ml sample is the first stage of the quality control process. The remainder of the process is as follows.

- If the 5 ml sample contains more than 2 bacteria, then a 50 ml sample is taken.
- If this 50 ml sample contains more than 8 bacteria, then a sample of 1000 ml is taken.
- If this 1000 ml sample contains more than 90 bacteria, then the supply is declared to be 'unsatisfactory'.

- (iii) Find the probability that a random sample of 50 ml contains more than 8 bacteria. [3]

June 2008

Question 4

A radioactive source is decaying at a mean rate of 3.4 counts per 5 seconds.

- (i) State conditions for a Poisson distribution to be a suitable model for the rate of decay of the source. [2]

You may assume that a Poisson distribution with a mean rate of 3.4 counts per 5 seconds is a suitable model.

- (ii) State the variance of this Poisson distribution. [1]
 (iii) Find the probability of
 (A) exactly 3 counts in a 5-second period, [2]
 (B) at least 3 counts in a 5-second period. [3]
 (iv) Find the probability of exactly 40 counts in a period of 60 seconds. [4]

June 2010

Exam timings: Q1 (19 mins), Q2 (11 mins), Q3 (15 mins), Q4 (14 mins)

Mei Statistics 2 The Poisson Distribution Answers

Chao Zhang



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Probability & Statistics John du Feu,2018-05-29 Exam board Cambridge Assessment International Education Level A level Subject Mathematics First teaching September 2018 First exams Summer 2020 Endorsed by Cambridge Assessment

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Table of Contents Mei Statistics 2 The Poisson Distribution Answers

1. Understanding the eBook Mei Statistics 2 The Poisson Distribution Answers
 - The Rise of Digital Reading Mei Statistics 2 The Poisson Distribution Answers
 - Advantages of eBooks Over Traditional Books
2. Identifying Mei Statistics 2 The Poisson Distribution Answers
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Mei Statistics 2 The Poisson Distribution Answers
 - User-Friendly Interface
4. Exploring eBook Recommendations from Mei Statistics 2 The Poisson Distribution Answers
 - Personalized Recommendations
 - Mei Statistics 2 The Poisson Distribution Answers User Reviews and Ratings

- Mei Statistics 2 The Poisson Distribution Answers and Bestseller Lists
- 5. Accessing Mei Statistics 2 The Poisson Distribution Answers Free and Paid eBooks
 - Mei Statistics 2 The Poisson Distribution Answers Public Domain eBooks
 - Mei Statistics 2 The Poisson Distribution Answers eBook Subscription Services
 - Mei Statistics 2 The Poisson Distribution Answers Budget-Friendly Options
- 6. Navigating Mei Statistics 2 The Poisson Distribution Answers eBook Formats
 - ePub, PDF, MOBI, and More
 - Mei Statistics 2 The Poisson Distribution Answers Compatibility with Devices
 - Mei Statistics 2 The Poisson Distribution Answers Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Mei Statistics 2 The Poisson Distribution Answers
 - Highlighting and Note-Taking Mei Statistics 2 The Poisson Distribution Answers
 - Interactive Elements Mei Statistics 2 The Poisson Distribution Answers
- 8. Staying Engaged with Mei Statistics 2 The Poisson Distribution Answers
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Mei Statistics 2 The Poisson Distribution Answers
- 9. Balancing eBooks and Physical Books Mei Statistics 2 The Poisson Distribution Answers
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Mei Statistics 2 The Poisson Distribution Answers
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Mei Statistics 2 The Poisson Distribution Answers
 - Setting Reading Goals Mei Statistics 2 The Poisson Distribution Answers
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Mei Statistics 2 The Poisson Distribution Answers
 - Fact-Checking eBook Content of Mei Statistics 2 The Poisson Distribution Answers
 - Distinguishing Credible Sources

13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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