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TUTGATHER PRACTICE PAPER

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION 2027

MATHEMATICS Extended Part Module M1
PAPER

Question-Answer Book

Candidate Number

TUTGATHER
PRACTICE PAPER · NOT AN OFFICIAL HKEAA PAPER

1 hour 5 minutes

This paper must be answered in English

Topic practice: Applications of Binomial and Poisson Distributions

INSTRUCTIONS

(1) This paper consists of THREE sections, A(1), A(2) and B.

(2) Attempt ALL questions in this paper. Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins.

(3) Unless otherwise specified, all working must be clearly shown.

(4) Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.

(5) The diagrams in this paper are not necessarily drawn to scale.

(6) Calculators and mathematical drawing instruments may be used.

(7) The marks for each question are shown in brackets.

(8) No extra time will be given after the 'Time is up' announcement.

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SECTION A(1) (16 marks)

1. In a certain city, the number of traffic accidents per day follows a Poisson distribution with mean 3.2. Find the probability that on a randomly chosen day there are exactly 5 traffic accidents. Give your answer correct to 3 significant figures. **(3 marks)**

2. A fair six-sided die is rolled 10 times. Find the probability that a '6' appears at most once. Give your answer correct to 3 significant figures. **(3 marks)**

3. The number of emails received by a company per hour follows a Poisson distribution with mean 8. Find the probability that in a randomly chosen 2-hour period, the company receives more than 20 emails. Give your answer correct to 3 significant figures. **(4 marks)**

Answers written in the margins will not be marked.
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4. A factory produces light bulbs, and 5% of the bulbs are defective. A random sample of 20 bulbs is selected. **(6 marks)**

(a) Find the probability that exactly 2 bulbs in the sample are defective. (2 marks)

(b) Find the probability that at least 1 bulb in the sample is defective. (2 marks)

(c) Find the expected number of defective bulbs in the sample. (2 marks)

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SECTION A(2) (24 marks)

5. A call centre receives calls at an average rate of 4 calls per minute. Assume that the number of calls received in any time interval follows a Poisson distribution and that calls arrive independently. **(7 marks)**

(a) Find the probability that exactly 3 calls are received in a given minute. (2 marks)

(b) Find the probability that at least 2 calls are received in a given 30-second interval. (3 marks)

(c) Find the probability that exactly 2 calls are received in a given minute and exactly 1 call is received in the next minute. (2 marks)

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6. In a large population, 30% of people have blood type A. A random sample of 15 people is selected. **(8 marks)**

(a) Find the probability that exactly 5 people in the sample have blood type A. (2 marks)

(b) Find the probability that at least 6 people in the sample have blood type A. (3 marks)

(c) Find the expected number and the standard deviation of the number of people with blood type A in the sample. (3 marks)

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7. A radioactive source emits particles at an average rate of 2 particles per second. Assume that the number of particles emitted in any time interval follows a Poisson distribution. **(9 marks)**

(a) Find the probability that exactly 3 particles are emitted in a given second. (2 marks)

(b) Find the probability that at least 1 particle is emitted in a given 2-second interval. (3 marks)

(c) Find the probability that exactly 2 particles are emitted in a given second and exactly 3 particles are emitted in the next second. (4 marks)

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SECTION B (10 marks)

8. A hospital emergency room receives patients at an average rate of 5 patients per hour during the day. Assume that the number of patients arriving in any time interval follows a Poisson distribution and that arrivals are independent. **(10 marks)**

(a) Find the probability that exactly 4 patients arrive in a given hour. (2 marks)

(b) Find the probability that at least 2 patients arrive in a given 30-minute interval. (3 marks)

(c) Find the probability that exactly 3 patients arrive in a given hour and exactly 2 patients arrive in the next hour. (2 marks)

(d) The hospital wants to determine the number of beds needed so that the probability of running out of beds in a given hour is at most 0.05. Find the minimum number of beds required. (3 marks)

END OF PAPER

Answers written in the margins will not be marked.

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