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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: Probability 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. The discrete random variable X has the probability distribution $P(X = x) = k(\frac{1}{2})^x$ for $x = 1, 2, 3, \ldots$, where k is a constant. Find k and hence find $P(X \geq 3)$. **(3 marks)**

2. Let X be a discrete random variable with $E(X) = 4$ and $\text{Var}(X) = 5$. Find $E(3X - 2)$ and $\text{Var}(3X - 2)$. **(3 marks)**

3. A bag contains 3 red balls and 2 blue balls. Two balls are drawn at random without replacement. Let X be the number of red balls drawn. Construct the probability distribution of X and find $E(X)$. **(4 marks)**

Answers written in the margins will not be marked.
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4. The discrete random variable X has the probability distribution shown below, where a and b are constants. **(6 marks)**

x	**0**	**1**	**2**	**3**
$P(X = x)$	a	0.2	b	0.3

It is given that $E(X) = 1.7$.

(a) Find a and b.

(b) Find Var(X).

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SECTION A(2) (24 marks)

5. Let X be a discrete random variable with probability distribution **(7 marks)**

x	-1	0	1	2
$P(X = x)$	0.1	0.3	0.4	0.2

(a) Find $E(X)$ and Var(X).

(b) Find $E(2X + 1)$ and Var($2X + 1$).

(c) Find $E(X^2 + 3X)$.

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6. A game is played with a fair six-sided die. If the outcome is 1, 2 or 3, the player loses \$2. If the outcome is 4 or 5, the player wins \$1. If the outcome is 6, the player wins \$4. Let X be the net gain of the player in dollars. **(8 marks)**

(a) Construct the probability distribution of X.

(b) Find $E(X)$ and $\text{Var}(X)$.

(c) The game is played 10 times independently. Find the expected total net gain and the variance of the total net gain.

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7. The discrete random variable X has probability distribution $P(X = x) = c(x + 1)$ for $x = 0, 1, 2, 3$, where c is a constant. **(9 marks)**

(a) Find c.

(b) Find $E(X)$ and Var(X).

(c) Find $P(X \leq 1 \mid X \leq 2)$.

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SECTION B (10 marks)

8. Let X be a discrete random variable with probability distribution $P(X = x) = \frac{x}{10}$ for $x = 1, 2, 3, 4$. **(10 marks)**

(a) Verify that the sum of the probabilities is 1.

(b) Find $E(X)$ and Var(X).

(c) Let $Y = 2X + 3$. Find $E(Y)$ and Var(Y).

(d) Find $E(X^2 - 2X + 1)$.

END OF PAPER

Answers written in the margins will not be marked.

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