

DISCRETE PROBABILITY DISTRIBUTIONS

- ① X has a probability distribution as shown in the table below;

x	1	2	3	4	5
$P(X=x)$	$\frac{1}{10}$	$\frac{3}{10}$	a	$\frac{1}{5}$	$\frac{1}{20}$

Find: (a) the value of a

b) $P(X \geq 3)$.

c) $P(2 \leq X < 4)$.

d) $P(X < 1)$.

(e) $P(X > 2 | X < 5)$.

- ② Write down the probability distribution for each of the following variables.

a) The number of heads when two fair coins are tossed.

b) The number of tails when three fair coins are tossed; Hence determine the likelihood that not more than two tails are obtained if at least one tail shows up.

- ③ A game consists of throwing tennis balls into a bucket from a given distance. The probability that William will get the tennis ball in the bucket is 0.4. A turn consists of three attempts.

a) Construct the probability distribution for the number of tennis balls that land in the bucket in a turn.

b) William wins the game if, at the end of his turn, there are two or more tennis balls in the bucket. What is the probability that William does not win a prize?

④ A student has a fair coin and two six-sided dice, one of which is white and the other is blue. The student tosses the coin and then rolls both dice. Let X be a random variable that if the coin falls heads, X is the sum of the scores on the two dice, otherwise X is the score on the white die only.

a) Find the p.d.f of X

b) Find $P(3 \leq X \leq 7)$.

c) State the assumptions made to evaluate the p.d.f.

⑤ X is a discrete random variable such that $P(X=5)=0.1$, $P(X=6)=0.2$, $P(X=7)=0.4$ and $P(X=8)=2P(X=9)$ for $x=5, 6, 7, 8, 9$.

Find i) (a) $P(6 < X < 9)$

b) $P(5 \leq X < 9 / 5 < X \leq 7)$.

c) the mode

d) Sketch the graph of the probability distribution.

⑥ The p.d.f of a random variable X is given by the function $f(x) = \frac{1}{84} \binom{5}{x} \binom{4}{3-x}$

where $x=0, 1, 2, 3$ and $\binom{n}{r} \equiv$ combination.

a) Calculate the numerical probabilities.

b) Determine i) $P(X > 2)$.

ii) the mode

c) Sketch the graph of $f(x)$.

Ques 7) The random variable X takes on integral values only and has a p.d.f given by $f(x) = \begin{cases} kx & ; x = 1, 2, 3, 4, 5 \\ k(10-x) & ; x = 6, 7, 8, 9 \end{cases}$

- Find;
- the value of the constant k
 - $P(X > 5 / X < 8)$.
 - the expected value of X
 - the variance of X .
 - the modal value.

Ques 8) Box A has 5 cards; 2 kings and 3 Aces. Box B has 6 cards; 3 kings and 3 Aces. The likelihood that Box A is selected at random is twice that of Box B. Two cards were randomly selected, one at a time without replacement. If X is the random variable for the number of kings selected, determine;

- the probability distribution of X .
- $P(X > 1 / X < 2)$.
- $E(X)$
- $\text{Var}(X)$.

Ques 9) X is a random variable such that $x = 0, 1, 2, 3, 4$.
 $P(X=0) = 2P(X=1) = P(X=2) = 2P(X=3) = 3P(X=4)$.
Determine;

- $P(X > 2)$
- $\text{Var}(X)$.
- mode

Research about π (some numbers)

- a) Expectation / Mean of a discrete random variable; $E(x)$.
 - b) $\text{Var}(x)$
 - c) Drawing a graph of $f(x)$ for Discrete random variables.
 - d) Cumulative density function; $F(x)$.
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